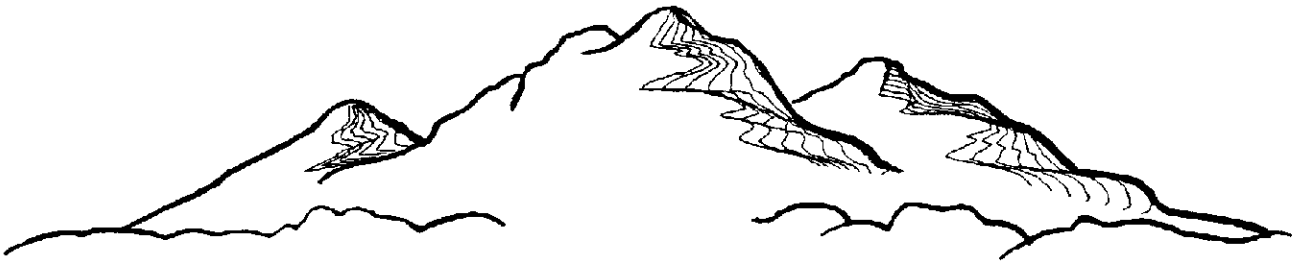
CERRO GRANDE PRESCRIBED FIRE

May 4-8, 2000



INVESTIGATION REPORT

May 18, 2000

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INVESTIGATION REPORT

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Fire Investigation Team

National Interagency Fire Center
Boise, Idaho

U.S. Department of the Interior, National Park Service
U.S. Department of the Interior, Bureau of Land Management
U.S. Department of Agriculture, Forest Service
Department of Energy
New Mexico Energy, Minerals & Natural Resources Dept., Forestry Division

CERRO GRANDE PRESCRIBED FIRE
FIRE INVESTIGATIVE TEAM
May 18, 2000

May 18, 2000

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May 18, 2000

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EXECUTIVE SUMMARY

On May 4, 2000, in the late evening, fire personnel at Bandelier National Monument, National Park Service, ignited a prescribed fire with an approved plan. Firing and line control occurred during the early morning of May 5. Sporadic wind changes caused some spotting within the unit and a slopover on the upper east fireline. Because of the slopover the prescribed fire was declared a wildfire at 1300 hours on May 5. The fire was contained on May 6 and early on May 7; however, at approximately 1100 hours on May 7 winds increased significantly from the west and resulted in major fire activity and ultimately caused the fire to move out of control to the east on the Santa Fe National Forest. The fire was taken over by a Type 1 team on May 8.

In its most extreme state on May 10, the Cerro Grande Prescribed Fire was carried by very high winds, with embers blowing a mile or more across the fire lines to the north, south, and east, entering Los Alamos Canyon towards Los Alamos, New Mexico. The towns of Los Alamos and White Rock were in the fire's path and more than 18,000 residents were evacuated. By the end of the day on May 10, the fire had burned 18,000 acres, destroying 235 homes, and damaging many other structures. The fire also spread towards the Los Alamos National Laboratory, and although fires spotted onto the facility's lands, all major structures were secured and no releases of radiation occurred. The fire also burned other private lands and portions of San Ildefonso Pueblo and Santa Clara Pueblo. As of May 17 the fire was uncontrolled and approaching over 45,000 acres.

Secretary of the Interior Bruce Babbitt formed an interagency Fire Investigation Team on May 11 to examine events and circumstances from the beginning of planning the prescribed fire until the fire was turned over to a Type 1 Incident Management Team on May 8. Furthermore, Secretary Babbitt and Secretary of Agriculture Dan Glickman suspended all federal prescribed burning for 30 days, or longer, west of the 100th meridian.

The team based its findings and recommendations on interviews with key personnel and other people who witnessed the fire; documents associated with approval and implementation of the prescribed fire; on-site observations; and technical analyses of factors including weather, climate, and fire behavior.

The Fire Investigation Team concludes that federal personnel <u>failed to properly plan and implement the Upper Frijoles Prescribed Fire, which became known as the Cerro Grande Prescribed Fire.</u> Throughout the planning and implementation, critical mistakes were made. Government officials failed:

- To utilize the correct National Park Service complexity analysis process.
- To provide substantive review of the prescribed fire plan before it was approved.
- To evaluate conditions adjacent to the prescribed fire boundary with regards to fire behavior, fuel conditions, and public safety in the event the fire crossed the planning boundaries.
- To complete and document the onsite review of critical conditions identified in the prescribed fire plan prior to ignition.
- To provide adequate contingency resources to successfully suppress the fire.

- To provide any wind predictions in the 3-5 day forecast for the periods of May 7 to May 9.
- To follow safety policies for firefighters and the public.

The investigation team believes that the Federal Wildland Fire Policy is sound; however, the success of the policy depends upon strict adherence to the implementation actions throughout every agency and at every level for it to be effective.

The Cerro Grande Prescribed Fire Investigation Report will be provided to an Independent Review Board, which will review the team's findings and recommendations.

CERRO GRANDE PRESCRIBED FIRE INVESTIGATION REPORT
MAY 4-8, 2000

INTRODUCTION

Fire personnel at Bandelier National Monument, National Park Service (NPS) in New Mexico prepared a prescribed fire plan for the Upper Frijoles Units 1 and 5, now known as the Cerro Grande Prescribed Fire. The units encompassed approximately 1,000 acres in the headwaters of Frijoles creek above State Route 4 to the park boundary at Cerro Grande summit. This prescribed fire was part of the 10-year prescribed fire schedule approved in the fire management plan for Bandelier. The prescribed fire was scheduled for a three-phased treatment. Phase 1 consisted of burning grasslands in the upper part of the units. Phase 2 was the forested area on both the east and west side of the drainage, and Phase 3 was the central wetter area. (See Figures 1, 2, and 3)

In the late evening on May 4, 2000, the prescribed fire project was initiated. The intent was to back the fire down from the ridge and then extinguish the lower edge of the fire in the grass fuels. This would create a buffer of burned area between the park boundary and the areas to be included in Phases 1, 2, and 3. The ignition proceeded slowly and only when the ignition pattern changed did the spread and intensity increase. The fire burned through the control line (slopover) on the upper east side of the prescribed fire area during the late morning hours of May 5. Even with this slopover outside the prescribed fire area, the burn boss believed the prescribed fire remained within prescription. Fire personnel worked to suppress the slopover while continuing to hold the line around the remainder of the area they had ignited. They ordered additional resources in accordance with the contingency plan written in the prescribed fire plan. The contingency resources consisting of an additional crew and a helicopter were on the fire by late morning, but by early afternoon on May 5, the slopover continued to be a problem and the crew requested retardant to control it. This retardant request made the burn boss reconsider if the prescribed fire was still within prescription. It was not. The decision was made to declare the prescribed fire a wildland fire and initiate appropriate responses. A Type 3 incident command was established with existing personnel. On May 6, fireline was constructed down the ridges using pre-existing control lines, and strengthened using limited ignitions. The crews tied the line in with State Route 4 early on the morning of May 7. Crews then ignited along the road beginning on the east side working west to connect the east and west sides and closed off the fire area.

At noon on May 7, stronger winds influenced the fire area and the fire behavior became increasingly erratic and spotting occurred from a southern point into Frijoles Canyon. This forced a decision for park management to order a Type 1 Incident Management Team to assume command of the wildland fire. By mid afternoon, additional spotfires were reported east of the fire on National Forest System lands, and were rapidly increasing in intensity. These spotfires represented a potential threat to the Los Alamos National Laboratory.

A Type1 Incident Management Team assumed command of the fire in the early morning of May 8. On May 10, the Cerro Grande was a running crown fire that burned into the town of Los Alamos and threatened neighboring White Rock. There were 235 homes destroyed and approximately 18,000 residents were evacuated.

Figure 1
Bandelier National Monument and Vicinity

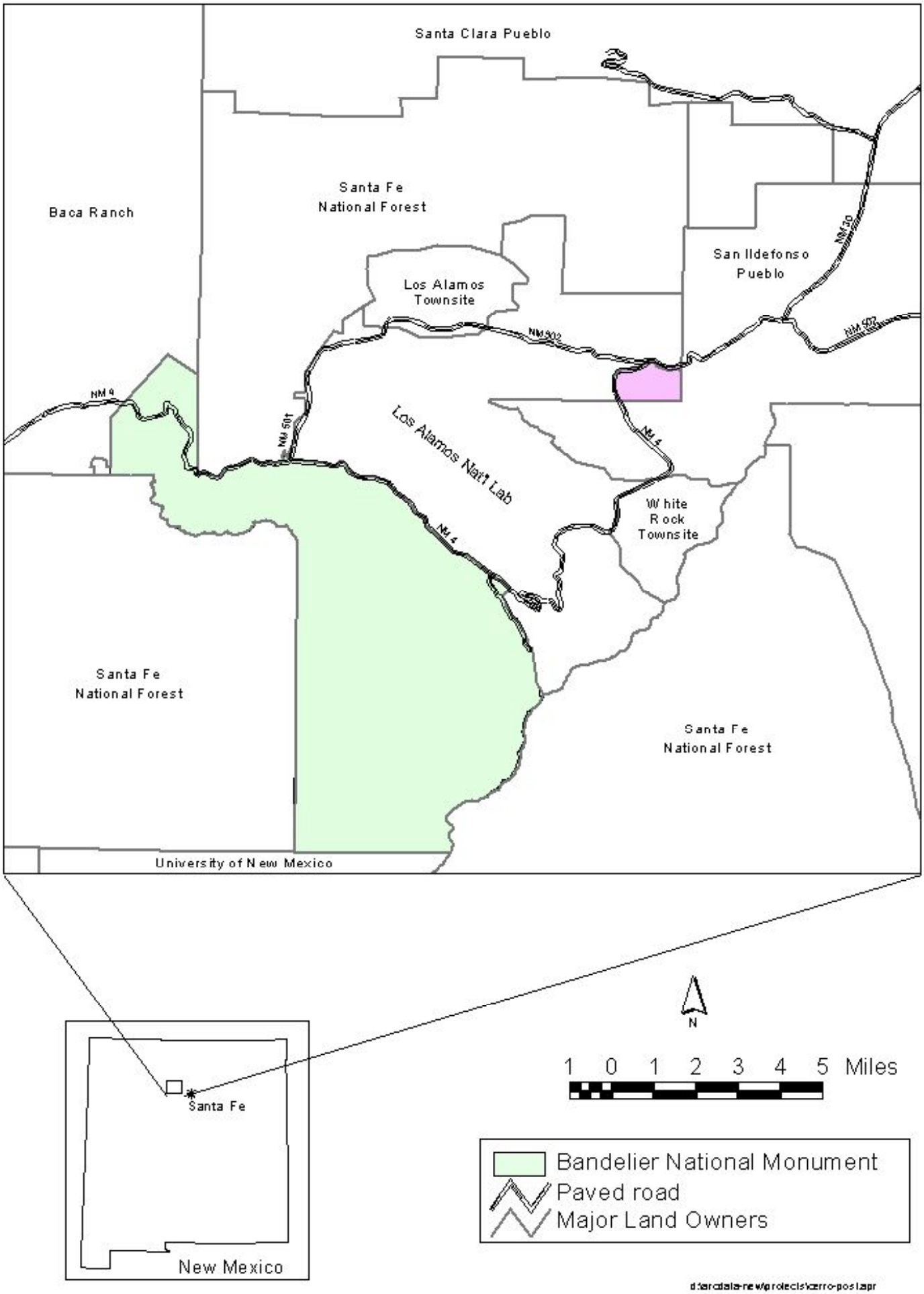


Figure 2
Bandelier National Monument
Prescribed Fire Units 1 & 5 Boundaries

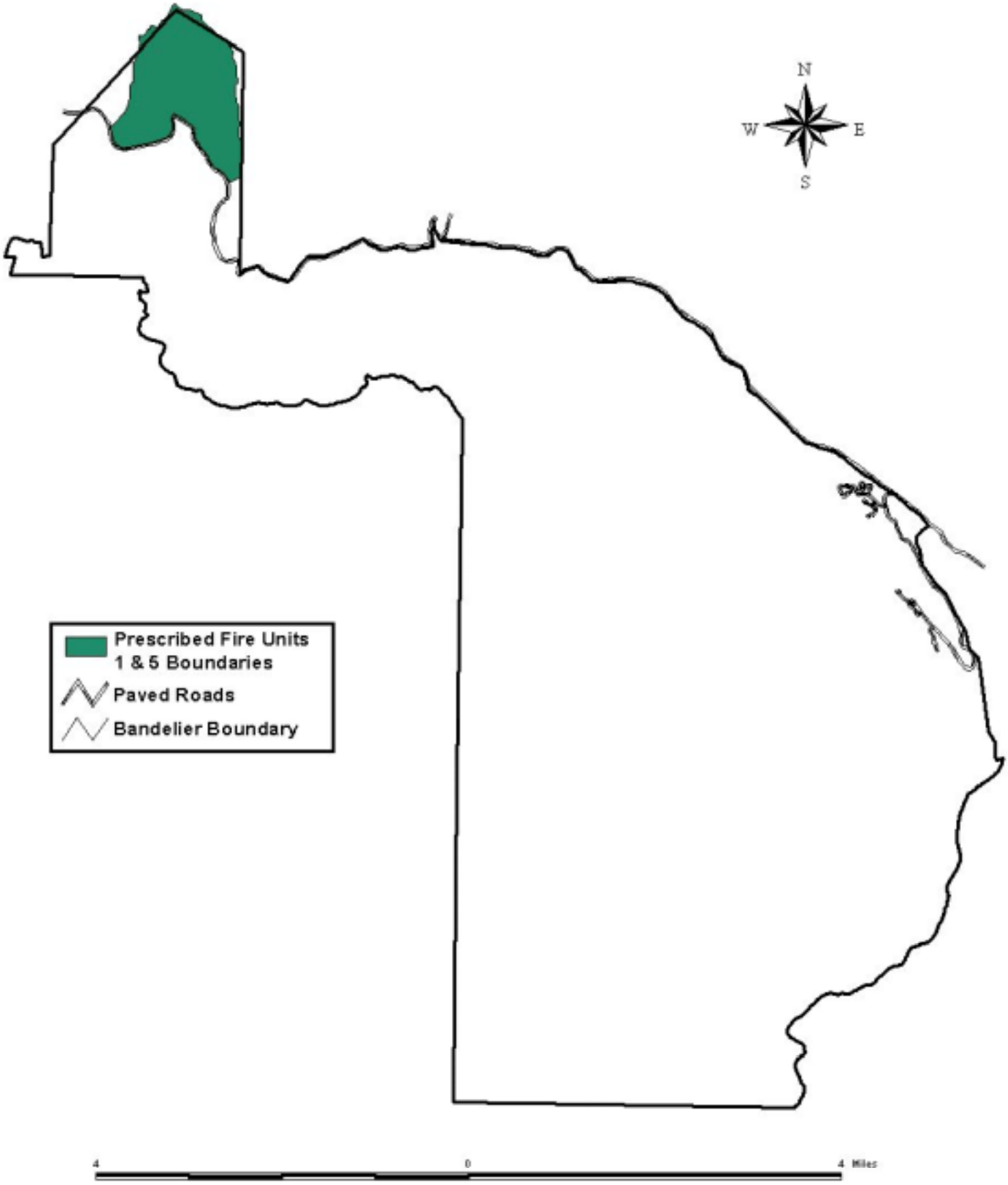
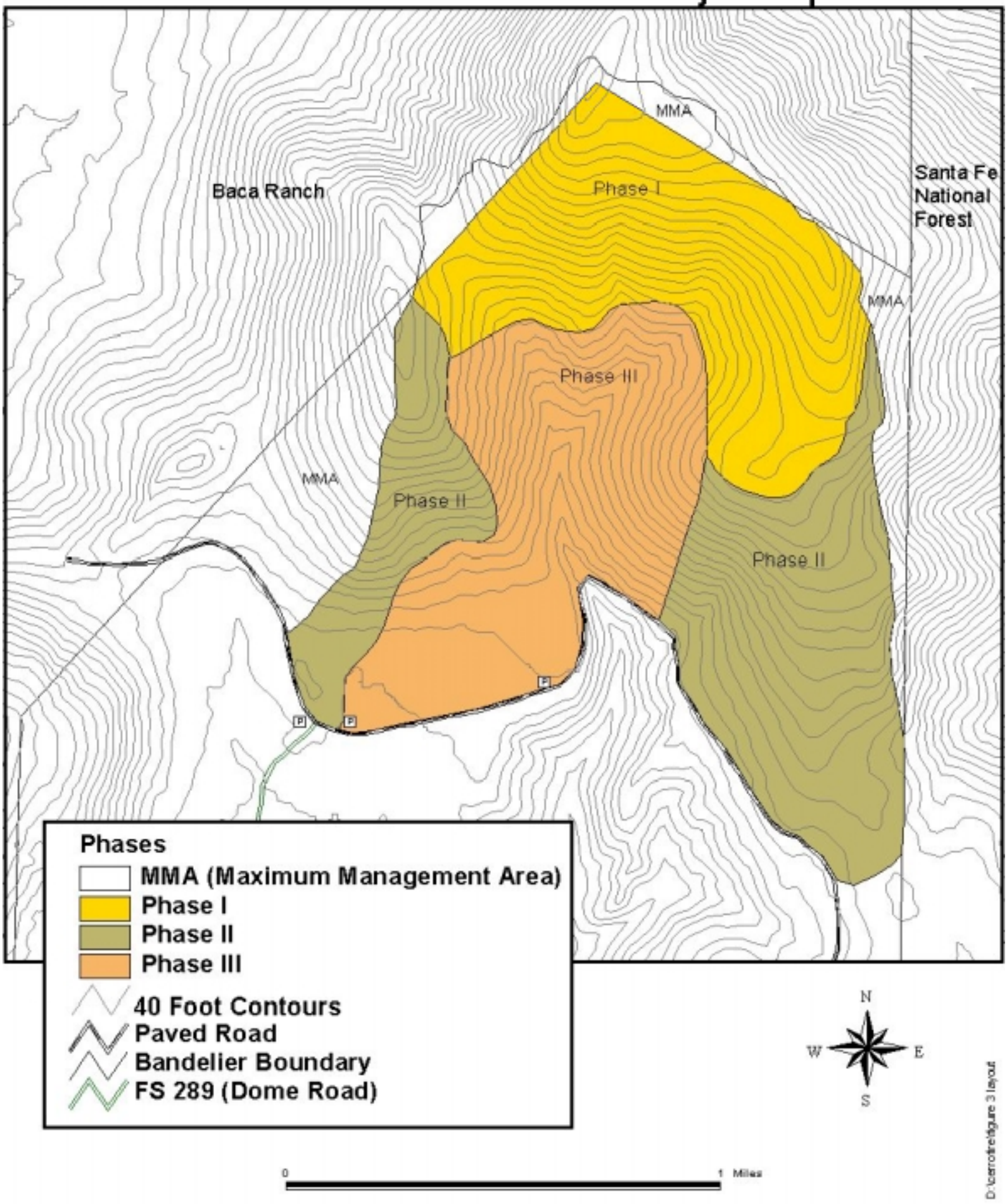


Figure 3
Bandelier National Monument
Prescribed Fire Units 1 & 5 - Project Map



INVESTIGATION TEAM

Secretary Babbitt directed the National Interagency Fire Center to form a Fire Investigation Team to review the circumstances of the planning and implementation of the Cerro Grande Prescribed Fire **(Appendix 1)**. The Director of the National Park Service Robert Stanton signed the delegation of authority for the team on May 12, 2000. **Appendix 2** is a list of team members and functions. The team was given a specific purpose and scope to fulfill by May 18, 2000.

Purpose and Objectives

The team's purpose was to investigate and report on the circumstances associated with the planning and implementation with the planning and implementation of the Cerro Grande Prescribed Fire in Bandelier National Monument in New Mexico, and determine if overall National Park Service guidance and procedures were followed. The team examined and reported on events and circumstances that occurred during May 4-8, 2000, which was the period beginning with the planning and implementation of the prescribed fire to the transition to the Type 1 Interagency Incident Management Team. **Appendix 3** is the Upper Frijoles Units 1 and 5 Prescribed Fire Plan, and **Appendix 4** is the Wildland Fire Situation Analysis.

Specific objectives for the investigation were to determine:

- If the prescribed fire plan was adequate given the complexity, objectives, and environmental conditions, and if it complied with guidance set forth in Director's Orders-18 and Reference Manual-18, which are NPS documents for policy and direction on fire management.

- If the prescription, actions, and procedures set forth in the prescribed fire plan were followed.

- If prescribed fire training and experience of personnel involved were commensurate with agency qualification standards.

- Recommendations for immediate and long-term actions to prevent similar future occurrences and improve program performance.

Process

As directed in the delegation of authority, the Fire Investigation Team followed National Park Service procedures as described in Chapter 13, Evaluation and Review, Reference Manual-18 (USDI National Park Service 1998a). Team members completed the assignment using the following processes:

- Identified, collected, and analyzed the factual data associated with the planning, implementation, and escape of the prescribed fire through its redesignation as a wildland fire and management by the Type 1 Incident Management Team.

- Completed technical analyses of weather, climate, fuels, and fire behavior factors.

- Conducted interviews with key personnel involved with planning and implementation of the

prescribed fire and its conversion to a wildland fire.

- Prepared an investigation report.

Scope of Investigation

The report centers on the series of events from May 4-8, 2000, regarding the planning, implementation, and escape of the prescribed fire through its redesignation as a wildland fire. It also covers the transition from the local management team to the Type 1 Incident Management Team.

The investigation report is intended as an objective factual account. The findings of the Investigation Team will be reported to an Independent Review Board appointed by Secretary Babbitt. The Independent Review Board will review the findings and recommendations presented in the Cerro Grande Fire Investigation Report.

Team Composition

The Fire Investigation Team was an interagency team composed of representatives of the Bureau of Land Management, USDA Forest Service, National Park Service, National Weather Service, Department of Energy, Bureau of Reclamation, and New Mexico Energy, Minerals, and Natural Resources Department of Forestry Division. The team worked with local counties and tribal governments who served as liaisons to the team. Those governments involved included the counties of Rio Arriba, Santa Fe, and Sandoval, and the Pueblos of San Ildefonso and Santa Clara.

NATIONAL PARK SERVICE FIRE MANAGEMENT

The Organic Act of 1916 founded the National Park Service with the mission to perpetuate natural conditions and processes, preserve cultural resources, and provide for public enjoyment, as specified by the enabling legislation and other legal mandates. The agency has an overriding conservation mission rather than multiple use.

From 1916 to 1968, national policy was strictly to suppress all fires. Officially all fires, whatever their size or origin, were considered wildfires and suppressed as quickly as possible. The fact that the presence of fire and other natural disturbances was essential and normal for plant and animal communities was recognized. Further evidence showed that lack of fire was a major contributor to increasing fuel accumulations, especially in forest communities. Everglades National Park began researching controlled burns in the 1950s. The Leopold Report (Leopold et al. 1963) underscored the importance of restoring ecological processes. In response to that report, NPS fire management policy changed dramatically in 1968. Naturally ignited fires were recognized as "natural phenomena" and use of prescribed fire was accepted as a means of achieving resources and fuel reduction objectives. During the past 30 years the national program has developed in recognition of the complexity of fires on the landscape and the professional skills needed for fire management.

National Fire Program

Wildland fire management activities are essential to protect human life, personal property, and irreplaceable natural and cultural resources, and to accomplish the NPS mission. Interagency recognition of risks and expenses associated with wildland fire management culminated in the Federal Wildland Fire Management Policy and Program Review (USDA Forest Service and DOI 1995). The Secretary of the Interior has accepted and endorsed the principles, policies, and recommendations in the report, and has directed the NPS to implement them.

There is a hierarchy of authorities and plans associated with wildland fire. The NPS Organic Act of 1916 mandates conservation of resources processes. NPS Management Policies, Director's Orders-18, and Reference Manual-18 are national level direction. Parks prepare individual fire management plans with environmental compliance, and the prescribed fire plan is a subordinate document.

NPS Management Policies.

NPS Management Policies (USDI National Park Service 2000a) for wildland fire management were revised in 1998 to meet the intent of the new Director's Orders and the Federal Wildland Fire Management Policy and Program Review. Policies stated that park fire management programs will be designed to meet specific resources management objectives and to ensure that firefighter and public safety are not compromised. A fire management plan with a comprehensive environmental assessment will be developed.

The policies continued that all fires burning in natural or landscaped vegetation will be classified as either wildland fires or prescribed fires. Wildland fires will be effectively managed, considering resource values to be protected and firefighter and public safety, using a full range of strategic and tactical operations. Prescribed fires, which are ignited by park managers to achieve resource objectives,

will have monitoring of fire behavior, smoke behavior, fire decisions, and fire effects in order to determine whether specific objectives were met.

All parks will use a systematic decision making process to determine the most appropriate management strategies for all unplanned ignitions and for prescribed fires that are no longer meeting resource objectives. Superintendents will consider the full range of suppression strategies. Suppression methods for wildland fires should minimize impacts of the suppression action and the fire, commensurate with effective control and resource values to be protected.

Director's Order-18. In November 1998, the Director of the National Park Service approved the new Director's Orders-18 Wildland Fire Management (DO-18) (USDI National Park Service 1998b). Director's Order-18 incorporated the 1995 policy and program review by 1) institutionalizing within NPS the new policies, organizational and operational relationships, and changes in law and reporting requirements reflected in the report, and 2) establishing a framework by which the NPS will implement the report's principles, policies, and recommendations.

Reference Manual-18. Reference Manual-18 Wildland Fire Management (RM-18) is a technical discussion of wildland fire management requirements and procedures that provides detailed definitions and expanded guidance of all information presented in DO-18 (USDI National Park Service 1998a). Among other subjects, contents of RM-18 include guidance for safety, planning, qualifications, wildland fire and prescribed fire management, monitoring, and incident evaluation and review.

Bandelier National Monument Fire Program

Site Description. Bandelier National Monument is located in the southern portion of the Pajarito Plateau in the Jemez Mountains at the southern edge of the Rocky Mountains in north central New Mexico (USDI National Park Service 1997). The monument comprises 32,727 acres of area composed of volcanic ash deposits and lava flows that have been eroded into deep canyons. Elevations range from 5,300 feet to 10,199 feet. Prime archeological resources, which are noted in the enabling legislation, are remnants of the Puebloan People between 1100 and 1600 A.D.

The monument is bordered to the south, west, and northeast by the Santa Fe National Forest, to the north by the private lands of the Baca Ranch, and to the east by the Department of Energy Los Alamos National Laboratory (Figure 1). The communities of Los Alamos and White Rock are within five air miles to the east and southeast, respectively. Bandelier is a member of the Joint Powers Operating Plan, Santa Fe Zone, which provides for mutual aid initial attack of wildfires using the concept of closest available resources.

Fire Management Program. Forest communities cover most of the monument with high elevation grasslands occurring as breaks in the forest. Major communities are juniper grasslands, pinon-juniper, ponderosa pine, mixed conifer, and spruce-fir. Fire history studies showed frequent historic fires dating back four centuries throughout what is now monument land (USDI National Park Service 1997). The average fire frequency for all studies in the ponderosa pine-mixed conifer communities was one fire in 10 years during the 18th and 19th centuries. Lightning fires began in the early spring and peaked in late June to early July then decreased significantly as the summer rainy season progressed. Fire occurrence was drastically reduced starting in the late 1800s due to steadily increasing human settlement and land

uses. Suppression and land uses led to an increase in forest fuel accumulations, even-aged forest composition, loss of open forest structure, and decline of fire-dependent species. Fire behavior changed from predominantly lower to moderate intensity ground and surface fires with some crowning to great potential and occurrence of high severity crown fires.

The current Bandelier National Monument Wildland Fire Management Plan was approved in January 1997, and it was a revision of the first fire plan that was approved in 1986. The 1997 plan incorporated the principles, policies, and recommendations from the 1995 Federal Wildland Fire Management Policy and Program Review. An addendum to the fire plan in June 1997 described an agreement between NPS and US Fish and Wildlife Service about endangered species. Another addendum was done in June 1998 that changed the terminology in the fire management plan to the current usage in the 1995 Federal Wildland Fire Management Policy. The plan described operational details for conducting a comprehensive program of wildland and prescribed fire, safety, monitoring, research, education, and air quality.

The wildland fire plan prescribed actions to implement the Servicewide fire management policies and to achieve park resources management objectives. The four objectives stated in the plan are:

- Allow prescribed natural fires to function in fire-dependent ecosystem,
- Use prescribed fire to meet management objectives,
- Protect life, property, and park resources from the effects of unwanted fire, and
- Prevent adverse impacts from fire suppression.

Prescribed fire plans are subordinate to the fire management plan. They are prepared for each burn and have required elements as directed by RM-18. At a minimum, those elements include description of the area, goals and objectives, range of acceptable results expected, project assessment, implementation actions, cooperation, contingency plan, funding, smoke management, monitoring, and post-burn activities. The superintendent must approve plans before they are implemented.

CERRO GRANDE PRESCRIBED FIRE

Conducting a prescribed fire involves planning and implementation, and RM-18 is used as technical guidance (USDI National Park Service 1998b). The general steps to conduct a prescribed fire are:

- The park resources management plan identifies the need for wildland and prescribed fire and sets forth objectives.
- Fire management plan is written and approved with environmental compliance.
- Specific prescribed fire plans, which are subordinate to the fire management plan, are prepared for selected areas, and environmental compliance is confirmed for the site. The plan is reviewed by peers within the park. Other interested parties should be included in the review process, although that is not required.
- The prescribed fire plan is approved by the agency administrator.
- The burn site is prepared to keep the fire within the perimeters.
- Environmental and regional factors, such as weather, fuels, other fires, resource availability, etc., are tracked.
- Coordinate notification and implementation with other agencies and interested parties.
- Execute the fire and monitor behavior and effects.
- Prepare evaluation documentation.

Following are details about the preparation of the Upper Frijoles Units 1 and 5 prescribed fire plan written by Bandelier staff. Implementation describes the chronological account of the fire events from May 4 to 8 for ignition of the prescribed fire, fire behavior and weather changes, implementation of the suppression efforts, and efforts made to protect life and property. There are appendices relevant to this section. **Appendix 5** shows the staff position organization charts for Bandelier National Monument's park managers and resources management division. **Appendix 6** is a validation of prescription parameters used for the Upper Frijoles Prescribed Fire**.** **Appendix 7** is a summary of weather information for the Cerro Grande Prescribed Fire. **Appendix 8** is a discussion of the events leading to the escape of the Upper Frijoles Units 1 and 5 Prescribed Fire.

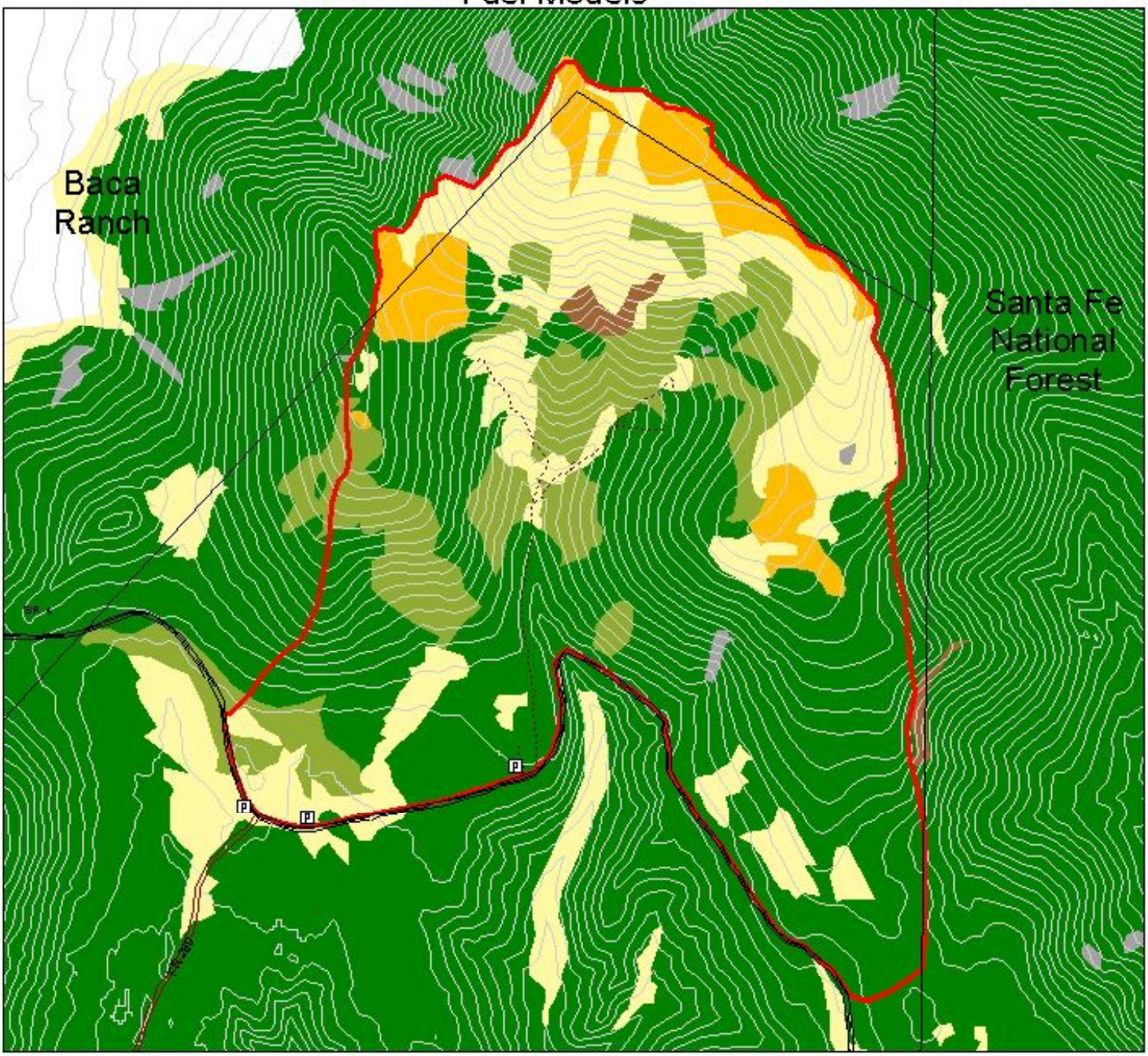
Planning

The Prescribed Fire Plan for the Upper Frijoles Creek drainage was originally signed and approved on April 19, 2000 (USDI National Park Service 2000b). On May 4, an amendment to the plan was signed and approved, which excluded private property on the Baca Ranch from the project area.

The Upper Frijoles Units 1 and 5 are in the northwest corner of Bandelier (Figure 2). They encompass 1,000 acres in the headwaters of Frijoles Creek above U.S. Highway 4 to the park boundary at the Cerro Grande summit. The vegetation in the area consists mostly of ponderosa pine-mixed conifer with some mixed conifer areas and montaine grasslands at the higher elevations (Figure 4). Included in the 1,000 acres is approximately 32 acres of the Baca Ranch.

The area within Unit 1 was burned in 1993. The fire was not as successful as planned, as much of the area within the burn unit was inherently moist and did not burn very well. Dead fuel loadings, from averaged plot information from the 1993 fire and the current prescribed fire were:

Figure 4
Bandelier National Monument
Burn Unit 1
Fuel Models



- Grass understory, models 2 or C
- Tall grass, models 3 or L
- Brush, models 5 or F
- Short needles, models 8 or G
- Long needles, models 9 or C
- Rock outcrop
- Old logging road
- Paved road
- Dirt road
- Burn unit perimeter
- Bandelier boundary

N

1:20,000
40 foot contour interval

0.5 0 0.5 Miles

d:\arcdata-new\projects\cerro-pos1.apr

Pre-1993 Burn Total Fueling Loading	34.4 tons/acre
Current Total Fuel Loading	29.0 tons/acre (84% of original)

The primary purpose of the project was to reduce hazard fuels in the burn unit, while allowing fire to be restored as a keystone natural process. With the exceptions of the grasslands, dry conditions were needed to accomplish fire objectives. The prescribed fire was to be accomplished in three phases. The first phase was to burn the upper part of the area that contained the grasslands. The second phase was to burn the timbered areas along the burn perimeter and drier aspects (usually south facing slopes) within the project area. This phase would occur shortly after or concurrently with the first phase. The third phase was to be delayed until extremely dry conditions develop that would allow for burning of the wetter areas. The third phase would most likely happen several weeks or even months after the initial burning.

Implementation

Following is a summary of events that became the Cerro Grande Prescribed Fire. Figures 5A through 5E show the initial ignition location and subsequent spread areas, while Figures 5F through 5I show the fire progression during days 1 through 4.

Thursday, May 4

The burn boss prepared the amendment to the prescribed fire plan, excluding the 32 acres of private land from the project. The park superintendent approved this amendment at 1300 hours.

The burn boss notified Santa Fe Zone Dispatch (Zone Dispatch) in the morning of the intent to implement the fire plan. The dispatcher expressed concerns about Bandelier conducting a prescribed fire when the Forest Service had already suspended prescribed fire activities on national forest lands and wildland fires were currently burning.

The burn boss and fire program assistant made notifications to the various agencies and individuals on the Bandelier prescribed fire notification list.

At 1830 hours, the holding boss notified Zone Dispatch of the prescribed fire. The burn boss conducted the prescribed fire briefing.

At 1900 hours, the holding boss called the National Weather Service confirming the winds in the spot weather forecast.

At 1920 hours, the test fire was ignited near the summit of Cerro Grande. Twenty fire personnel were on the scene. At approximately 2000 hours, the test fire was successfully completed, and the fire behavior was within expected parameters; the decision was made to continue the prescribed fire by the burn boss. They began the blackline by burning down the northeast edge of the fire from the test fire area. Progress was slow using the ignition pattern outlined in the plan. They changed the ignition

Figure 5A
(1) Thursday, May 4, 2000
Test Fire Ignited
1920 Hours

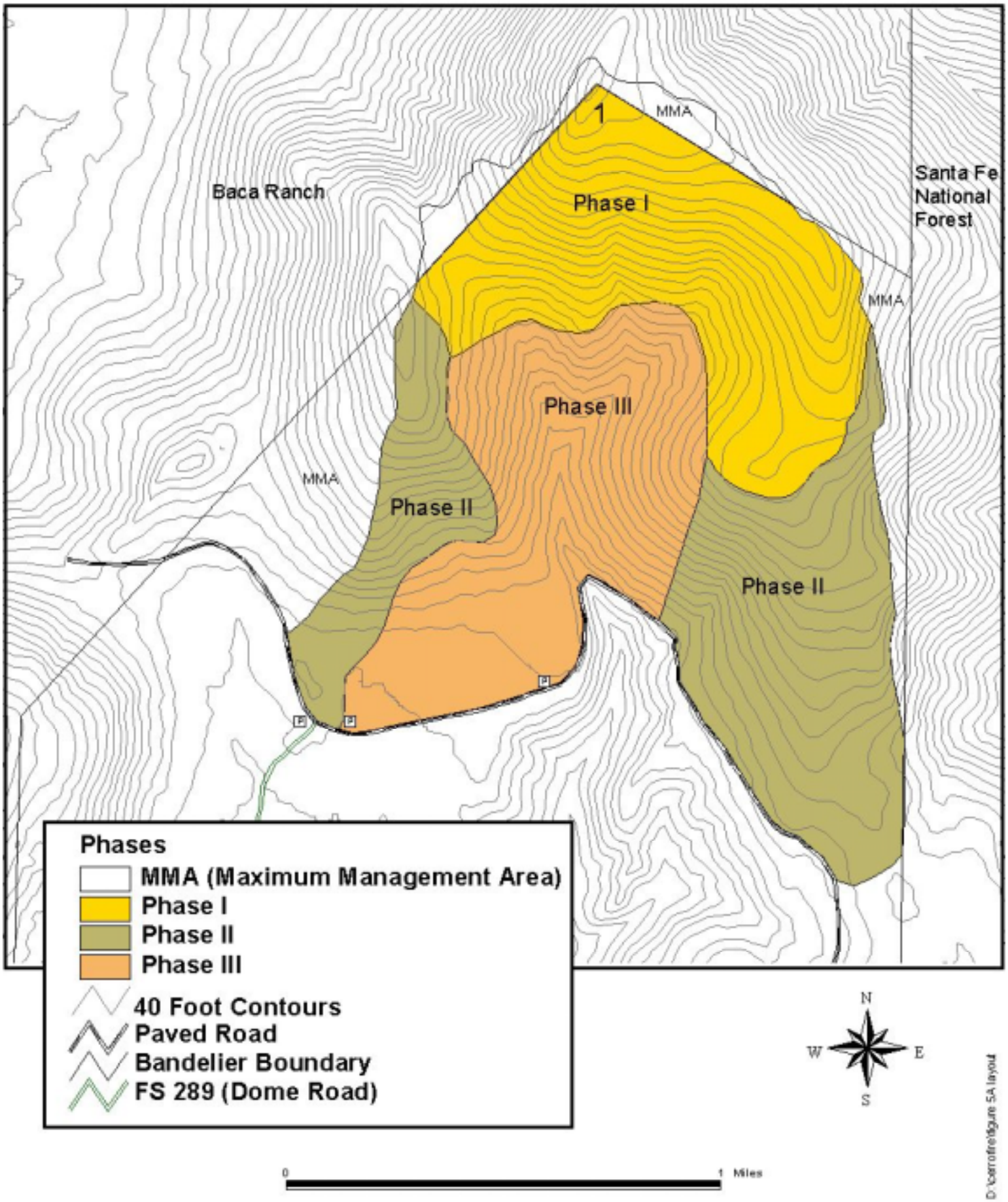


Figure 5B
(2) Thursday, May 4, 2000
Double-black Line Established
Approximately 2100 Hours

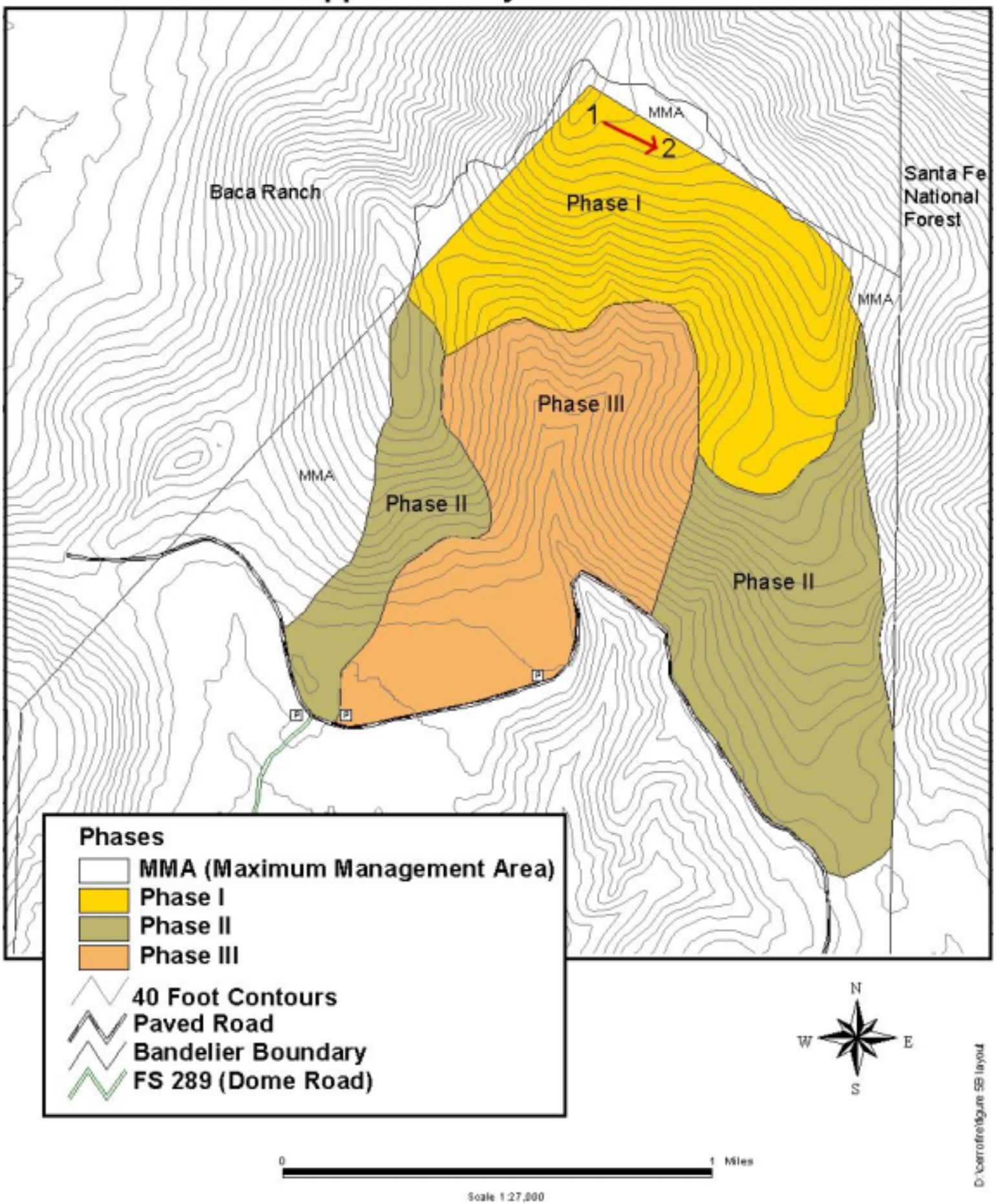


Figure 5C
(3) Thursday, May 4, 2000
Firing Secured on East Edge
2200 Hours

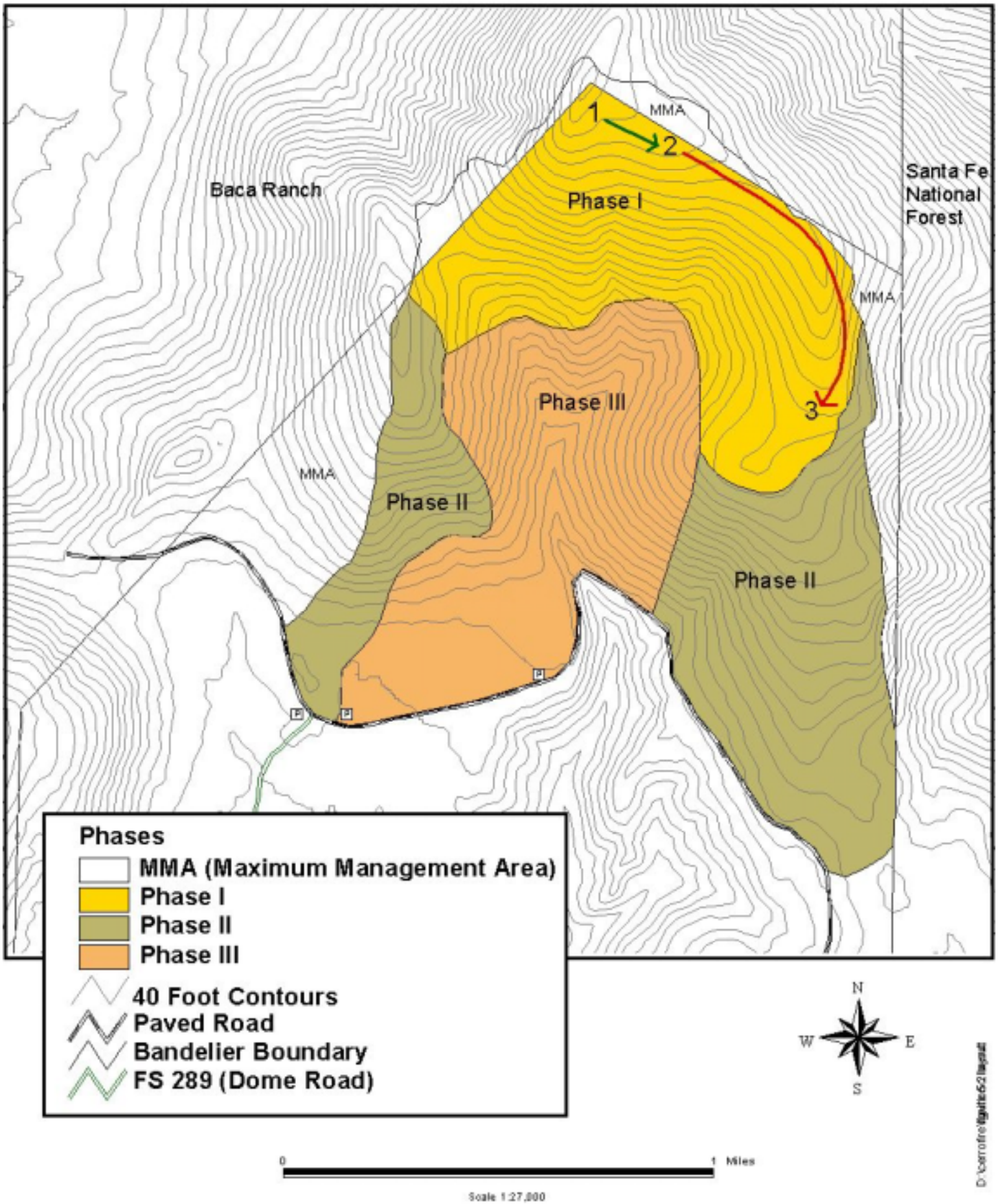


Figure 5D
(4) Thursday, May 4, 2000
Firing Begins on West Flank
Approximately 2315 Hours

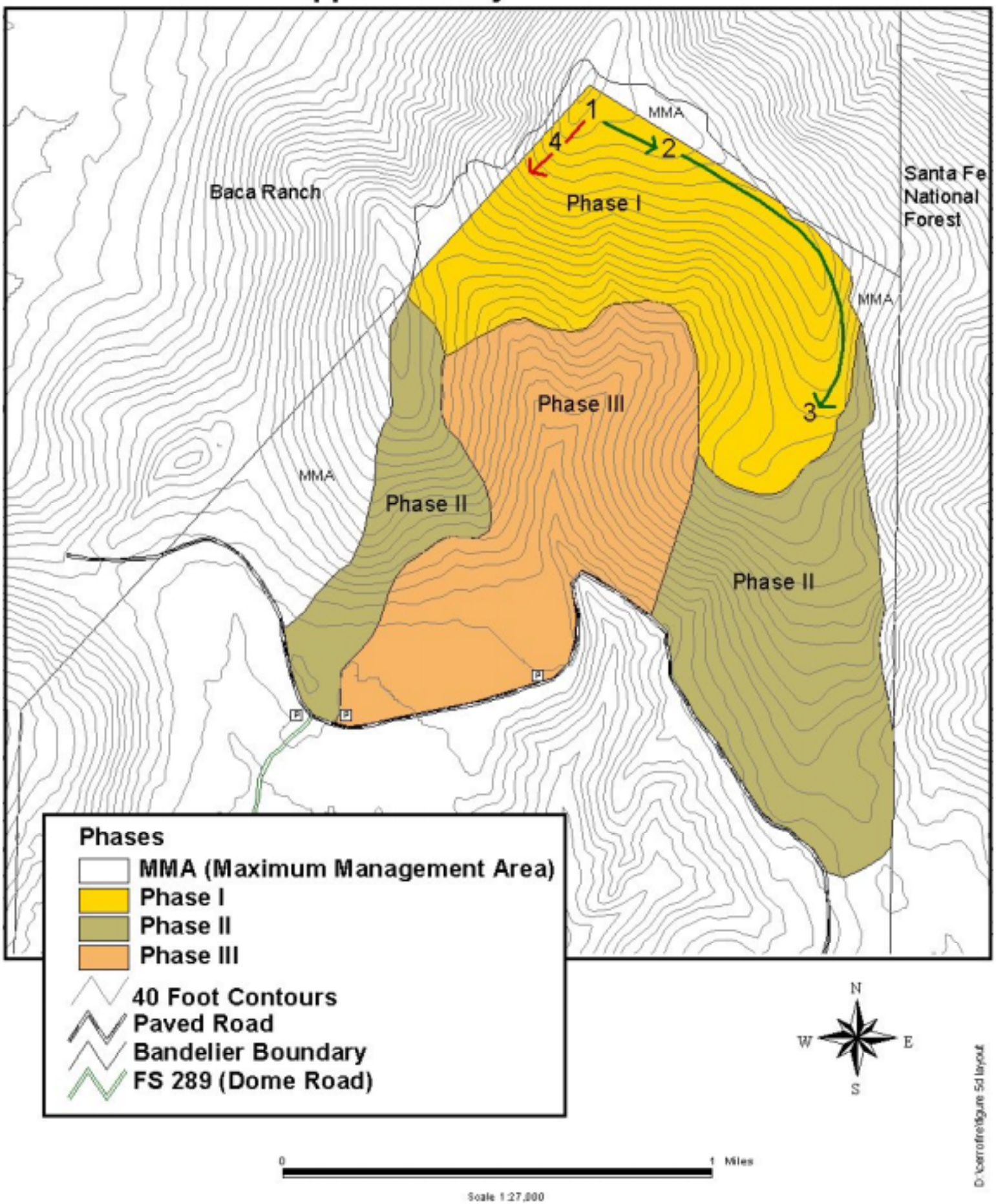


Figure 5E
(5) Friday, May 5, 2000
Firing Secured on West Flank
0200 Hours

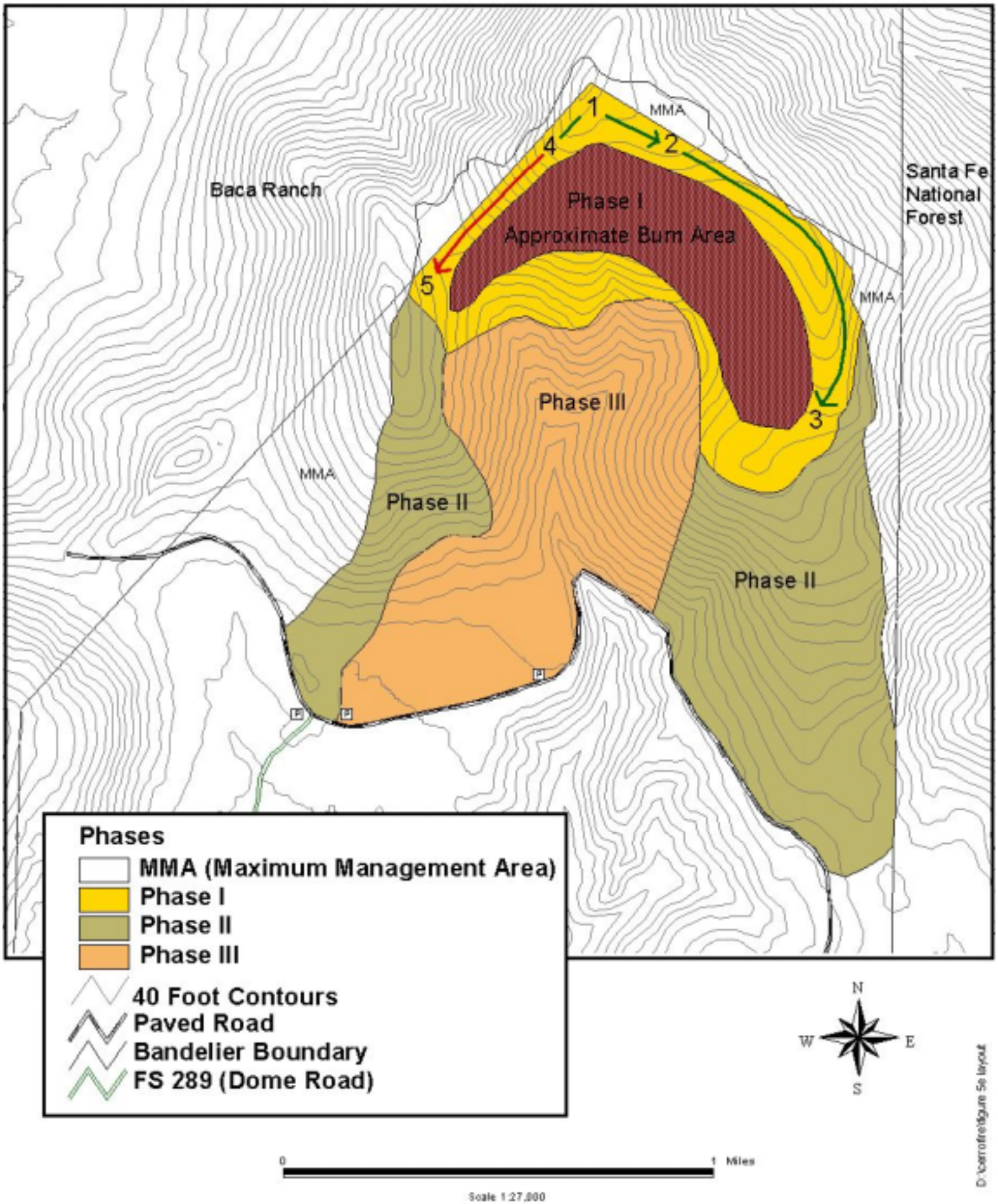


Figure 5F
(6) Friday, May 5, 2000
Slopover and Retardant Drop
Project Converted to Wildland Fire
1300 Hours

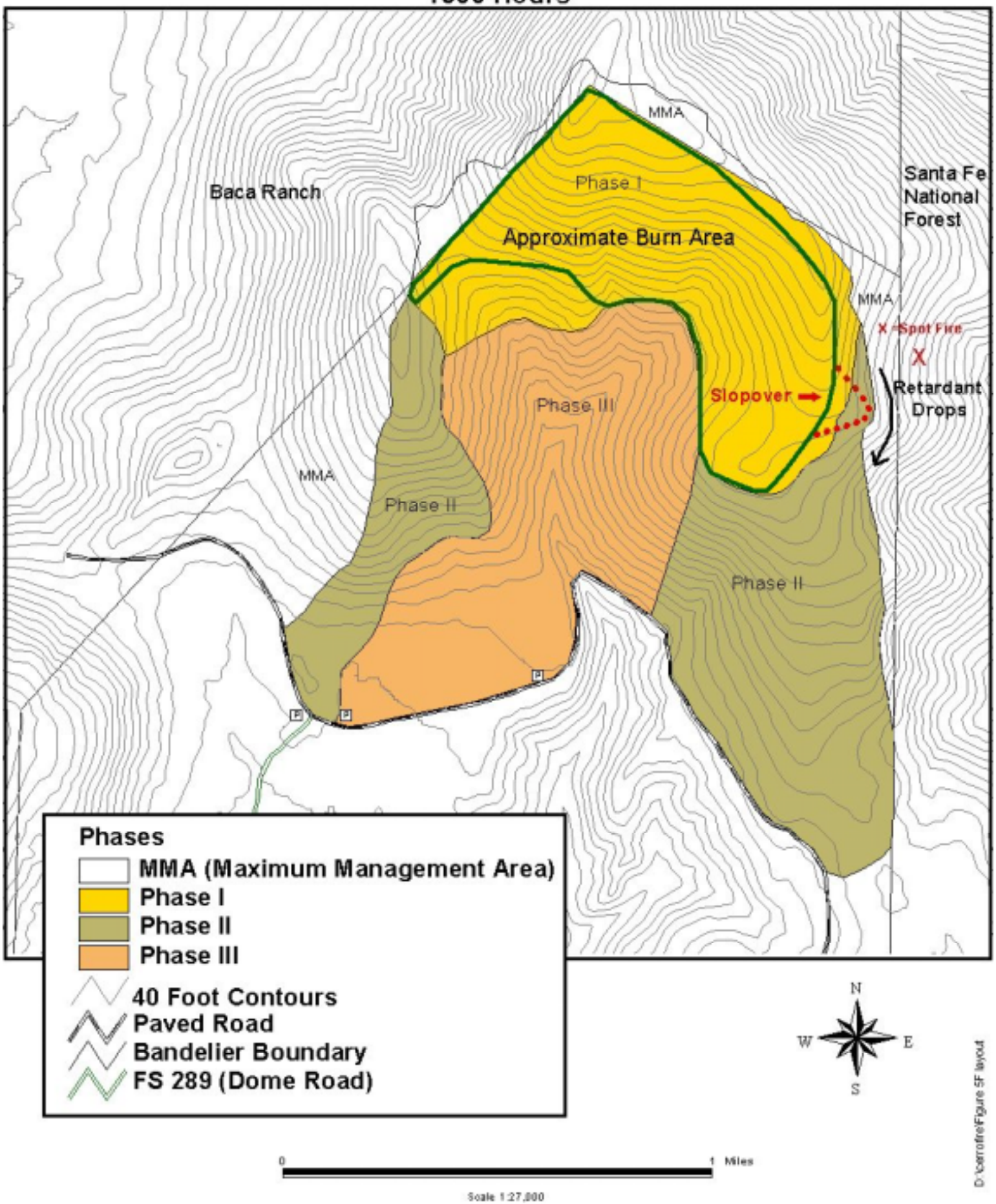


Figure 5G
(7) Saturday, May 6, 2000
Wildland Fire Situation
Approximately 1800 Hours

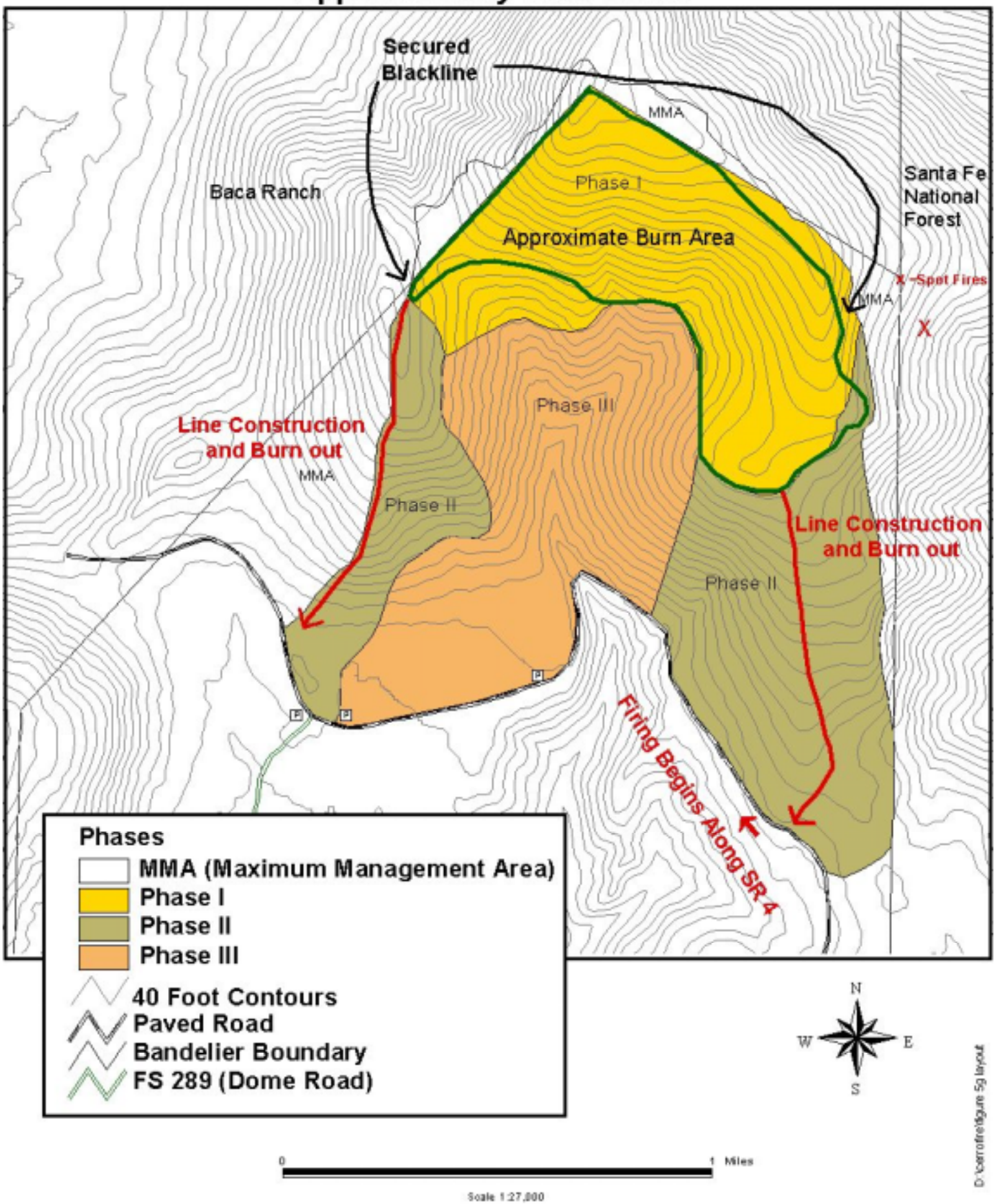


Figure 5H
(8) Sunday, May 7, 2000
Spot Fires into Frijoles Canyon
Approximately 1200 Hours

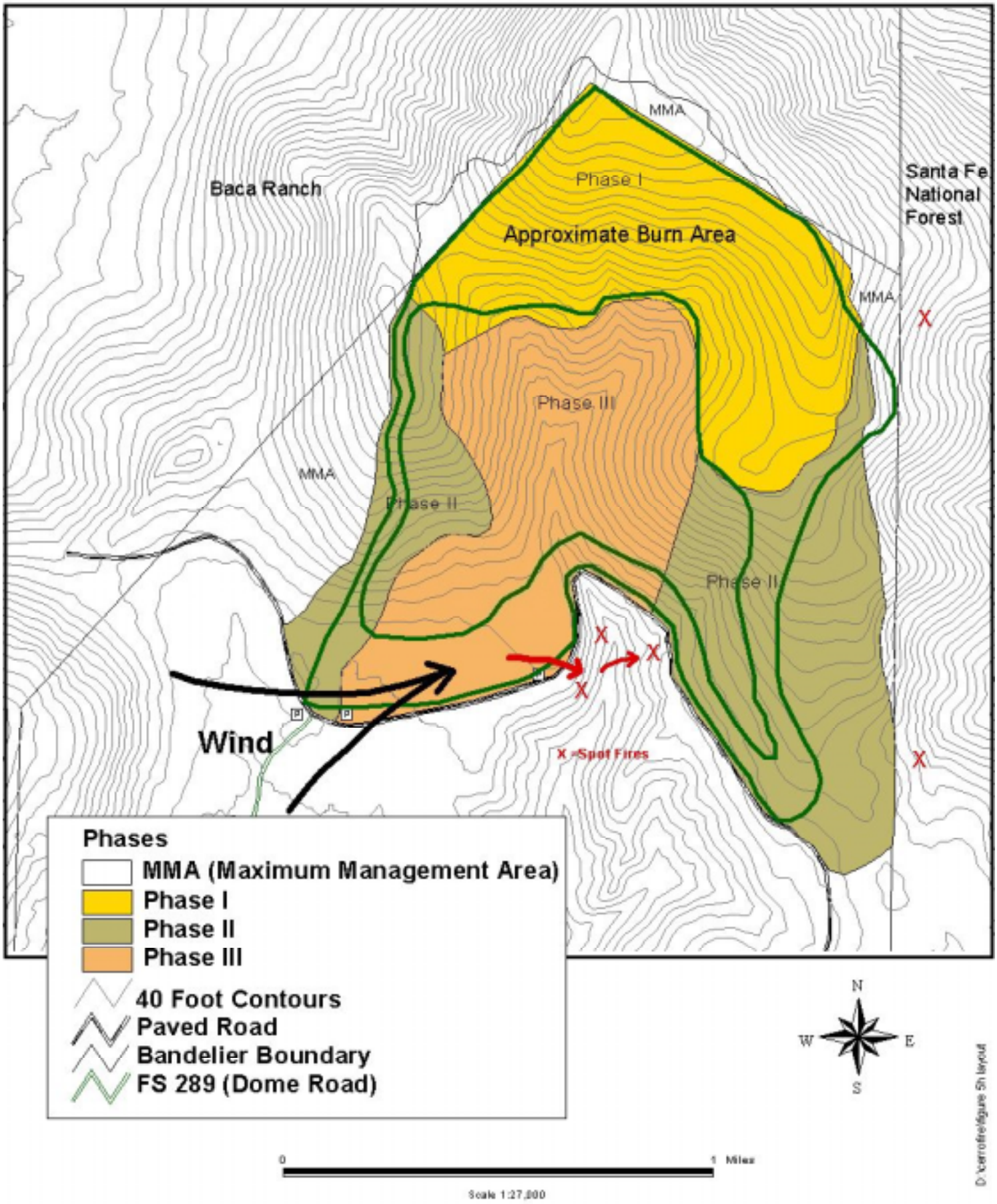
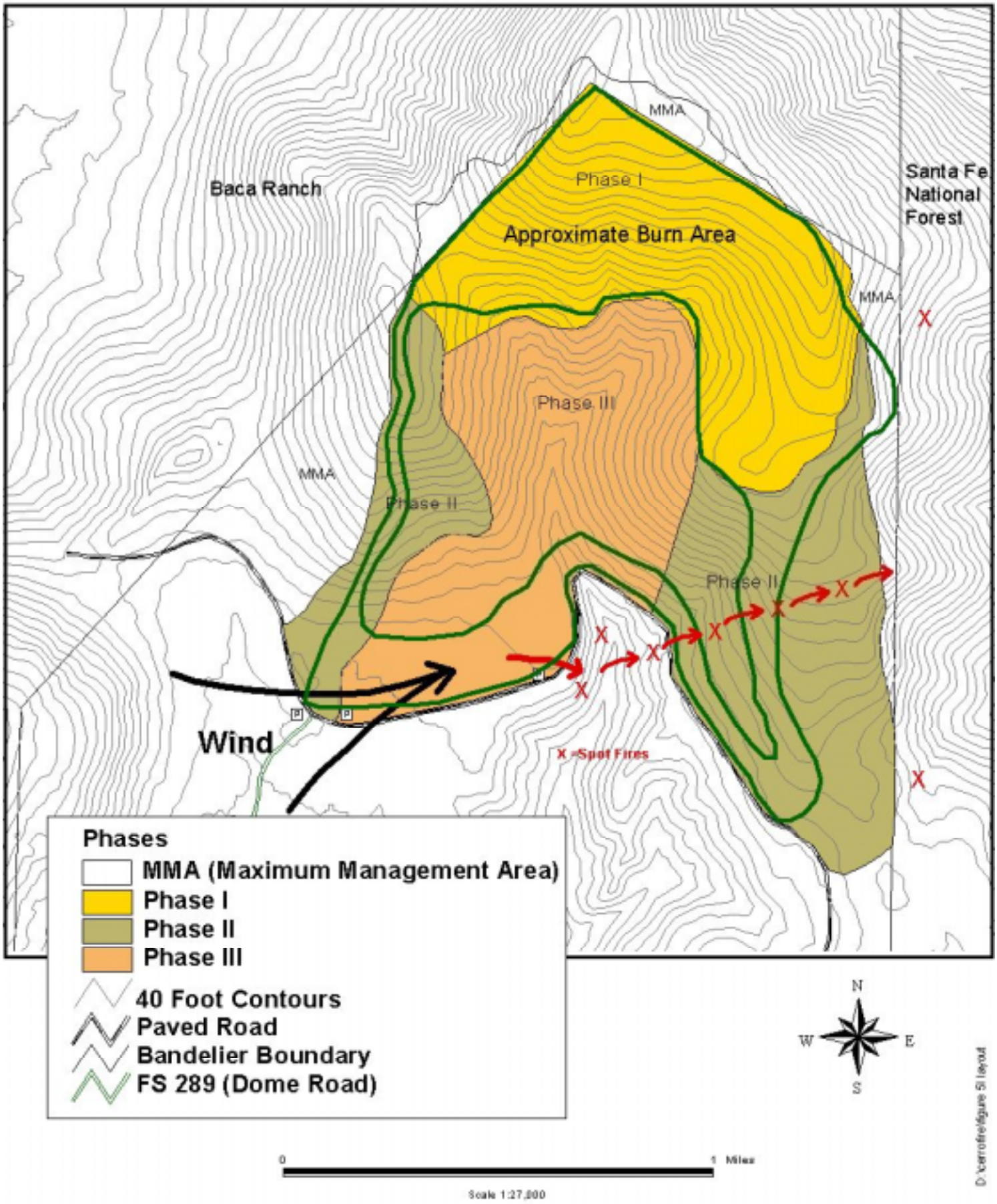


Figure 5l
(8) Sunday, May 7, 2000
Spotting Run up East Flank
Approximately 1700 Hours



pattern to speed up the progress and the burn boss made a decision to stop suppressing the fire on the interior side of the ignition lines.

At about 2200 hours, ignition was completed on the northeast edge of the fire area.

The burn boss began walking back to the test fire area. Upon reaching it, the burn boss discovered the fire had burned through the blackline on the northeast and was burning southwest into the canyon faster than anticipated.

At 2200 hours, two additional firefighters arrived on the east side of the fire.

At 2300 hours, the ignition crew of three and a holding crew of 12 arrived back at the test fire area to suppress the fire burning outside the test fire.

At approximately 2315 hours, ignition began down the northwest edge of the unit.

Friday, May 5

At approximately 0100 hours, the crews reached the upper saddle and spent the next 1-1/2 hours bringing the fire back from the knob into the saddle, securing the line at 0230 hours.

Between 0100 and 0130 hours, the burn boss sent part of the Black Mesa crew down the mountain to get some sleep. At 0230 hours, five NPS personnel, the burn boss, the fire observer, and the remainder of the Black Mesa 10-person crew hiked down to the vehicles to get some sleep. The burn boss then left the fire, going to the office in the NPS housing area to order contingency resources.

At 0300, the burn boss called Zone Dispatch to order a Type 3 helicopter and a 20-person hand crew; he was told to call back in the morning. He also called the crew of Bandelier Engine 91 and asked them to come on duty at 0530 hours and go to the fire.

At 0600 hours, the burn boss and the fire observer began to determine the status of the ordered resources and contact key park staff regarding the fire situation. The holding boss updated the burn boss on the fire. The interior fire had backed below where the blacklining operations had stopped.

At approximately 0730, the burn boss reached Zone Dispatch, having tried since 0630 hours, to request a Type 1 20-person hand crew and a Type 3 helicopter. The dispatcher responded that he would need to check with others before filling this order. The dispatcher then called the park FMO and explained that the prescribed fire needed to be converted to a wildland fire so the requested resources could be obtained. The park FMO and the Zone Dispatcher reached agreement whereby resources would be ordered for a wildland fire currently burning on the national forest, but would be diverted to the prescribed fire.

At 1000 hours, the fire observer, the burn boss, and the holding boss discussed a change in command of the prescribed fire, as the burn boss needed sleep. The decision was made that the fire observer would now become the burn boss. Shortly thereafter, the holding crew on the northeast side reported fire slopover outside the line and they were having difficulty containing it. They requested water drops and

additional firefighters.

At 1030 hours, the Type 3 helicopter (H312) arrived, dropping off two personnel on the northeast side of the fire and departed to the helibase to pick up the bucket and begin water drops.

At 1100 hours, the Type 1 hand crew arrived at the fire. Five people went up the west line and 13 people went up the east line to the northeast side of the fire to assist in containing the slopover.

At 1255 hours, an air tanker was requested for the slopover on the northeast side and arrived an hour later. At this point, the burn boss made the decision to convert the prescribed fire to a wildland fire, which then became the Cerro Grande fire. The burn boss took over the fire as the Incident Commander (IC) and additional resources were ordered. Efforts then focused on suppressing the fire.

At approximately 1630 hours, a spot fire was detected one-quarter mile east of the main fire in Water Canyon, which the Type 1 hand crew contained. Another Type 1 hand crew arrived at the fire and started walking in.

At 1630 hours, the IC briefed park management on the Cerro Grande fire situation.

At 2115 hours, the Wildland Fire Situation Analysis (WFSA) was completed by the IC, the park Fire Management Officer, and the Chief of Resources Management and approved by the Superintendent.

At 2255 hours, Zone Dispatch requested the current fire weather observations to send to the National Weather Service (NWS). During the nighttime hours, crews began burning out the east handline (the part of a natural or constructed fire barrier that is scraped or dug to mineral soil) and improved the west saw line.

At 2355 hours, the NWS issued a spot weather forecast, calling for a fire weather watch on Saturday, May 6.

Saturday, May 6

During the nighttime hours, between 2400 and 0800 hours, one hand crew went off-shift, which left one hand crew on the fire to do fireline operations.

At 0230 hours, the hand crew began its blacklining operations along the east and west sides of the fire to stay ahead of the fire as it backed down the hill.

At 0728 hours, the hand crew requested an air tactical group supervisor, after a second spot fire was observed outside the fire area to the east, which was successfully contained.

During the daytime hours, the crew held the lines on the east and west sides of the fire, down to State Road 4.

At 1425 hours, the park Superintendent and key fire staff met with the interagency cooperators (Los Alamos National Laboratory. U.S. Forest Service and Los Alamos County) to discuss the suppression

strategy and tactics selected in the WFSA.

At 1846 hours, the crews continued firing operations to secure the handline along the east side of the fire. Progression was slow.

Sunday, May 7

At 0730 hours, the hand crew for the day operational period replaced the night crew on the east line and continued firing operations down to and west along State Road 4.

At approximately 0800 hours, air attack reported a spot fire on the park/forest boundary. By 1110, the spot was fully contained.

All burning operations along State Route 4 were halted at 1000 hours due to down slope wind conditions.

At 1150 hours, winds increased from the west and a spot fire occurred across State Route 4 into Frijoles Canyon.

At 1230 hours, the spot fire was growing rapidly and a Type 1 Incident Management Team and two Type 1 crews, two Type 2 crews, and one Type 3 helicopter were requested.

At 1240 hours, a decision was made by the IC to evacuate Graduation Flats and American Springs.

At approximately 1300 hours, interagency road closures and evacuation procedures were initiated. The Santa Fe National Forest Supervisor and Forest FMO were notified of these actions.

At 1450 hours, spot fires were reported along the eastside of the fire, increasing in intensity with the potential to threaten Los Alamos National Laboratory.

At 1700 hours, the spot fires in Frijoles Canyon were contained by the two Type 1 hand crews.

By 1700 hours, a spot fire to the east of the fire had grown to approximately 100 acres with additional spotting up to one-quarter mile ahead of the main fire.

At 1845 hours, a decision was made to burn out sections along State Route 501 and Forest Road 1 (Camp May Road) to protect the Los Alamos National Laboratory and the town of Los Alamos.

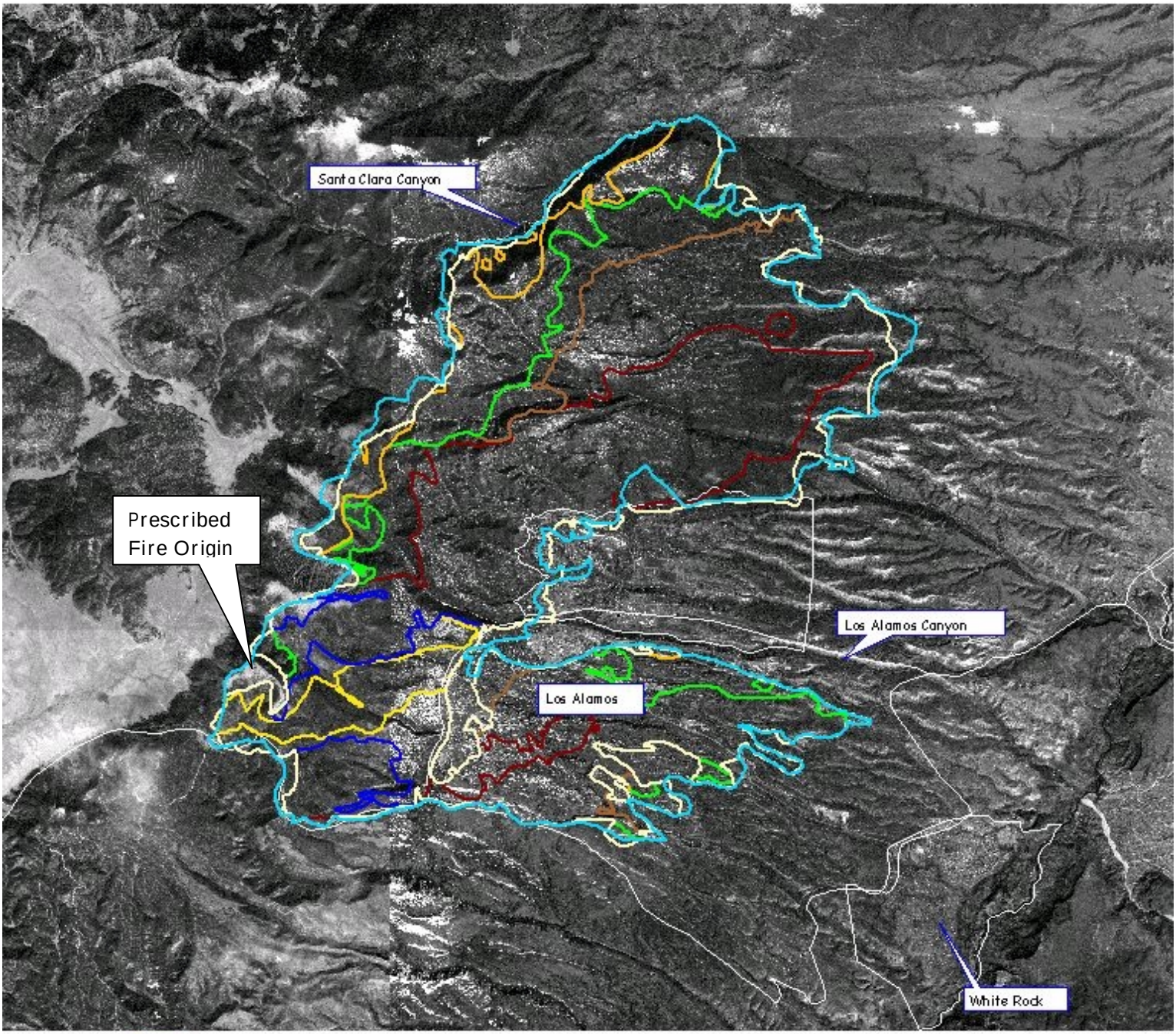
At 2100 hours, an interagency meeting was held to develop a unified command delegation of authority and a revision of the WFSA.

Monday May 8

At 0100 hours, the Type 1 Incident Management Team was briefed by the agency administrators and took over the fire operations at 0600 hours. (Fig. 6 shows the Cerro Grande Fire as of May 17, 2000.)

Figure 6

CERRO GRANDE FIRE
IR MAPS MAY 8 -15, 2000
(IR TAKEN BY USFS)



May 15 Midnight - 46,925 acres
MAY 14 Midnight - 44,323 acres
MAY 13 Midnight - 42,232 acres
MAY 12 Midnight - 36,117 acres
MAY 11 Midnight - 32,901 acres
MAY 10 Midnight - 19,650 acres
MAY 9 Midnight - 4,296 acres
MAY 8 Midnight - 1,968 acres

N

8000 0 8000 16000 Feet

This map is for informational purposes only.

EMNRD

NEW MEXICO STATE FORESTRY

FINDINGS AND RECOMMENDATIONS

Findings and recommendations are presented below to answer the questions asked of the Fire Investigative Team in the delegation of authority. Findings and recommendations cover planning, implementation, and qualifications.

Planning

1. Was the prescribed fire plan adequate given the complexity, objectives, and environmental conditions, and did it comply with guidance set forth in Director's Orders-18 and Reference Manual-18, which are NPS documents for policy and direction on fire management?

The investigation has found that the prescribed fire plan was not adequate.

Finding A: The complexity rating process completed for the Upper Frijoles 1 and 5 (Cerro Grande) prescribed fire plan did not follow the National Park Service rating system. The range of numeric ratings assigned by Bandelier, i.e., 1,2,3, did not comply with the Worksheet Numeric Rating Guide in RM-18, which has a numeric ratings range of 1,3,5 (USDI National Park Service 1988b). This error in and of itself resulted in the prescribed fire being rated as low-moderate complexity (87) by Bandelier staff rather than moderate-high (137) when the correct values were used.

Recommendation: Agencies must ensure that complexity rating systems are used properly.

Finding B: There are different prescribed fire complexity rating systems being used by different agencies, and within the southwest geographic area there are no standard systems among agencies.

Recommendation: Agencies should jointly develop and use interagency complexity rating standards for specific geographic areas rather than agency-wide standards.

Finding C: A number of the prescribed fire complexity elements in the rating guide were consistently underrated based on the investigation team review. This underrating coupled with the apparent misuse of the system identified in Finding A resulted in a significant misclassification of the complexity. An analysis of where each complexity element was underrated is shown in Table 1.

Recommendation: Implement in the plan review process, a specific checklist that indicates review of the complexity rating. Ensure that all prescribed fire planners and reviewers are trained in how to accurately use the complexity standards in the complexity rating system.

Table 1. The analysis of the underrated complexity elements. (Worksheet Numeric Rating Guide in RM-18)

Safety	• The burn unit's fireline was unanchored. • There was no hand line along the boundary of adjacent landowner (Baca Ranch). • No escape routes were identified. • Incident action plan did not conform to National Wildfire Coordinating Group standards. • Staff not available for extended periods; 0200-0300 crew's relief created personnel shortage. • Inadequate staffing resulted in extended hours and extreme shift periods lasting 12 hours prior to ignition . • Spot weather forecast was issued at 1220; ignition was 1930. Weather observations were taken at Cerro Grande Summit the morning of May 4, up to 11 am. No further weather observations were taken until 1735. • Weather observations were in compliance. Holding Specialist had a telephone consultation with the NWS at 1900. • Two single resources were not on the fire and not briefed; dealing with a flare up on another prescribed fire in park. • No resources were identified to relieve current personnel assigned to the fire and the plan was unclear as to where the fire would be stopped. • Costs were an issue; as an AD crew, the Black Mesa Crew could only be used 24 hours prior to ignition and 24 hours after being taken off active assignment. Cost preparation for the unit had not been completed. • The complexity of the fire exceeded the management capability of the organization.
Threats to the Boundary	• State of New Mexico and U.S. Forest Service did not have an agreement with Bandelier to allow prescribed fire on those properties. • High probability of spot fires given that the prescription calls for flame lengths at 9 feet with consumption and torching of overstory trees. • Boundaries had continuous fuels requiring line construction to keep fire from crossing.
Fuels and Fire Behavior	• All aspects except the north were presented within the burn area. • Variable slope conditions were 0 to 20%. • Five fuel types with variable loading (grasses composed of two different fuel types). • Potentially long duration fire unless the fire is extinguished and totally mopped up. • Drought index indicates moderate drought and is expected to continue

Objectives	• This prescribed fire was an action to restore a fuel situation • Objectives required a different treatment for each of the fuel types present in the burn unit, e.g. varying firing intensities required to achieve objectives. • Fire spotting objective under one quarter mile is invalid due to lack of agreements with adjacent landowners.

Management Organization	• Multiple resource incident; fire plan identified helicopters, crews, engines, and monitors which dictated an ICT3 organization, not an ITC4. • multiple operational periods requiring shifting of command and briefing and debriefing of resources at change of command.

Protection of Natural, Cultural and Social Values	• Dealing with multiple threatened and endangered species requires mitigations and constraints on operations. • As identified in burn units 1 and 5, cultural resource inventory dated July 1999, numerous cultural and historical resources were identified for protection as part of the project. • Research plots requiring protection

Logistics	• Duration of support is in multiple phases requiring multiple operational periods • Access is only to the bottom of the burn unit with the top of the burn unit being 1,100 feet in elevation, accessible only by foot • High external interest and concern • Some impact on neighbors and visitors due to operations adjacent to the road

Political Concerns	• No provisions to manage media on the fire

Tactical Operations	• Complex firing patterns dependant upon local weather and fuel conditions. • Simultaneous use of multiple firing sequences. • Aerial support for mitigating actions desirable. • Simultaneous actions were critical to accomplishment of objectives. • Multiple mitigation actions at various locations spread throughout the fire.

Interagency Coordination	• High competition for resources due to suppression of wildland fires within the zone. • Los Alamos National Laboratory concerns relative to prescribed fire.

Finding D: The prescribed fire plan was not substantively reviewed before it was approved by the agency administrator (Superintendent).

Recommendation: The prescribed fire plan must be reviewed by the unit fire management officer and an appropriate off-unit technically qualified reviewer.

Finding E: The prescribed fire planner did not receive sufficient oversight, guidance, and support to prepare the prescribed fire plan.

Recommendation: The Board of Review must consider accountability as discussed in the Federal Wildland Fire Management Policy and Program Review to determine appropriate actions with respect to this prescribed fire (USDA Forest Service and DOI 1995, page 30).

Finding F: The prescribed fire plan prescription was inadequate for all phases of the burn due to wide elevation variations, varying aspects, and different fuel types. The prescription necessary to meet objectives at the upper elevations would cause unacceptable resource damage on the lower elevation of the burn unit.

Recommendation: Agencies should ensure that within landscape scale projects there are separate and distinct prescriptions for each fuel model.

Finding G: The prescribed fire plan prescription projected flame lengths in excess of the limits set in the Bandelier NM Fire Management Plan.

Recommendation: Prescribed fire plans must be consistent with fire management plans.

Finding H: Bandelier National Monument personnel did not receive or solicit comments from all cooperating agencies in the planning process. After the incident, cooperating agencies expressed concern about the decision to ignite the prescribed fire.

Recommendation: The Federal Wildland Fire Management Policy and Review requires coordination (USDA Forest Service and DOI 1995, Guiding Principles). To strengthen the existing policy we recommend that each prescribed fire plan be reviewed by all adjacent land and/or fire managers and concurred by signature. If not concurred, then the project must be modified such that the maximum manageable area (the area that could be burned in prescription) excludes such other property or jurisdictions.

Finding I: The prescribed fire plan amendment prepared the day of the burn did not consider the full consequences of the changes and actions necessary for successful completion and coordination of the prescribed fire.

Recommendation: Any amendment must go through the same review, approval, and notification process as the original plan.

Finding J: The contingency plan inadequately identified actions needed to keep the prescribed fire within the prescribed parameters and necessary actions to be taken if it escaped.

Recommendation: Agencies should jointly develop prescribed fire implementation policy that requires Wildland Fire Situation Analysis alternatives for the lands adjacent to the prescribed fire unit, and include the alternatives in the contingency plan.

Implementation

2. Were the prescription, actions, and procedures set forth in the prescribed fire plan followed?

There were a number of critical deviations from the prescription, actions, and procedures set forth in the prescribed fire plan, as well as standard fire practices.

Finding A: The "Go-No Go" checklist was not completed prior to the burn.

Recommendation: This critical checklist must be completed so the prescribed fire burn boss can make the appropriate decision to proceed or not proceed with the burn.

Finding B: Contingency resources were not ordered and placed on standby prior to implementation of the prescribed fire.

Recommendation: Contingency resources identified in the plan should be ordered through normal wildland fire procedures to ensure their availability.

Finding C: On the early morning of May 5, USDA Forest Service contingency resources were ordered and did not arrive until approximately 1100 hours. Lateness of arrival of contingency resources influenced control of an isolated spot fire but did not effect the escape of the fire.

Recommendation: Federal agencies must resolve the inconsistency regarding the use of contingency resources. Some believe contingency resources are to keep prescribed fire with in burn boundaries, while others believe that contingency resources are only ordered when the prescribed fire escapes.

Finding D: Once the prescribed fire was declared a wildfire, wildland fire suppression tactics were used that were not in accordance with the Wildland Fire Situation Analysis. This resulted in additional fire being introduced into the unit, which ultimately produced the source of spotting and escape when high winds developed on Sunday, May 7.

Recommendation: Fire operations must not deviate from the strategies and tactics identified in the current Wildland Fire Situation Analysis.

Finding E: Numerous safety violations occurred, i.e., unanchored fireline, unheeded work rest guidelines, aviation SAFECOM, lack of identified escape routes and others.

Recommendation: Firefighter and public safety is the highest management consideration. The Board of Review must consider the safety policy discussed in the Federal Wildland Fire Management Policy and Program Review to determine appropriate actions (USDA Forest Service and DOI 1995, page 20).

Finding F: The weather forecast from Albuquerque on Friday afternoon, May 5, fire did not provide any wind predictions in the 3-5 day forecast for the period Sunday, May 7 through Tuesday, May 9. This is a period with area wind gusts greater than 30 mph on both Sunday and Monday. This information is critical for multi-day incidents.

Recommendation: The National Weather Service must follow policy to provide wind information in the extended portion of the fire weather forecast. If information is not provided in the forecast, fire personnel must immediately request such information.

Finding G: There are a significant number of other issues with regard to coordination and use of National Weather Service forecasting in the implementation in the prescribed fire. These issues and recommendations are identified below:

Issue 1: Moderate drought existed in northern New Mexico and surrounding regions in the spring of 2000, having built since the fall of 1999. NPS did not adequately account for the effects of this drought in planning or implementing the Cerro Grande prescribed fire.

Recommendation: Effects of long-term drought must be factored into prescribed fire planning and implementation.

Issue 2: Light precipitation fell at the burn site on April 29 thru May 1. However, the prevailing warm, dry pattern under a ridge of high pressure aloft returned on May 2.

Recommendation: None

Issue 3: The NPS followed policy in asking for, receiving, and making use of a site-specific (spot) weather forecast from the National Weather Service Forecast Office in Albuquerque for the Cerro Grande Prescribed Fire.

Recommendation: Continue policy of requiring spot forecast for all site-specific applications (consistent with the recommendation under Finding D).

Issue 4: On the night of May 4 and the morning of May 5, the Haines Index, which is a measure of atmospheric stability and dryness and indicates the potential for large fire growth, did not contribute to the escape of the Cerro Grande Prescribed Fire.

Recommendation: Wildland fire management agencies need to jointly review the usefulness of the Haines Index.

Issue 5: Onsite weather observations provided by the NPS for the Cerro Grande Prescribed Fire on May 4 and 5 were generally well covered in the spot forecast provided by the National

Weather Service.

Recommendation: Continue to utilize onsite weather observations during wildland and prescribed fires to validate and improve weather forecasting capabilities.

Issue 6: The 11 mph wind gust that occurred during the late evening hours of May 4th was at ridge-top level and was within forecast ridge-top wind speeds provided by the National Weather Service.

Recommendation: None

Issue 7: The standards for wind speed measurements used in National Fire Danger Rating System (NFDRS) fire weather observations are: 1) the anemometer height is 20 feet above the surface, or 20 feet above the vegetative cover, and 2) the standard observation time is 10 minutes. These standards often cause confusion among fire personnel, who don't measure 10 minute or 20-foot winds.

Recommendation: Standardize all non-NFDRS observed and forecast winds to the 20-foot level and two-minute average. We suggest that a study be undertaken to evaluate the use of two-minute winds in NFDRS.

Issue 8: The NWS Albuquerque practices regarding Fire Weather Watches and Red Flag Warnings may have caused some confusion. Some Fire Weather Watches and Red Flag Warnings did not specify affected areas, cause, and valid period.

Recommendation: All fire weather forecast offices should follow policy and include this information on all Fire Weather Watches and Red Flag Warnings for every zone or grouping of zones forecast.

Issue 9: Red Flag Warnings can remain in effect for more than 24 hours for continuous wind events.

Recommendation: Red Flag Warnings should remain in effect until the weather pattern causing the Red Flag conditions no longer exists.

Issue 10: At times fire management personnel did not have a current spot forecast because the burn boss at the incident had set up no regular schedule for spot forecasts.

Recommendation: The prescribed fire plan needs to establish a regular schedule for obtaining spot forecasts.

Issue 11: After May 4, there was a decrease in communications and feedback between the NPS fire management personnel and NWS forecasters in Albuquerque.

Recommendation: Fire management personnel and fire weather forecasters need to be pro-active in establishing and maintaining adequate communications throughout an incident.

The prescribed fire plan needs to include this requirement.

Issue 12: The Incident Action Plan (IAP) for Sunday, May 7 did not include a weather forecast for the day operational period.

Recommendation: Incident Management Teams must ensure IAPs include a weather forecast for the current operational period.

Finding H: Conditions adjacent to the prescribed fire boundary were not given adequate consideration with regard to fire behavior, fuel conditions, and public safety in the event the fire crossed the planned burn boundaries.

Recommendation: Agencies should jointly develop prescribed fire implementation policy that requires Wildland Fire Situation Analysis alternatives for the lands adjacent to the prescribed fire unit, and include the alternatives in the contingency plan. (Same as recommendation 1-J above.)

Finding I: The current wildland fire situation in the Southwest was not given full consideration when the prescribed fire was initiated.

Recommendation: Before the decision is made to implement a prescribed fire, the geographic area preparedness level must be considered, and there must be appropriate coordination with the Geographic Area Coordination Center based on the preparedness level.

Finding J: The preparedness level coordination and allocation of resources for all wildland fire use is not adequately addressed in the Southwest Geographic Area Mobilization Guide.

Recommendation: Preparedness level coordination and allocation of resources for all wildland fire use should be addressed in the Southwest Geographic Area Mobilization Guide, specifically strengthening the criteria for prescribed fire.

Finding K: Actions taken to notify cooperating agencies and interested parties of this prescribed fire did occur within the time frame specified in the prescribed fire plan. The communications that did happen on May 4, however, did not adequately reflect the complexity and full nature of the prescribed fire about to be undertaken.

Recommendation: Appropriate pre-notification and communication with adjacent land owners, interested and concerned parties, and other agencies should be undertaken as specified in the Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide (USDA Forest Service and DOI 1998, page 69).

Qualifications

3. Were prescribed fire training and experience of personnel involved commensurate with agency qualification standards?

<u>All personnel met existing National Wildfire Coordinating Group standards.</u>

Finding A: The technical and operational experience of the burn boss was not adequate to plan and conduct the prescribed burn given its true complexity.

Recommendation: Unit managers will review individual wildland fire qualifications to ensure that technical and operational skills and experience are commensurate with the fuel and project complexity.

Finding B: Personnel implementing this prescribed fire met established National Wildfire Coordinating Group standard for tasks performed on the fire.

Recommendation: None

CONCLUSIONS

On May 4, 2000, Bandelier National Monument fire management personnel ignited a prescribed burn, Upper Frijoles 1&5, which has become known as the Cerro Grande Prescribed Fire, near the summit of Cerro Grande. This prescribed fire was based upon a flawed plan and required fire management policies were not followed. This fire progressed without problems until on May 5 at approximately 1300 hours when slopover and spotting resulted in the burn boss declaring it a wildfire. The wildfire was managed by a Type 3 Incident Management team and staffed by local firefighters until May 7. Around noon, stronger than forecasted gusts of wind of up to 50 miles per hour caused the fire activity to increase dramatically. The winds continued to intensify, the fire developed numerous spotfires, and triggered a crown fire. This in turn resulted in extreme fire intensity which fire crews could not attack. A Type I Incident Management Team was ordered and upon arrival, after assessing the condition of the fire and the current management personnel, assumed command.

Based upon a review by the Investigation Team's fire behavior specialists, it is possible that if sufficient contingency resources had been at the burn site on May 5, these resources may have been able to contain the "slop-over" without the need to convert the prescribed burn to a wildfire. If that had occurred the prescribed fire would have progressed to the forest fuels where it is probable that the fire would have slowed or stopped completely. Thus, the fuels would not have been preheated and dried out and no ignition source would have existed to initiate the crown fire that resulted on May 7.

Conclusions of the investigation are as follows:

- The Board of Review needs to consider accountability as described in the Federal Wildland Fire Management Policy and Program Review to determine appropriate actions to address the overall findings of this report (USDA Forest Service and USDI 1995, page 30).

- This incident critically demonstrates the need to continue to provide for firefighter and public safety, and must be given the highest management considerations when managing wildland fire as outlined in the Federal Wildland Fire Management Policy and Program Review (USDA Forest Service and USDI 1995, page 20).

- All agencies must ensure that all administrators are actively involved and committed to the fire management activities. Agency administrators must set the example and establish that wildland and prescribed fire management are critical and of highest importance.

- Agencies must follow all policies set forth in the Federal Wildland Fire Management Policy and Program Review if we are to expect to continue using fire as a critically important management tool to restore natural conditions, maintain forest health, provide wildlife habitat, reduce hazardous fuel buildup, protect watersheds, and improve range condition.

- Agencies must ensure that leaders and managers at all levels set the example in working closely together in planning and implementing fire management activities. Agencies also must ensure that a component of their fire management program includes proactive communication and coordination

with local communities and cooperators. The consequences of not doing so are totally unacceptable.

- The Federal Wildland Fire Management Policy was adopted by the Secretaries of Interior and Agriculture on December 18, 1995. Federal agencies have not fully completed manuals, guidelines, and procedures to fully implement policy along interagency lines. Federal agencies must jointly complete standardization of manuals and procedures to assure consistency of plans and operations to promote cooperation and integrate fire activities across agency boundaries and provide leadership for cooperation with state and local fire management organizations.

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APPENDIX

APPENDIX 1. LIST OF TEAM MEMBERS AND LIAISONS.

APPENDIX 2. DELEGATION OF AUTHORITY FOR THE INTERAGENCY FIRE INVESTIGATION TEAM.

APPENDIX 3. UPPER FRIJOLES UNITS 1 AND 5 PRESCRIBED FIRE PLAN.

APPENDIX 4. CERRO GRANDE WILDLAND FIRE SITUATION ANALYSIS.

APPENDIX 5. STAFF ORGANIZATION CHARTS FOR BANDELIER NATIONAL MONUMENT.

APPENDIX 6. VALIDATION OF PRESCRIPTION PARAMETERS FOR UPPER FRIJOLES UNITS 1 AND 5 PRESCRIBED FIRE.

APPENDIX 7. SUMMARY OF WEATHER INFORMATION FOR CERRO GRANDE PRESCRIBED FIRE.

APPENDIX 8. EVENTS LEADING UP TO THE ESCAPE OF THE UPPER FRIJOLES UNITS 1 AND 5 PRESCRIBED FIRE.

APPENDIX 1. LIST OF TEAM MEMBERS AND LIAISONS.

Cerro Grande Prescribed Fire Investigation Team Liaisons

Antonio Guillen	Emergency Preparednes Coordinator	Rio Arriba County, Espanola, NM
Samuel O. Montoya	County Manager	Santa Fe County, Santa Fe, NM
Clark "Sparkie" Speakman	ES Director/Fire Marshall	Sandoval County, Bernalillo, NM
Denny Gutierrez	Governor	Santa Clara Pueblo
Perry Martinez	Governor	San Ildefonso Pueblo

Team Members

Steve Anderson	Asst. Field Office Manager	BLM-Albuquerque FO, NM
Joan Anzelmo	Chief, Division of Public Affairs	NPS-Grand Teton NP, WY
Dick Bahr	Fuels Specialist	NPS-NIFC, Boise, ID
Bill Blake	Chief Ranger	NPS-Death Valley NP, CA
John Brenna	Special Agent	BLM-Albuquerque FO, NM
Mike Campbell	Supervisory Training Specialist	BLM-NIFC, Boise, ID
Ken Castro	Fire Management Officer	NPS-Lassen Volcano NP, CA
Tom Chavez	Occupation Health and Safety Spec.	BLM-Albuquerque FO, NM
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Chip Davis	Special Agent	NPS-National HQ, Washington, DC
Kathy Davis	Natural Resource Manager	NPS-Southern Arizona Group, Phoenix, AZ
Al DeLaCruz	Special Agent	NPS-Sequoia NP, CA
Tony Delfin	Resource Development Bureau Chief New Mexico Energy, Minerals and Natural Resources Department Forestry Division	Santa Fe, NM
Linda DeVon	Computer Specialist	NPS-Tucson, AZ
Diane Friez	Personnel Officer	BLM- Billings, MT
Pat Haddad	Fire Program Specialist	NPS-Tucson, AZ
Alan Hoffmeister	Public Affairs Officer	BLM-Coos Bay FO, OR
Jim Koutz	A/V Production Specialist	USDA FS-Missoula, MT
James A. Loach	Associate Regional Director	

	Midwest Region	NPS-Omaha, NE
Thomas P. Lonnie	Deputy State Director Montana and Dakotas	BLM-Billings, MT
Joanie Losacco	Deputy State Director, External Affairs	BLM-Phoenix, AZ
Connie Maestas	Human Resource Specialist	BLM-Albuquerque FO, NM
Georgia McAdams	Budget Assistant	NPS-Yellowstone NP, WY
McKinley-Ben Miller	Forester	BLM-Albuquerque FO, NM
Dan O'Brien	Fire/Fuels Planner	USDA FS-WallaWalla, WA
Mark Pirtle	Special Agent	BLM-Reno, NV
C. S. (Tyler) Przybylek	Chief of Staff, Albuquerque Operations	DOE-Albuquerque, NM
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Jennifer Sypher	Special Agent	NPS-Grand Canyon NP, AZ
Tom L. Thompson	Deputy Regional Forester Rocky Mountain Region	USDA–FS Denver, CO
J.R. Tomasovic	Chief Ranger	NPS-Gulf Island NS, FL
John Werth	Meteorologist	NWS-Seattle, WA

USDI-United States Department of the Interior
USDA-United States Department of Agriculture
BLM-Bureau of Land Management
NPS-National Park Service
DOE-Department of Energy
BOR-Bureau of Reclamation
NWS-National Weather Service
FS-Forest Service
FO-Field Office
NS-National Seashore
MTDC-Missoula Technology Development Center

APPENDIX 2. DELEGATION OF AUTHORITY FOR THE INTERAGENCY FIRE INVESTIGATION TEAM.

United States Department of the Interior

NATIONAL PARK SERVICE
1849 C Street, N.W.
Washington, D.C. 20240

IN REPLY REFER TO:
In Reply Refer to:
A96

May 12, 2000

To: Tom Lonnie, Team Leader, Bureau of Land Management

From: Director, National Park Service

Subject: Cerro Grande Fire Investigation

In accordance with the Secretary of the Interior's direction, the National Interagency Fire Center has formed a Fire Investigative Team. This letter constitutes the delegation of authority for the Fire Investigative Team. This investigative team will follow NPS procedures as described in Chapter 13, Evaluation and Review, Reference Manual -18.

The purpose is to investigate the circumstances associated with the planning and implementation of the Cerro Grande Prescribed Fire in Bandelier National Monument and determine if overall NPS guidance and procedures were followed. The Investigative Team will examine events and circumstances during the time period beginning with the planning and implementation of the prescribed fire to the transition to the Type I Interagency Incident Management Team.

Specific objectives for this investigation include:

- If the Prescribed Fire Plan was adequate given complexity, objectives, and environmental conditions, and if it complied with NPS guidance set forth in Director's Orders #18 and Reference Manual -18,
- If the prescription, actions, and procedures set forth in the Prescribed Fire Plan were followed,
- If prescribed fire training and experience of personnel involved were commensurate with agency qualification standards, and
- Recommendations for immediate and long-term actions to prevent similar future occurrences and improve program performance.

Individuals who have already been assigned to gather information vital to the investigation will join the Investigative Team. These individuals are Tim Sexton and Ken Castro.

The Investigative Team will complete work by May 18, 2000. The findings of the Investigative Team will be reported to an Independent Review Board who will be appointed by the Secretary. This Board will contain federal and non-federal members.

This delegation shall go into effect at 1500 hours (MST) on May 12, 2000.

1700 (EST) 05/12/00

FOR Robert Stanton

UNTIL MR STANTON SIGNS THIS OR A REVISED VERSION IN SANTA FE

APPENDIX 3. UPPER FRIJOLES UNITS 1 AND 5 PRESCRIBED FIRE PLAN.

Amendment to
Bandelier National Monument
Management Ignited Prescribed Fire
Burn Plan
Burn Unit – Upper Frijoles 1 and 5

Reason for Amendment:

The original burn plan states that an agreement with the Baca Location Number 1 land owner will be received before ignition to allow for 32 acres of land to be burned on Baca Ranch property and allow for up to 20 acres to be managed for spot-fires and slopovers. This agreement has not been received. This amendment will detail the actions necessary to conduct the burn to keep the fire on Bandelier National Monument and minimize possible escapes onto the Baca Ranch.

Implementation Actions:

General Scope of Amendment:
Black-lining along project control lines will be accomplished prior to burning during cooler and moister conditions which will help enhance control efforts along control lines.

Ignition plan:
Ignition will proceed with a test burn near the Cerro Grande summit on monument lands. Ignition will continue if the test burn is controllable by holding forces. Ignition will continue down the east and west lines, mainly using strip backing firing with hand held ignition devices. If ignitions not meeting resource objectives, ignition will be limited to just black-lining operations. Ignition will only proceed as fast as control resources can keep up with ignition operations. Black lining may be continued into the timbered areas as long as holding forces can easily keep the fire within the unit boundaries.

Holding Plan:
Backpack pumps will be staged along the monument boundary. Holding will be accomplished using fire personnel with backpack pumps and swatters. Holding forces will limit fire spread to the monument property. Any spread off monument property will be suppressed as quickly as possible. Ignition resources may halt ignition and assist holding forces as directed by the holding boss and burn boss.

Contingency Plan: The following resources will need to be available within the following time periods:

2 Type 1 or 2 Crews	within 4 hours
2 Type 6 Engines	within 4 hours

If the fire leaves the monument property the holding supervisor will act as ICT4. If the escape is not containable within one burning period by resources on the project the escape will be declared a wildland fire and a WFSA will be developed and appropriate action will be implemented.

Organization:

Position	Minimum Qualifications
Burn Boss	RXB2
Ignition Specialist	RXI2
Ignition Crew	2 FFT2
Holding Boss	CREW and ICT4
Holding Crew	1 FFT1 and 4 FFT2
Fire Monitor	1 FEMO
Traffic Control	2 FFT2, (in place as seen by burn boss, will probably be part of ignition or holding crews)

Other Changes to the burn plan:
The Maximum Manageable Area on the Baca Ranch and the area of the burn on Baca Ranch property will be excluded from the project area.

Prepared By:

Reviewed By:

Reviewed By:

Approved By:

Bandelier National Monument
Management Ignited Prescribed Fire
Burn Plan
Burn Unit – Upper Frijoles 1 and 5

Prepared By: _____ Date: _____

Reviewed By: _____ Date: _____

Reviewed By: _____ Date: _____

Approved By: _____ Date: _____

Executive Summary

Upper Frijoles Units 1 and 5 are in the northwest corner of Bandelier National Monument. They encompass 1,000 acres in the headwaters of Frijoles creek above US highway 4 to the park boundary at the Cerro Grande summit. The vegetation in the area consists mostly of ponderosa pine/mixed conifer with some mixed conifer areas and montaine grasslands at the higher elevations. Included in the 1,000 acres is approximately 32 acres of the Baca Ranch (per attached written agreement).

The area within Unit 1 was burned in 1993. The burn was not as successful as planned, as much of the area within the burn unit is inherently moist and did not burn very well. Dead fuel loadings, pre 1993 burn and current, from averaged plot information are as follows:

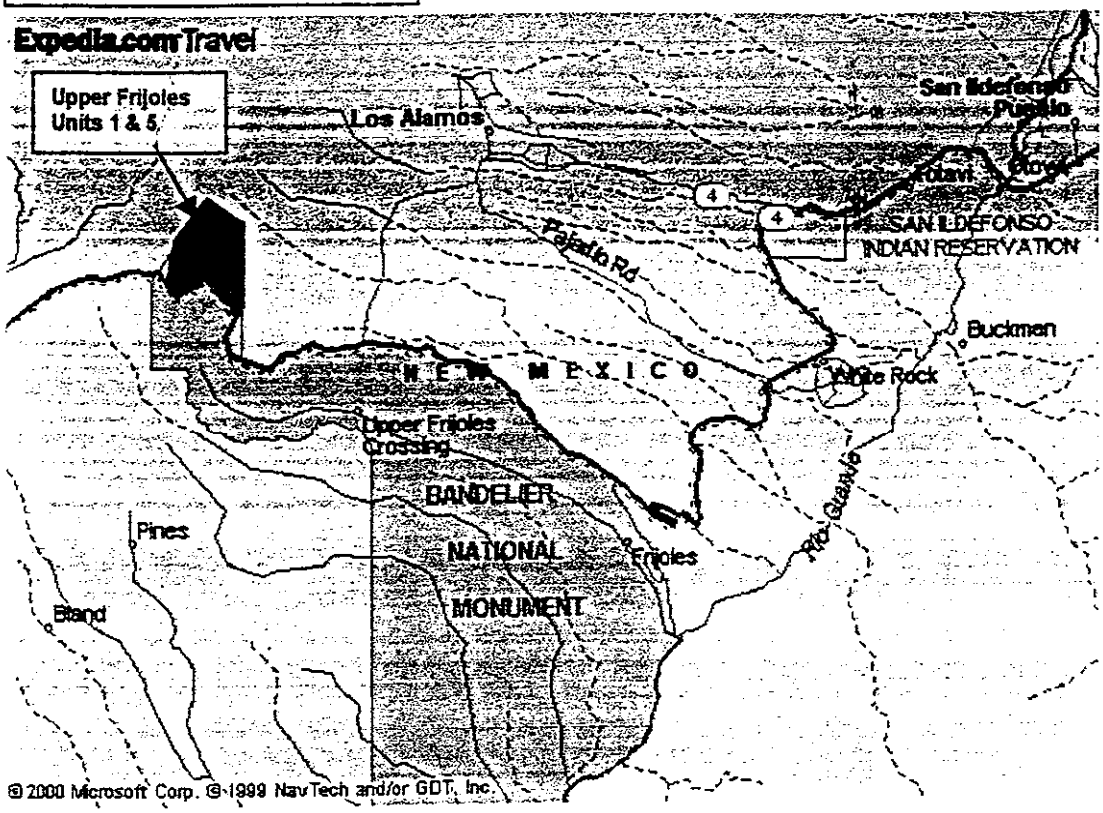
Pre 1993 Burn Total Fuel Loading	34.4 Tons/Acre
Current Total Fuel Loading	29.0 Tons/Acre (84% of original)

The primary purpose of the project is to reduce hazard fuels in the burn unit while allowing fire to be restored as a keystone natural process. Removal of cured herbaceous material; dead fuels and mid-story canopy are some objectives of the burn. This will reduce the threat of unwanted fires moving onto non-park lands, and allow the processes associated with fire to occur within the burn area.

With the exception of the grasslands, dry conditions will be needed to accomplish burn objectives. The burn will be accomplished in three phases. The first phase will be to burn the upper part of the burn that consists of grasslands. The second phase will burn the timbered areas along the burn perimeter and drier aspects (generally south facing slopes) within the project area. This phase will occur shortly after or concurrently with the first phase. The third phase will be delayed until extremely dry conditions develop that will allow for burning of the wetter areas. The third phase will most likely occur several weeks or even months after the initial burning. The third phase of the burn should require minimal resources, as containment will be accomplished by the previous burning.

The burn is moderately complex. There are issues associated with private lands within and adjacent to the burn perimeter and Forest Service lands that bound the burn unit, cultural and natural resources within the burn unit, and a reasonable chance of air quality impacts in the Los Alamos area. Coordination with neighboring landowners, resource managers within the park and following the smoke management plan for the burn should mitigate these issues.

Figure 1: Vicinity Map



1. Burn Unit Description:

Vicinity Map: See Figure 1: Vicinity Map

Project Map: See Figure 2: Project Map

Location:

Township 19 North, Range 5 East, Sections 21 and 22

Latitude North 35° 52'
Longitude West 106° 25'

UTM Zone Easting 325.50
Northing 3969.70

Size: Phase I – 200 to 300 acres (includes 32 acres of the Baca Ranch)
Phase II – 300 to 600 acres
Phase III – 100 to 500 acres
Total acreage – 1,000 acres

Slope: 2 to 20 %

Aspect: SW, S, and E
Primarily South

Vegetation/Fuel Models: See Figure 3: Fuel Model Map

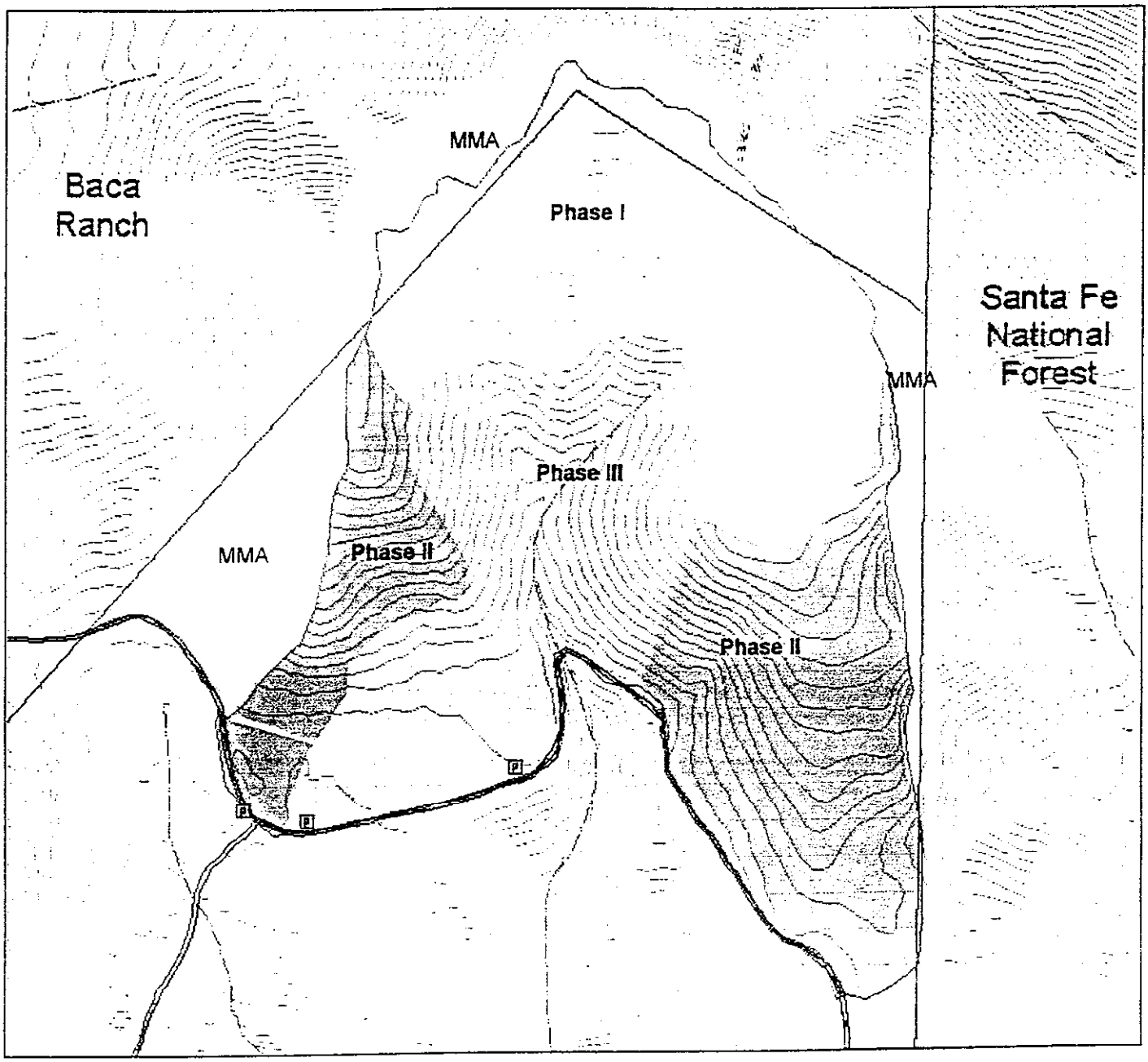
Vegetation Type	Acres	% of Burn Unit	NFFL Fuel Model	NFDRS Fuel Model
Ponderosa Pine/Mixed Conifer	163	14%	9	C
Ponderosa Pine	243	21%	2	C
Montane Grassland	78	6%	1*	L
Mixed Conifer	672	58%	8	G

*Fuel Model 3 converted to Fuel Model 1. May very depending on time of season and growing conditions.

Description of Boundaries:
South Boundary: State Route 4 from BM 9070 to an area approximately 200 yards north of the dome road.
West Boundary: Starting at State Route 4 the boundary goes up to the saddle along the park boundary. The burn generally follows the west side of the ridgeline (where the slope abruptly drops off) to peak 9626. The burn then follows the edge of the montain grasslands to the Cerro Grande Summit.
East Boundary: Starting at State Route 4 the boundary will cross the flats and head up a minor ridgeline to peak 9743. The burn will then follow some rock outcroppings and the eastern edge of the montain grasslands to the Cerro Grande Summit.

Maximum Manageable Area: See Figure 2: Project Map
The maximum manageable area includes areas within the burn project boundaries, but outside the established control lines. It also includes up to 20 acres of the Baca Ranch on the north and northwest sides of the unit.

Figure 2: Project Map



Burn perimeter
Land owner boundary
Paved road
Dirt road
Hydrology

Phase I
Phase II
Phase III
MMA

N

1:20,000
40 foot contour interval

0.5 0 0.5 Miles

Figure 3: Fuel Model Map

Fuel Models
- Short grass, models 1 or A
- Grass understory, models 2 or C
- Tall grass, models 3 or L
- Brush, models 4 or B
- Brush, models 5 or F
- Short needles, models 8 or G
- Long needles, models 9 or C
- Heavier fuels, models 10 or U
- Water
- Bare ground or developed area
- Old logging road
- Paved road
- Dirt road
- Burn unit perimeter
- Bandelier boundary

N

1:20,000
40 foot contour interval

0.5 0 0.5 Miles

2. Goals and Objectives:

Goal 1: Provide for the safety of fire personnel and the public.

Objective:

- *Insure the public receive no injuries*
- Insure no loss time injuries to fire personnel

Goal 2: Restore fire as a keystone natural process.

Objectives: Cerro Grande Monitoring Type

- Reduce pole tree density by 30-70% within 5 years post-burn.
- Reduce over-story trees with a diameter breast height (dbh) of 15.1-49.9 cm by no more than 25% within 5 years post-burn.
- Maintain at least 80% of all over-story trees with a dbh >49.9 cm within 5 years post-burn.

Objectives: Aspen Monitoring Type

- Reduce density of non aspen over-story trees with a dbh , 50 cm by at least 30% within 5 years post-burn
- Reduce the density of all non-aspen pole trees by at least 30% within 5 years post-burn.
- Reduce density of all non-aspen seedling trees by at least 30% within 2 years post-burn.

***Objectives**: Mixed Conifer Monitoring Type*

- Reduce live over-story tree (dbh = 15.1-49.9 cm) density by 10-30% within 5 years post-burn.
- Reduce live pole tree (dbh = 2.5 – 15.0 cm) density by 30-70% within 5 years post-burn

Goal 3: Reduce hazard fuel accumulations in the burn unit

Objectives:

- Reduce total fuel load by 40-80% immediate post-burn.

Goal 4: Ensure the burn does not violate state air quality standards

Objectives:

- Ensure smoke does not violate 90 % of the National Ambient Air Quality Standards in smoke sensitive areas (Los Alamos and White Rock)
- Limit severe visibility impacts to Class 1 airsheds to no more than 5 days
- Provide a contact to address smoke complaints and educate the public on the need to use prescribed fires

Goal 5: Minimize damage to sensitive cultural and natural resources, and to neighboring lands.

Objectives: cultural resources in accordance with the agreement with SHPO.

- Protect ~~all significant cultural sites from damage~~
- Keep mechanized equipment out of spotted owl habitat
- Contain all spot fires and slopovers at less than 5 acres in size

Goal 6: Contain the burn within the established perimeter

Objectives:

- Contain slopovers and spots with burn personnel at less than 5 acres in size within one burning period
- Reduce long range spotting to less than ¼ mile by altering ignition sequence and timing

3. Range of Acceptable Results

If two thirds of the objectives for all goals are met the project will be considered acceptable. If less than two thirds of the objectives for each goal are achieved, the results will be reviewed and recommendations for future projects will be developed.

4. Project Assessment:
Complexity: (See attached complexity rating criteria)
The complexity of this burn is **87** or **Low to Moderate Complexity**

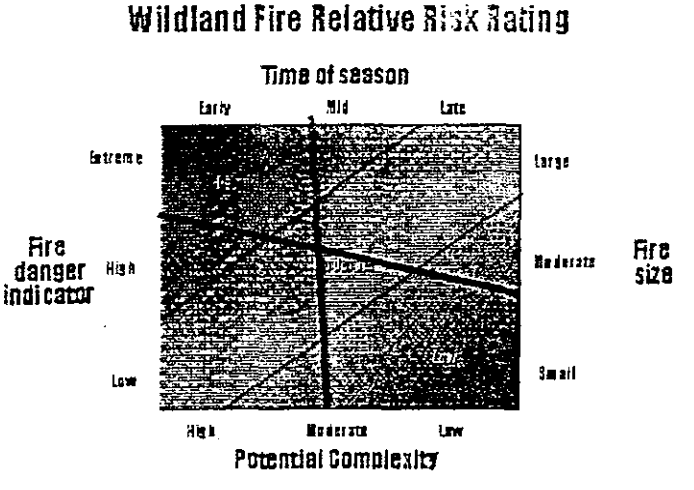
WILDLAND AND PRESCRIBED FIRE COMPLEXITY RATING WORKSHEET

Complexity element	Weighting factor	Complexity value	Total points
Safety	5	2	10
Threats to boundaries	5	2	10
Fuels and fire behavior	5	2	10
Objectives	4	2	8
Management organization	4	2	8
Improvements	3	2	6
Natural, cultural, social values	3	2	6
Air quality values	3	3	9
Logistics	3	2	6
Political concerns	2	3	6
Tactical operations	2	3	6
Interagency coordination	1	2	2
		Total Complexity Points:	87

Complexity Value Breakpoints: Low 40-90, Moderate 91-140, High 141-200

Risk Assessment:

Relative Risk – Moderate
Relative risk may need to be adjusted due to timing of the burn phases and actual fire danger indices at the time of ignition. Most foreseeable changes will *still result in moderate relative risk.*



Probability of Success – Moderate
Success of meeting objectives is moderate, as it requires relatively high fire *behavior over an extended area of the burn. Escapes from the burn area are* somewhat likely, but fuel and terrain features should minimize fire growth outside the burn unit. Safety will be accomplished by communications of hazards and

mitigation measures. Air quality issues will be addressed before unhealthy conditions develop.
Success of meeting control objectives for the burn is high as natural features, changes in aspects and control resources will be adequate for anticipated conditions.

Consequences of Failure – Moderate
Timber and private land values are the primary threats. No structures are in the immediate area. Smoke impacts to sensitive areas could produce political problems that may impact future prescribed fire operations. These will be mitigated by providing public information about the burn and possible smoke impacts, burning under optimal dispersal conditions and halting ignition operations if impacts approach smoke management threshold limits.

5. Implementation Actions

A. Pre-burn Considerations

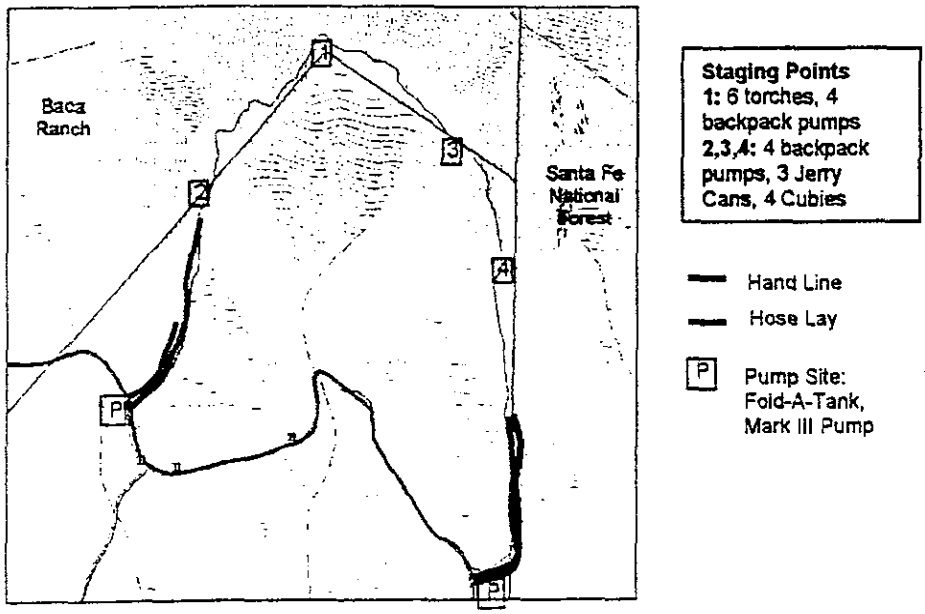
On site: See Figure 4: Preparation Needs

- Construct hand line along designated areas
- Fall or line snags that may fall across control lines
- Set up hose lays in designated areas
- Stage equipment in designated areas
- Complete cultural resource protection mitigation measures
- Collect live, 10 and 100 hour fuel moisture samples in wet and dry areas weekly at least 3 weeks prior to the burn
- Collect weather and fire behavior data hourly during ignition operations

Off site

- Obtain written permission to burn approximately 32 acres of the Baca # 1 property and allow up to 20 acres of escape onto Baca #1 property
- Post "Prescribed Burn Ahead" and "Management Fire, Do Not Report" signs at both ends of the burn unit along Route 4.
- Obtain Air Quality Permit from the New Mexico Environmental Department
- Coordinate logistics (lodging, food) for out of park resources
- Provide a smoke monitor for the Los Alamos/White Rock area
- Notify all agencies and individuals on the Bandelier Prescribed Fire Notification List starting three days prior to burning
- Provide a Public Information/Smoke Management telephone number and contact person at Bandelier National Monument
- Issue a press release one week prior to ignition

Figure 4: Preparation Needs



B. Briefing

A pre-burn briefing will identify all anticipated safety hazards associated with the prescribed fire. Specific topics to include are:

- Lookouts, Communications, Escape Routes and Safety Zones
- Snags
- Coordination of firing and holding events
- Contingency actions
- Medical Plan
- Fire weather and fire behavior
- Unit assignments
- Strategies and tactics to employ
- Minimum Impact Operations

C. Test Fire

A test fire will be conducted every day prior to any burning in a representative location within the burn area to test for fire behavior characteristics prescribed to meet objectives and control of the burn. The test fire will be initiated in an easily containable area. Results of the test fire will be documented and results communicated to the burn boss who will make the decision to continue burning or not.

Public access to the burn area will be restricted to traffic along State Route 4. Limited picture taking and watching of the fire will be permitted only if the safety of the public is not jeopardized and burn operations are not impaired by the actions. The public will not be allowed to enter the burn area.

Other considerations

A fire weather station is located in the south east corner of the unit. This station will be protected with a wet line with support of an engine.

Dendrobanded trees are included in the burn unit. The firing pattern may be modified in these areas and jackpots of fuels may be removed to ensure that there is no mortality of these trees.

A Forest Service representative will be present on the burn site to assess possible conversion of escapes to wildland fires on Forest Service lands during phase II of the project.

An agreement with the Baca #1 Ranch is established to allow for burning approximately 32 acres of the Baca property, and allow for the management of up to 20 acres of slopovers and spot fires.

Mexican Spotted Owl nesting and roosting areas may occur within the project area. If these owls are found, minimal disturbance of the area will occur and firing will be altered to minimize impacts to these areas.

The State Historic Preservation Office concurrence with applicable laws will be followed for cultural resources.

Smoke may impact State Route 4. Traffic control will be enforced on this road if smoke causes visibility problems day and night as long as there is a foreseeable problem.

Use of vehicles on old roads within the burn will not be allowed unless ~~there is an~~ an emergency evacuation is needed.

D. Prescription:
Because of the complex interactions between weather, fuel moisture and fire behavior, **prescription perimeters for fire behavior will be used to determine if the burn is in prescription or not.** All elements of weather and fuel moisture that result in fire behavior sufficient to meet management objectives will be used. Weather and fuel moisture data within the prescriptions listed below are likely to result in the fire behavior needed. Fuel moisture guidelines will be used to assess the conditions needed to execute the burn. Additional constraints on the prescription will be included to meet smoke management objectives.

All values are for head fires. Flanking and or backing fires will be used if fire behavior from these types of firing result in fire behavior within the prescribed conditions listed below.

Weather	FM 9	Fm 8	FM 2	FM 1
Temperature (°F)	40-90			
Relative Humidity (%)	15-50			
Wind Direction	Any			
Wind Speed (Eye Level, MPH)	0-8			
Fuel Moisture	**FM 9**	**FM 8**	**FM 2**	**FM 1**
1 Hour (%)	3-8			
10 Hour (%)	4-10			
100 Hour (%)	7-12			
1000 Hour (%)	8-12			
Live Herbaceous (%)	50-150			
Live Woody (%)	50-150			
Fire Behavior	**FM 9**	**FM 8**	**FM 2**	**FM 1**
Rate of Spread (Chains/Hour)	<10	<10	<60	<160
Flame Length	1" to 6'	1" to 6'	1" to 9'	1" to 9'

Smoke Management Prescription:
The Smoke management prescription is based on dispersal conditions that will allow for optimal dispersion of smoke. SASM runs have defined the following criteria as having no violations of National Ambient Air Quality Standards.

Smoke Management Prescription Parameters

Dispersal	Fair to Excellent
Transport Wind Speed (Min)	2 mph.

E. Special Considerations

Public and Personnel Safety
All burn personnel will wear standard fire fighting leather boots, Nomex pants and shirt, leather gloves and hard hat. They will carry a fire shelter and a fire tool at all times. Supervisory personnel and sufficient numbers of other personnel will carry programmable radios.

All standard wildland firefighter safety rules and guidelines will be strictly enforced (see Fireline handbook).

All assigned personnel will be certified and current. Exceptions are support drivers and non-certified observers who will be accompanied by supervisory line personnel at the discretion of the Burn Boss. Trainees will be allowed as long as they are supervised by a certified and current Trainer for that position.

F. Burn Organization

The burn organization for each phase of the burn will be different due to the special needs of each phase. The following is a list of the minimum number and qualifications needed to conduct each phase:

Phase 1

Position	Minimum Qualification	Proposed Name or Source
Command		
Burn Boss	RXB2	
Resource Advisor	Resource Advisor	
Cultural Resource Advisor	Resource Advisor	
Operations		
Ignition Specialist	RXI2	
2 Igniters	FFT2	Fire Use Module
Holding Specialist	CRWB and ICT4	Band Provided
4 Firefighters	FFT2	BIA Provided
Planning		
Fire Monitor	FEMO	Fire Use Module
Smoke Monitor	FEMO	Fire Use Module
Logistics/Finance		
L/F Lead	Knowledge of Band and Fire	Band Provided (may be accomplished by the Burn Boss)

Phase II

Position	Minimum Qualification	Proposed Name or Source
Command		
Burn Boss	RXB2	
Resource Advisor	Resource Advisor	
USFS Representative	USFS Employee	Espanola RD Provided
Resource Advisor	Resource Advisor	Band Provided
Operations		
Division A	Both CRWB and ICT4	Band Provided
6 Firefighters	1 FFT1 and 5 FFT2	BIA Provided
Ignition Specialist	RXI2	
3 Igniters	FFT2	Fire Use Module
Division B	Both CRWB and ICT4	USFS Provided
6 Firefighters	1 FFT1 and 5 FFT2	USFS Provided
Ignition Specialist	RXI2	Fire Use Module
3 Igniters	FFT2	Fire Use Module
Division C	ENG8	USFS Provided
2 Type 6 Engines	ENG8 and FFT2	USFS and Band Provided
Water Tender	600 Gal.	LANL Provided
Planning		
Div. A Monitor	FEMO	Fire Use Module
Div. B Monitor	FEMO	Fire Use Module
Smoke Monitor	FEMO	Fire Use Module
Logistics		
2 Traffic Control	2 Flag-persons	Band Provided
Finance		
Finance Lead	Time and Procurement Knowledge	Band Provided (may be provided by Burn Boss)

Phase III

Position	Minimum Qualification	Proposed Name or Source
Command		
Burn Boss	RXB2	
Resource Advisor	Resource Advisor	~~Band Provided~~
Operations		
Holding	ICT4	Band Provided
Ignition Specialist	RXI2	Fire Use Module
2 Igniters	FFT2	Fire Use Module
Planning		
Fire Monitor	FEMO	Fire Use Module
Smoke Monitor	FEMO	Fire Use Module

G. Ignition Plan: See Figure 5: Ignition and Holding Map
The burn will be accomplished in three phases. Phase I of the project will burn the grasslands and upper elevations of the burn area. Phase II will burn the timbered areas along the unit boundaries and the aspects that will burn (generally south facing slopes). Phase III of the burn will target much of the wetter areas within the burn unit and will require substantial drying after Phases I and II are completed. Phase I and II may occur within a few days of each other or concurrently. Phase III will require substantial drying and will likely occur several weeks or even months after the first two phases.

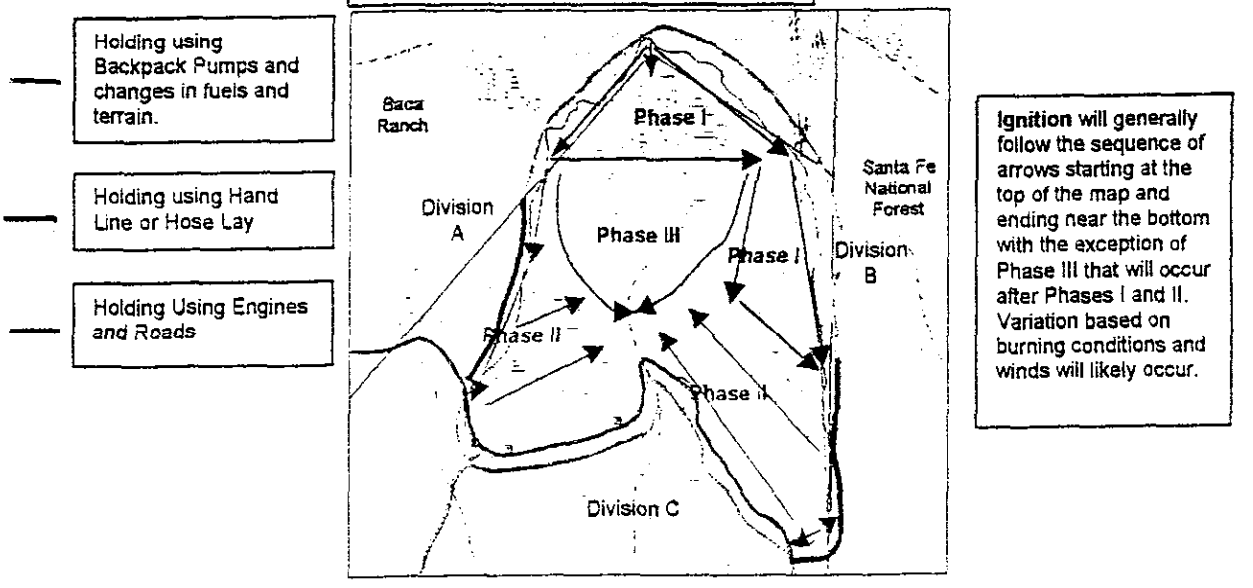
All ignition plans may be altered depending on wind direction and fire behavior during ignition operations.

Phase I
A backing fire will be lit using hand ignition devices in the grasslands near the Cerro Grande summit to develop a sufficient safety zone for firing operations to commence. Holding boundaries will be lit by hand allowing backing and flanking fires to develop a safety buffer. Head fires will be ignited in the grasslands near the Cerro Grande summit and upper elevations of the burn.

Phase II
Ignition using strip and spot head, flanking and backing ignition in the timbered areas depending on fire behavior needed to meet control and resource objectives. Interior firing will be advanced as line firing develops a sufficient barrier to stop runs in areas that will support fire. Interior firing will likely use strip head firing, although flanking and backing fires will be used if these methods meet burn objectives.

Phase III
Areas not burned during Phase I or II will be targeted for Phase III. Ignition will begin at areas near the burn perimeter that seem insufficient to hold interior ignitions. Ignition will continue in pockets of unburned areas within the interior of the unit using strip head fires, flanking fires or backing fires depending on fire behavior that will meet burn objectives.

Figure 5: Ignition and Holding Map



H. Holding Plan: See Figure 5: Ignition and Holding Map
Holding of the burn will require a reasonable number of resources during Phase I and II of the burn. Minimal holding resources will be needed for Phase III of the burn.

Phase I and II
Hand line will be constructed and hose lays installed as shown in Figure 4: Preparation Map. Control lines will be accomplished in all other areas by using changes in terrain and fuels that should limit fire spread. Hand Crews with hand tools and backpack pumps will follow the firing operations down hill patrolling for spot fires and slopovers. Fires creeping into non-lined areas will be contained with check lines. Engines will patrol State Route 4 as fire approaches the road. Lookouts will be posted along ridgelines to assess potential problems and watch for long range spotting. Holding bosses will coordinate with the appropriate ignition specialist if ignition is proceeding beyond the capability of the holding forces.

Phase II
Phase I and II operations should produce sufficient black lining to contain Phase III ignitions. In areas that are suspect, holding will be accomplished by a few firefighters with hand tools and backpack pumps. A lookout will be posted to observe for possible long range spotting or reburn of previously burned areas. An engine may be used to patrol along State Route 4 if the Burn Boss identifies a need for this resource.

6. Cooperation and Public Information
The burn will require cooperation from neighboring cooperators and landowners. Resources will be needed from outside the Bandelier NM staff to conduct this burn. The Espanola Ranger District of the Santa Fe national forest has requested that District resources be assigned to divisions that border their lands. The Baca ranch has been informed and agreed to allow 32 acres of their land to be burned within the project boundary and up to 20 acres to be managed if slopovers or spotfires occur.
A press release will be issued prior to ignition of either phase of the burn to inform the public. A contact at Bandelier NM will be available to answer questions and address

complaints about smoke. The Fire Program Assistant will use the Bandelier Contact List to contact other parties that may have concerns at least one day prior to any ignition.

7. Contingency Plan

Prior to ignition of the burn the following resources should be available within the allotted time frames:

Retardant Aircraft	within 2 hours
Type III Helicopter w/bucket	within 4 hours
2 Type I or Type II Crews	within 4 hours

The Burn Boss has the discretion to call the burn a wildfire at any time if the burn exceeds the scope of this plan in order to enhance suppression efforts needed to control the fire. The appearance of spot fires or slopovers does not necessarily constitute the conversion of the burn to a wildland fire. If spot fires or slopovers are beyond the capabilities of burn resources to contain within the current burn period, the escapes will be converted to a wildland fire. A Forest Service representative has the authority to convert any escape onto Forest Service lands to a wildland fire. Escapes onto the private lands on the Baca ranch will be allowed as long as they do not exceed the intent of the agreement between the park and the ranch. The holding boss on the appropriate division will assume the duties of IAIC for all escapes. Further ignitions on the effected division may be halted with the decision of the holding supervisor. Ignition resources may assist holding personnel during escapes, as directed by the holding supervisor. If escapes are converted to wildfire status a WFSA will be developed and appropriate action taken to respond to the fire. The burn may not be included in the suppression action if the Burn Boss and IAIC conclude that the burn is still within prescription and the burn poses no other threats to suppression actions.

8. Funding

Base hours for personnel will not be charged to the project account. An estimated cost breakdown for **all costs** associated with the project follows:

Project Phase	Planning			Preparation			Execution			Evaluation		
	Base Hrs	Prem Hrs	Cost	Base Hrs	Prem Hrs	Cost	Bse Hrs	Prem Hrs	Cost	Base Hrs	Prem Hrs	Cost
Personnel	40	0	700	400	0	4,800	700	600	23,700	80	0	960
Supplies			40			200			1,000			0
Aircraft			0			0			0			0
Miscellaneous			0			0			1,000			0
Totals			740			5,000			25,700			960
Total Project Cost	**$32,400**											
Cost/Acre	**$324/Acre**											

9. Smoke Management and Air Quality: See Figure 6: Smoke Vector Map
Smoke from the burn has the greatest possibility to impact the city of Los Alamos and State Route 4. The general southwest flow of air during the day will send the smoke towards the Los Alamos Area. Nighttime smoke should flow across State Route 4 down Frijoles Canyon. The attached Smoke Vector map shows likely areas where the smoke will move. Impacts to Los Alamos should be minimal as the elevation of the burn and burning under good dispersal conditions should keep smoke above the town. A qualified Fire Effects Monitor will be in the Los Alamos area to assess smoke impacts and communicate smoke conditions to the Burn Boss. Impacts on state Route 4 will be mitigated by using traffic control and pilot cars through smokey areas and will be continued during the nighttime as long as there is a foreseeable problem.

Smoke from this prescribed fire may impact the following sensitive receptor sites:

Towns:

Los Alamos, 5 miles NE
White Rock, 10 miles E

Class 1 Airsheds:

Bandelier National Monument, burn lies within the monument. Most of the monument is SE of the burn.

Roads:

State Highway 4, borders the burn on the south

Sensitive Areas:

Bandelier National Monument Visitor Center, 7 miles east.

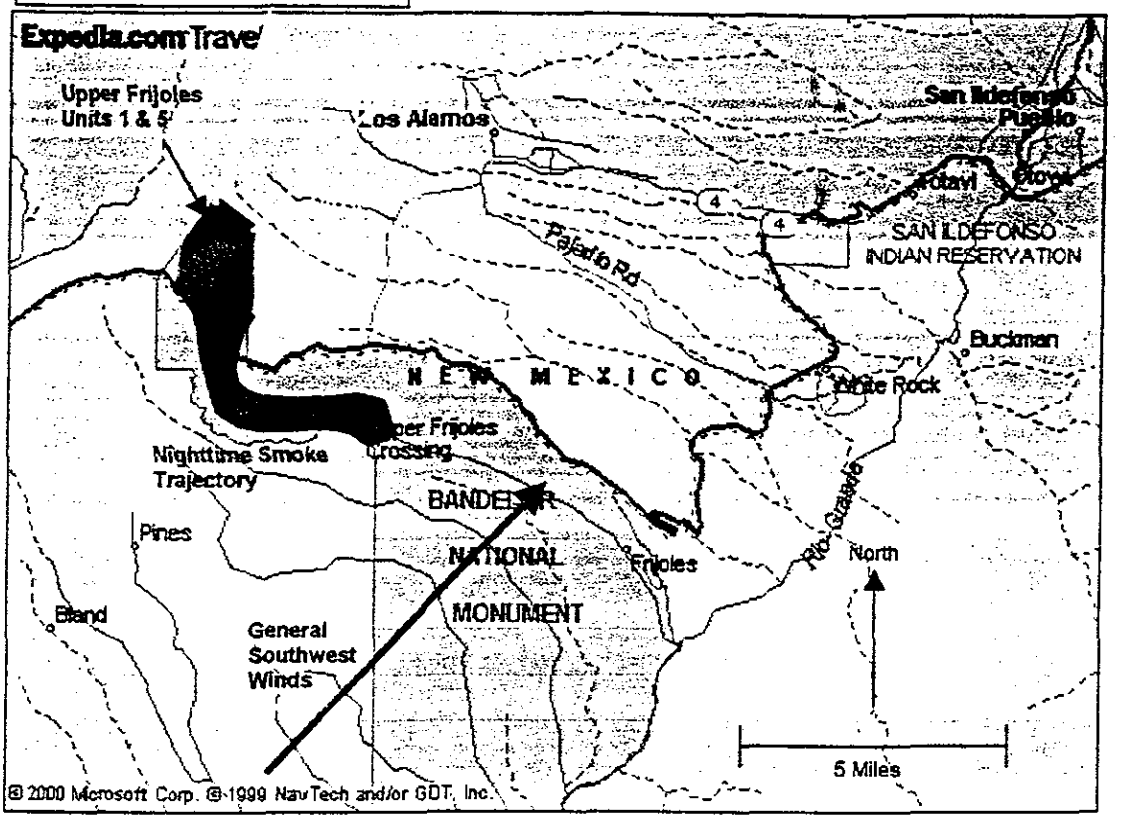
The following guidelines will be followed to meet the air quality objectives of the burn plan.

	Threshold Parameter	Implementation Action
Visibility in Los Alamos or White Rock		
	<6 miles	Discontinue Ignitions
	<5 miles	Contain Fire Spread
	<4 miles	Initiate Mop-Up
Severe visibility impacts in Bandelier National Monument		
	3 days	Discontinue Ignitions
	4 days	Contain Fire Spread
	5 days	Initiate Mop-Up
Visibility along State Route 4		
	<300 ft	Slow to 25 mph (Using Pilot Cars)
	<200 ft	Slow to 15 mph
	<100 ft	Implement one way traffic
	< 50 ft	Close road to traffic
Visibility in the Visitor Center Area		
	<4 miles	Discontinue Ignitions
	<3 miles	Contain Fire Spread
	<2 miles	Initiate Mop-Up

Smoke Complaints

To minimize smoke complaints the park will use a public information and education program to educate the public on the uses of prescribed fire and the possible smoke impacts that may develop. Included information within this program are: Press Releases, Information Bulletins for park visitors and the public, notification per the parks Prescribed Fire Notification List, and providing a public information/Smoke complaint contact. If complaints numbers are significant and verified, the Burn Boss may discontinue ignitions, contain the fire spread and initiate mop-up of the burn to resolve the problem.

Figure 6: Smoke Vector Map



10. Monitoring

Monitoring data will be collected according to the guidelines established in the Western Region Fire Monitoring Handbook. Short and long-term changes will be monitored through photo points, downed fuel inventory transects and established forest inventory plots.

Weather and fire behavior observations will be monitored by qualified fire effects monitors. Pertinent information will be communicated to the burn Boss and effected line personnel.

Smoke monitoring will be accomplished in the Los Alamos or White Rock areas by a qualified Fire Effects Monitor. Visibility and smoke dispersal information will be communicated to the burn boss.

11. Post Burn Activities

The following is a checklist of post burn activities

- ☐ Review burn operations and safety and make recommendations for future burns
- ☐ Complete individual performance evaluations
- ☐ Notify Dispatch of daily accomplishment and project completion
- ☐ Release resources assigned to the burn
- ☐ Notify DEQ of burn completion and acreage
- ☐ Remove and rehab burn supplies and equipment
- ☐ Rehab burn area including control lines
- ☐ Place orders for used up or damaged equipment
- ☐ Compile cost tracking information
- ☐ Collect and analyze all execution monitoring data
- ☐ Collect documentation for fire folder
- ☐ Complete fire report for the burn

- ☐ Complete accomplishment report in SACS
- ☐ Perform post burn fire effects monitoring
- ☐ Review fire effects monitoring information and make recommendations for future burns
- ☐ Perform long term Fire effects monitoring
- ☐ Review long term fire effects monitoring information and make recommendations for future burns

WILDLAND AND PRESCRIBED FIRE COMPLEXITY RATING WORKSHEET

Complexity element	Weighting factor	Complexity value	Total points
Safety	5	2	10
Threats to boundaries	5	2	10
Fuels and fire behavior	5	2	10
Objectives	4	2	8
Management organization	4	2	8
Improvements	3	2	6
Natural, cultural, social values	3	2	6
Air quality values	3	~~2~~ 3	~~8~~ 9
Logistics	3	2	6
Political concerns	2	3	6
Tactical operations	2	3	6
Interagency coordination	1	2	2
		Total Complexity Points:	~~84~~ 87

The Wildland and Prescribed Fire Complexity Analysis provides a method to assess the complexity of both wildland and prescribed fires. The analysis incorporates an assigned numeric rating complexity value for specific complexity elements that are weighted in their contribution to overall complexity. The weighted value is multiplied times the numeric rating value to provide a value for that item. Then all values are added to generate the total complexity value. Breakpoint values are provided for low, moderate, and high complexity values.

The complexity analysis worksheet is accompanied by a guide to numeric values for each complexity element shown, provided on the following pages.

Wildland and Prescribed Fire Complexity Rating Worksheet Numeric Rating Guide

COMPLEXITY	GUIDE TO NUMERIC RATING

ELEMENT	1	2	3
Safety	• Safety issues are easily identifiable and mitigated	• Number of significant issues have been identified • All safety hazards have been identified on the LCES worksheet and mitigated	• SOF1 or SOF2 required • Complex safety issues exist
Threats to Boundaries	• Low threat to boundaries • POI<50% • Boundaries naturally defensible	• Moderate threat to boundaries • 50<POI<70% • Moderate risk of slopover or spot fires • Boundaries need mitigation actions for support to strengthen fuel breaks, lines, etc.	• High threat to boundaries • POI>70% • High risk of slopover or spot fires • Mitigation actions necessary to compensate for continuous fuels
Fuels/Fire Behavior	• Low variability in slope & aspect • Weather uniform and predictable • Surface fuels (grass, needles) only • Grass/shrub, or early seral forest communities • Short duration fire • No drought indicated	• Moderate variability in slope & aspect • Weather variable but predictable • Ladder fuels and torching • Fuel types/loads variable • Dense, tall shrub or mid-seral forest communities • Moderate duration fire • Drought index indicates normal conditions to moderate drought; expected to worsen	• High variability in slope & aspect • Weather variable and difficult to predict • Extreme fire behavior • Fuel types/loads highly variable • Late seral forest communities or long-return interval fire regimes • Altered fire regime, hazardous fuel/stand density conditions • Potentially long duration fire • Drought index indicates severe drought; expected to continue
Objectives	• Maintenance objectives • Prescriptions broad • Easily achieved objectives	• Restoration objectives • Reduction of both live and dead fuels • Moderate to substantial changes in two or more strata of vegetation • Objectives judged to be moderately hard to achieve • Objectives may require moderately intense fire behavior	• Restoration objectives in altered fuel situations • Precise treatment of fuels and multiple ecological objectives • Major change in the structure of 2 or more vegetative strata • Conflicts between objectives and constraints • Requires a high intensity fire or a combination of fire intensities that is difficult to achieve
Management Organization	• Span of control held to 3 • Single resource incident or project	• Span of control held to 4 • Multiple resource incident or project • Short-term commitment of specialized resources	• Span of control greater than 4 • Multiple branch, divisions or groups • Specialized resources needed to accomplish objectives • Organized management team (FUMT, IMT)
Improvements to be Protected	• No risk to people or property within or adjacent to fire	• Several values to be protected Mitigation through planning and/or preparations is adequate • May require some commitment of specialized resources	• Numerous values and/or high values to be protected • Severe damage likely without significant commitment of specialized resources with appropriate skill levels
Natural, Cultural, and Social Values to be Protected	• No risk to natural, cultural, and/or social resources within or adjacent to fire	• Several values to be protected • Mitigation through planning and/or preparations is adequate • May require some commitment of specialized resources	• Numerous values and/or high values to be protected • Severe damage likely without significant commitment of specialized resources with appropriate skill levels

Air Quality Values to be Protected	• Few smoke sensitive areas near fire • Smoke produced for less than 1 burning period • Air quality agencies generally require only initial notification and/or permitting • No potential for scheduling conflicts with cooperators	• Multiple smoke sensitive areas, but smoke impact mitigated in plan • Smoke produced for 2-4 burning periods • Daily burning bans are sometimes enacted during the burn season • Infrequent consultation with air quality agencies is needed • Low potential for scheduling conflicts with cooperators	• Multiple smoke sensitive areas with complex mitigation actions required • Health or visibility complaints likely • Smoke produced for greater than 4 burning periods • Multi-day burning bans are often enacted during the burn season • Smoke sensitive class 1 airsheds • Violation of state and federal health standards possible • Frequent consultation with air quality agencies is needed • High potential for scheduling conflicts with cooperators
Logistics	• Easy access • Duration of fire support is less than 4 days	• Difficult access • Duration of fire support between 4 and 10 days • Logistical position assigned • Anticipated difficulty in obtaining resources	• No vehicle access • Duration of support is greater than 10 days • Multiple logistical positions assigned • Remote camps and support necessary
Political Concerns	• No impact on neighbors or visitors • No controversy • No media interest	• Some impact on neighbors or visitors • Some controversy, but mitigated • Press release issued, but no media activity during operations	• High impact on neighbors or visitors • High internal or external interest and concern • Media present during operations
Tactical Operations	• No ignition or simple ignition patterns • Single ignition method used • Holding requirements minimal	• Multiple firing methods and/or sequences • Use of specialized ignition methods (i.e. terra-torch, Premo Mark III) • Resources required for up to one week • Holding actions to check, direct, or delay fire spread	• Complex firing patterns highly dependent upon local conditions • Simultaneous use of multiple firing methods and/or sequences • Simultaneous ground and aerial ignition Use of heli-torch • Resources required for over 1 week • Multiple mitigation actions at variable temporal and spatial points identified. • Success of actions critical to accomplishment of objectives • Aerial support for mitigation actions desirable/necessary
Interagency Coordination	• Cooperators not involved in operations • No concerns	• Simple joint-jurisdiction fires • Some competition for resources • Some concerns	• Complex multi-jurisdictional fires • High competition for resources • High concerns

Prescribed Fire
Go-No-Go Checklist

(A "NO" response to any item means stop!)

1. Is burn plan complete and approved?
2. Are all fire prescription specifications met?
3. Are all smoke management prescription specifications and requirements met? (are NWS predictions on mixing heights and dispersal included?)
4. Is the current and projected fire weather forecast favorable?
5. Are all personnel, required in the prescribed burn plan, on site and qualified for assigned positions?
6. Have all personnel been briefed on the prescribed burn plan requirements?
7. Have all personnel been briefed on safety hazards and LCES?
8. Is all the required equipment in place and in working order?
9. Are available, including backup, resources adequate for containment of escapes under worst-case conditions? Standing resource order to zone complete?
10. Is the test burn adequate for assessing the burn's potential?
11. In your opinion, can the burn be carried out according to plan and will it meet the planning objectives?
12. Is there an adequate contingency plan developed? Has it been communicated to assigned overhead?
13. Have notifications been completed?

If all 13 questions have been answered "YES", you may proceed with ignition.

Thirteen Prescribed Fire Situations That Shout "Watch Out"

1. You are burning with a plan that has not been approved by the appropriate agency administrator.
2. You are not a qualified Burn Boss but have been told to go ahead with the burn.
3. Objectives of the burn are not clear.
4. There are areas of special concern within the burn unit that cannot be burned.
5. Private land and/or structures adjoin the burn unit
6. You are uncomfortable with the prescription.
7. You have not requested a Spot Weather Forecast.
8. You decide a test fire is not necessary.
9. You decide your personnel are old hands and a briefing is not necessary.
10. Escape probability is small so you do not bother with a contingency plan.
11. You or the Ignition Specialist is beginning to lose control of the ignition pattern after starting.
12. Mop-up and/or patrol instructions are not specified or understood by the holding personnel.
13. You have not lost one in a long time and are starting to feel a little smug.

Project Name: Date:

Agency	Contact name	Telephone Number	E-Mail	Notified
USFS dispatch, Santa Fe N. F.		438-7800		
USFS Espanola Ranger District		(505)753-7331		
USFS Jemez Ranger District (will inform Cerro Pelado lockout)		(505)829-3535		
Los Alamos Emergency Coordination Center		667-6211		
NPS Systems Support Office		988-6114		
Southwest Coordination Center		(505) 842-3473		
State Police Department		827-9126		
Los Alamos Police Department		662-8222		
Los Alamos Fire Department (Station 7)		667-7080		
Santa Fe County Fire Dept.		992-3076		
NM State Forestry, Bernalillo		(505) 867-2334		
BIA, 3 Northern Pueblos		(505)753-1455		
San Ildefonso, Governor's Office		455-2273		
Cochiti Pueblo, Governor's Office		(505)4652244		
New Mexico Air Quality Division		827-0091		
LANL Air Quality		665-8858		
Albuquerque Chamber of Commerce		(505)764-3700		
Albuquerque Convention and Visitors Bureau		(505) 243-3696		
County Commissioners				
Corp of Engineers, Cochiti		465-0307		
Fish and Wildlife service		(505) 346-2525 x110		
Los Alamos Monitor		662-4185		
Santa Fe New Mexican		986-3035		
Albuquerque Journal		988-3881		
Los Alamos employees news bulletin				
KRSN - radio		661-2490		
LA Airport - Ross Aviation		667-4521		
Carl White - UNM		(505) 277-8689		
Terry Foxx - Lab Biologist		667-3024		
Bandelier in park				
Visitors Center		672-3861		
Enterance Station		672-1004		
e-mail to all employees				
Additional Contacts for large		ely to be visible for great distances		
Taos Zone Dispatch		(505) 758-8352		
Albuquerque Zone Dispatch		(505)346-2660		
Linda Jangula		(505) 271-9026 Cell (505) 238-1010		

DELEGATION OF AUTHORITY

As Superintendent of Bandelier National Monument, I am delegating to the authority to manage the suppression of the _____ fire in accordance with the attached guidelines, priorities, and constraints.

The briefing paper will also provide you with an outline of monument resources available for assignment to your operation under specified conditions.

Upon arrival of you and your team, myself or an appointed staff member, along with the local incident commander being relieved (if applicable) will deliver a briefing for your team.

My goals and constraints for managing this incident are as follows:

1. Insure the safety of firefighters and the public.
2. Protect life and property.
3. Minimize impacts of suppression on Natural and Cultural resources.
4. No Dozers are allowed within the monument boundaries.
5. A resource advisor will clear all proposed fireline and to assist in developing strategies.
6. No retardant within the monument boundaries without approval.
7. Cost efficiency.

_____ / _____

_____

Date Hour Superintendent
Bandelier National

Monument

Superintendent's Agency Representative to Incident Commander

This monument representative assigned to your team is _____ and will have line authority for the monument Superintendent. The representative will be expected to attend all briefings and strategy sessions, and assist with any problems that require the Superintendent's output.

Representative Office Phone:_____
Home Phone:_____
Title:_____
Red Card Qualifications:_____
_____

FMP AMENDMENT - NEW FIRE POLICY
BANDELIER NATIONAL MONUMENT
JUNE 9, 1998

In accordance with the Federal Wildland Fire Management Policy and terminology, the following changes in Bandelier's Fire Management Plan are effective immediately:

TERMINOLOGY

1. All references to "prescribed natural fire (PNF)" are now changed to "appropriate management response for wildland fire use".

2. All references to "management ignited prescribed fire (MIPF)" are now changed to "prescribed fire".

3. All references to "presuppression" are now changed to "preparedness".

4. All references to "Escaped Fire Situation Analysis (EFSA)" are now changed to "Wildland Fire Situation Analysis (WFSA)".

5. All references to "Fire Situation Analysis (FSA)" and "Interagency Prescribed Natural Fire Burn Plan" are now changed to "Wildland Fire Implementation Plan (WFIP)".

6. All references to the three suppression strategies of confine contain and control are hereby deleted.

PROCEDURES

1. WILDFIRE PROGRAM - In the event that initial attack action is unsuccessful, the Wildland Fire Situation Analysis (WFSA) will be utilized as the fire management strategy assessment and decision document. The WFSA outline is included as an attachment to this amendment.

2. PRESCRIBED FIRE PROGRAM - No changes in implementation procedures are necessary.

3. APPROPRIATE MANAGEMENT RESPONSE FOR WILDLAND FIRE USE - The following steps will be taken to assess, implement and document wildland fire use activities:

Stage 1, WFIP, Initial Fire Assessment:

Fire Situation: The attached Fire Situation outline will be used to conduct the initial assessment of a candidate fire.

Go-No/Go Decision: The decision for wildland fire use implementation should be made within 2 hours of the initial fire assessment and will utilize the attached Decision Criteria Checklist.

a. The prescription criteria for wildland fire use is contained in Appendix I of FMP and is included in the attachment.
b. Southwest Area Preparedness Level
   - Preparedness Levels I to III requires no upper level approval.
   - Preparedness Level IV requires regional approval for wildland fire use.
   - Preparedness Level V requires regional recommendation and national level approval.
c. The initial assessment of relative risk will be made through the use of the attached Wildland Fire Relative Risk Rating chart and the seasoned judgment and experience of fire staff.
d. The decision criteria will be reviewed and approved by the Park Superintendent (or acting).

Stage II, WFIP, Short - Term Implementation Actions: Should be completed within 24 hours of the initial fire assessment.

a. The attached Short - Term Implementation Action outline will be utilized. When identifying initial actions, it is important to remember that "appropriate management response" includes the full spectrum of responses depending upon the fire use objectives, safety concerns and other considerations.
b. The attached Wildland and Prescribed Fire Complexity Rating Worksheet will be prepared to identify the overall complexity of the wildland fire.
c. The attached Stage III Need Assessment Chart will be used to determine when Stage III of the WFIP needs to be completed.

Stage III, WFIP, Long - Term Implementation Actions: Should be completed within 24 hours of a determination of need.

a. The attached Stage III outline will be completed when indicated by the Needs Assessment Chart.
b. The Stage III plan will be prepared by the FMO/AFMO/FUMA, concurred by the Chief, Resources Management or designated Resource Advisor and approved by the Park Superintendent.

Periodic Fire Assessment: Evaluates the capability to continue managing the fire for the next assessment period and will be completed for all wildland fires for resource benefits.

a. The attachment contains instructions, checklists, charts and signature page for conducting periodic assessments.
b. The assessment frequency will be determined by the fire size, fire behavior; fire complexity and relative risk.
c. If one or more items on the Revalidation Checklist are answered with a "yes", management of this fire cannot continue within defined limits and a Wildland Fire Situation Analysis (WFSA) is necessary to develop a new strategic alternative.

Wildland Fire Situation Analysis (WFSA):

a. The WFSA is used to compare alternatives reflecting the full spectrum of appropriate management responses and will be prepared whenever it is determined that the current fire management response is inadequate to accomplish fire use objectives.
b. The attachment contains the WFSA format and instructions for completion. Please note that the WFSA contains it's own Fire Complexity Analysis.
c. Once a WFSA is prepared, there will be a daily review and revalidation by the Park Superintendent. A Daily Review form is included in the attachment.

Prepared by: _____ Date _____
Fire Management Officer

Reviewed by: _____ Date _____
Chief, Resources Management

Approved by: _____ Date _____
Superintendent

APPENDIX 4. CERRO GRANDE WILDLAND FIRE SITUATION ANALYSIS.

WILDLAND FIRE SITUATION ANALYSIS

Wildland Fire Situation Analysis (WFSA) is a decision-making process in which the Agency Administrator or representative describes the situation, establishes objectives and constraints for the management of the fire, compares multiple strategic wildland fire management alternatives, evaluates the expected effects of the alternatives, selects the preferred alternative, and documents the decision. The format and level of detail required is dependent on the specific incident and it's complexity. The key is to document the decision.

WFSA INITIATION

FIRE NAME	Cerro Grande
JURISDICTION(S)	NPS, near SFNF-Espanola District Boundary
DATE AND TIME INITIATED	5/5/00 1700

WFSA COMPLETION/FINAL REVIEW

THE SELECTED ALTERNATIVE ACHIEVED DESIRED OBJECTIVES ON (DATE/TIME):	
THE SELECTED ALTERNATIVE DID NOT ACHIEVE THE DESIRED OBJECTIVES AND A NEW WFSA WAS PREPARED ON (DATE/TIME):	Fire has escaped established perimeters and has exceeded capabilities of current fire mgt. organization. A Type1 Team has been ordered. A New WFSA is in process of being prepared
AGENCY ADMINISTRATOR OR REPRESENTATIVE SIGNATURE:	[signature] 5/7/2000 1625

WFSA INSTRUCTIONS

Section I. WFSA Information Page

The Agency Administrator completes this page.

I.A. Jurisdiction(s): Assign the agency that have or could have fire protection responsibility, e.g., USFWS, Forest Service, BLM, etc.

I.B. Geographic Area: Assign the recognized "Geographic Coordination Area" in which the fire is located, e.g., Northwest, Northern Rockies, etc.

I.C. Unit: Designate the local administrative unit, e.g., Hart Mountain Refuge Area, Flathead Indian Reservation, etc.

I.D. WFSA #: Identify the number assigned to the most recent WFSA for this fire.

I.E. Fire Name: Self-explanatory.

I.F. Incident Number: Identify the agency number assigned to the fire, e.g., BOD 296, BNF 001.

I.G. Accounting Code: Insert the local unit's accounting code.

I.H. Date/Time Prepared: Self-explanatory.

I.I. Attachments: Check here to designate attachments used in the completion of the WFSA. "Other" could include data or models used in the development of the WFSA. Briefly describe the "other" items used.

I. WILDLAND FIRE SITUATION ANALYSIS

A. JURISDICTION(S): National Park Service	**B. GEOGRAPHIC AREA:** Southwest Coordination Center Santa Fe Zone
B. UNIT(S): Bandelier Nat'l Monument	**D. WFSA #:** 1
E. FIRE NAME: Cerro Grande	**F. INCIDENT #:** NM-BAP-0009

F. ACCOUNTING CODE:

7128 - 0015 - 249

G. DATE/TIME PREPARED:

5/5/00 16:30 - 21:15

H. ATTACHMENTS:

- [x] COMPLEXITY MATRIX/ANALYSIS[1]
- [x] RISK ASSESSMENT[1]
- [x] PROBABILITY OF SUCCESS[1]
- [x] CONSEQUENCES OF FAILURE[1]
- [x] MAPS[1]
- [ ] DECISION TREE[2]
- [x] FIRE BEHAVIOR PROJECTIONS[1]
- [x] CALCULATIONS OF RESOURCE REQUIREMENTS[1]
- [ ] OTHER (SPECIFY)

[1] Required
[2] Required by the USFS

Section II. Objectives and Constraints

The Agency Administrator completes this page.

II.A. Objectives: Specify criteria that should be considered in the development of alternatives.

Safety objectives for firefighters, aviation, and public must receive the highest priority, Suppression objectives must relate to resource management objectives in the unit resource management plan.

Economic objectives could include closure of all portions of an area, thus impacting the public, or impacts to transportation, communication and resource values.

Environmental objectives could include management objectives for airshed, water quality, wildlife, etc.

Social objectives could include any local attitudes toward fire or smoke that might affect decisions on the fire, safety, etc.

Other objectives might include legal or administrative constraints which would have to be considered in the analysis of the fire situation, such as the need to keep the fire off other agency lands, etc.

II.B. Constraints: List constraints on wildland fire action. These could include constraints to designated wilderness, wilderness study areas,

environmentally or culturally sensitive areas, irreparable damage to resources or smoke management/air quality concerns. Economic constraints such as public and Agency cost could be considered here.

II. OBJECTIVES AND CONSTRAINTS

A. OBJECTIVES (must be specific and measurable):

1. ***SAFETY:***
   Public Provide for safety and well being of firefighters and the public. Insure the public receives no injuries.

   Firefighter Insure no lost time injuries to fire personnel.

2. ***ECONOMIC:*** Implement fire management actions in a cost effective manner.

3. ***ENVIRONMENTAL:*** No adverse impacts to T+E species and cultural resources. Minimize impacts to species of concern.

4. ***SOCIAL:*** Keep public informed to foster understanding and support for fire management actions taken.

5. ***OTHER:*** a. Limit fire spread to park boundary to the N, NW, NE, + E
   b. Keep fire out of Water Canyon
   c. Limit fire spread to the south to SR4

B. CONSTRAINTS: Retardant drops and foam permitted only if the fire poses a serious threat to cross the park's eastern boundary onto SFNF or Baca lands.
Archeologist present during all ground disturbing activities.
Minimize falling of snags and live trees greater than 20" dbh.

Pao

Section III. Alternatives

The FIRE MANAGER/and or INCIDENT COMMANDER complete(s) this page.

III.A. Wildland Fire Management Strategy: Briefly describe the general wildland fire strategies for each alternative. Alternatives must meet resource management plan objectives.

III.B. Narrative: Briefly describe each alternative with geographic names, locations, etc., that would be used when implementing a wildland fire strategy. For example, "contain within the Starvation Meadows' watershed by the first burning period".

III.C. Resources Needed: Resources listed must be reasonable to accomplish the tasks described in Section III.B. It is critical to also look at the reality of the availability of these needed resources.

III.D. Estimated Final Fire Size: Estimated final size for each alternative at time of containment.

III.E. Estimated Contain/Control Date: Estimates for each alternative shall be made based on predicted weather, fire behavior, resource availability and the effects of wildland fire management efforts.

III.F. Cost: Estimate all fire costs for each alternative. Consider mopup, rehabilitation, and other costs as necessary.

III.G. Risk Assessment: Probability of success/Consequences of failure: Describe probability as a % and associated consequences for success and failure. Develop this information from models, practical experience or other acceptable means. Consequences described will include fire size, days to contain, days to control, costs and other information such as park closures and effect on critical habitat. Include fire behavior and long-term fire weather forecasts to derive this information.

III.H. Complexity: Assign the complexity rating calculated in the Guide for Assessing Fire Complexity.

III.I. Maps: A map for each alternative must be prepared. The map shall be based on the "Probability of success/Consequences of Failure" and include other relative information.

III. ALTERNATIVES

	A	B	C
A. WILDLAND FIRE STRATEGY:	Full suppression through direct attack	Full suppression through indirect attack at main east fire road and burn unit fire line to the north.	~~Full suppression through indirect attack at original BU 1 boundary~~
B. NARRATIVE:	Build direct fireline on the perimeter that is currently not contained. This would be 1 mile of line constructed through heavy dead & down mixed conifer	The existing firelines would be utilized as control lines to burn out from.. The slop over on the east perimeter will be controlled w/ direct line	
C. RESOURCES NEEDED:			
HANDCREWS	2 20-person	2 20-person	
ENGINES	1 Type 6	3 Type 6	
DOZERS	Ø	Ø	
AIRTANKERS	Ø	Ø	
HELICOPTERS	1	1	
D. ESTIMATED FINAL FIRE SIZE:	~~700~~ 500	910	
E. ESTIMATED CONTAIN/ CONTROL DATE	contain 1800 5/7 control 1800 5/10	contain 1800 5/7 control 1800 5/10	
F. COSTS:	$ 52,000	$ 68,000	
G. RISK ASSESSMENT: PROBABILITY OF SUCCESS/ CONSEQUENCES OF FAILURE	probability of success is high. with the two crews and a day of preparation the operation should go safely and smoothly. Failure will result in additional acreage (~300 acres).	Probability of success is threatened by exposing crews to undesirable time in heavy dead & down. Resource damage will also result as firelines will be cut and dug into mineral soil	
H. COMPLEXITY:	Moderate	Moderate	
I. ATTACH MAPS FOR EACH ALTERNATIVE			

Section IV. Evaluation of Alternatives

The Agency Administrator(s), FMO and/or Incident Commander(s) completes this page.

IV.A. Evaluation Process: Conduct an analysis for each element of each objective and each alternative. Objective shall match those identified in section II.A. Use the best estimates available and quantify whenever possible. Provide ratings for each alternative and corresponding objective element. Fire effects may be negative, cause no change or may be positive. Examples are: 1) a system which employs a "-" for negative effect, a "0" for no change, and a "+" for positive effect; 2) a system which uses a numeric factor for importance of the consideration (soils, watershed, political, etc.) and assigns values (such as -1 to +1, -100 to +100, etc.) to each consideration, then arrives at a weighted average. If you have the ability to estimate dollar amounts for natural resource and cultural values this data is preferred. Use those methods which are most useful to managers and most appropriate for the situation and agency. To be able to evaluate positive fire effects, the area must be included in the resource management plan and be consistent with prescriptions and objectives of the Fire Management Plan.

Sum Of Economic Values: Calculate for each element the net effect of the rating system used for each alternative. This could include the balance of: pluses (+) and minuses (-), numerical rating (-3 and +3), or natural and cultural resource values in dollar amounts. (Again resource benefits may be used as part of the analysis process when the wildland fire is within a prescription consistent with approved Fire Management Plans and in support of the unit's Resource Management Plan.)

IV. EVALUATION OF ALTERNATIVES

A. EVALUATION PROCESS	A	B	C
SAFETY			
Firefighter	-3	0	
Aviation	-2	-2	
Public	-2	-3	
Sum of Safety Values			
ECONOMIC			
Forage N/A			
Improvements	0	0	
Recreation N/A			
Timber N/A			
Water	-1	0	
Wilderness N/A			
Wildlife	+1	+3	
Other (specify)			
Sum of Economic Values			
ENVIRONMENTAL			
Air	-3	-2	
Visual	0	0	
Fuels	+2	+4	
T & E Species	~~+0~~ 0	0	
Other (specify)			
Sum of Environmental Values			
SOCIAL			
Employment			
Public Concern	-3	-2	
Cultural	0	0	
Other (Specify)			
Sum of Social Values			
OTHER			
	-14	-2	

Section V. Analysis Summary

The Agency Administrator(s), FMO and/or Incident Commander(s) complete this page.

V.A. Compliance with Objectives: Prepare narratives that summarize each alternative's effectiveness in meeting each objective. Alternatives that do not comply with objectives are not acceptable. Narratives could be based on effectiveness and efficiency. For example: "most effective and least efficient", "least effective and most efficient", "or "effective and efficient". Or answers could be based on a two-tiered rating system such as "complies with objective" and "fully complies with or exceeds objective". Use a system that best fits the manager's needs.

V.B. Pertinent Data: Data for this section has already been presented and is duplicated here to help the Agency Administrator(s) confirm their selection of an alternative. Final Fire Size is displayed on page three, section III.D. Complexity is calculated in the attachments and displayed on page three, section III.H. Costs are displayed on page three, section III.F. Economic Values have been calculated and displayed on page four. Probability of Success/Consequence of Failure is calculated in the attachments and displayed on page three, section III.G.

V.C. External and Internal Influences: Assign information and data occurring at the time the WFSA is signed. Identify the Preparedness Index (1 through 5) for the National and Geographic levels. If available, indicate the Incident Priority assigned by the MAC group. Designate the Resource Availability status. This information is available at the Geographic Coordination Center and needed to select a viable alternative. Designate "yes" indicating an up-to-date weather forecast has been provided to, and used by, the Agency Administrator(s) to evaluate each alternative. Assign information to the "other" category as needed by the Agency Administrator(s).

Section VI. Decision

Identify the alternative selected. Must have clear and concise rationale for the decision, and a signature with date and time. Agency Administrator(s) signature is mandatory.

V. ANALYSIS SUMMARY

ALTERNATIVES	A	B	C
A. COMPLIANCE WITH OBJECTIVES:	Acceptable and realistic	Acceptable and realistic	
SAFETY	Firefighter safety is less, because of the need to cut+hold undusing line	Fire fighter safety Public safety reduced with Fire near the road.	
ECONOMIC	$19,000 less expensive		
ENVIRONMENTAL	environment effects are adverse w/reduction of beauty + increased soil disturbance.	Greatly reduced fuel loads improved wildlife habitat Air Quality reduced additional two days.	
SOCIAL	Public approval of tactics.	Interagency approval of option.	
OTHER			
B. PERTINENT DATA:			
FINAL FIRE SIZE	500 ac.	910 ac.	
COMPLEXITY	Moderate	Moderate	
COST	$52,000	$68,000	
RESOURCE VALUES	-14	-2	
PROBABILITY of SUCCESS	80%	85%	
CONSEQUENCES OF FAILURE	Threatening LANL and Townsite	Threatening LANL + Townsite.	

C. EXTERNAL/INTERNAL INFLUENCES:

NATIONAL AND GEOGRAPHIC PREPAREDNESS LEVEL	3
INCIDENT PRIORITY	N/A
RESOURCE AVAILABILITY	Moderate
WEATHER FORECAST (LONG-RANGE)	red continued warm and dry
FIRE BEHAVIOR PROJECTIONS	continued backing fire down the slopes with some flankly + torching

VI. DECISION

The selected alternative is: B

RATIONALE: Firefighter safety is higher. Resource impacts are primarily positive.

AGENCY ADMINISTRATOR SIGNATURE Charrie Sydoriak

DATE/TIME 21:20 May 5, 2000

A GUIDE FOR ASSESSING FIRE COMPLEXITY

Use of the Guide:

1. **Analyze each element and check the response yes or no.**

2. **If positive responses exceed, or are equal to, negative responses within any primary factor (A through G), the primary factor should be considered as a positive response.**

3. **If any three of the primary factors (A through G) are positive response, this indicates the fire situation is or is predicted to be Type I.**

4. **Factor H should be considered after all above steps. If more than two of these items are answered yes, and three or more of the other primary factors are positive responses, a Type I team should be considered. If the composites of H are negative, and there are fewer than three positive responses in the primary factors (A-G) a Type II team should be considered. If the answers to all questions in H are negative, it may be advisable to allow the existing overhead to continue action on the Fire.**

GLOSSARY OF TERMS

Potential for blow-up conditions - Any combination of fuels, weather and topography excessively endangering personnel.

Threatened and endangered species - Threat to habitat of such species, or in the case of flora, threat to the species itself.

Smoke Management - Any situation which creates a significant public response, such as smoke in a metropolitan area or visual pollution in high-use scenic areas.

Extended exposure to unusually hazardous line conditions - Extended burnout or backfire situations, rock slides, cliffs extremely steep terrain, abnormal fuel situations such as frost killed foliage, etc.

Disputed Fire Management responsibility - Any wildland fire where responsibility for management if not agreed upon due to lack of agreements or different interpretations, etc.

Disputed fire policy - Differing fire policies between suppression agencies when the fire involves multiple ownership is an example.

Pre-existing controversies - These may or may not be fire management related. Any controversy drawing public attention to an area may present unusual problems to the fire overhead and local management.

Have overhead overextended themselves mentally or physically -
This is a critical item that requires judgment by the responsible agency. It is difficult to write guidelines for this judgment because of the wide differences between individuals. If, however, the Agency Administrator feels the existing overhead cannot continue to function efficiently and take safe and aggressive action due to mental or physical reasons, assistance is mandatory.

FIRE COMPLEXITY ANALYSIS

A. FIRE BEHAVIOR: Observed or Predicted	Yes	No
1. Burning Index (from on-site measurement of weather conditions). Predicted to be above the 90% level using the major fuel model in which the fire is burning.	X	
2. Potential exists for "blowup" conditions (fuel moisture, winds, etc).		X
3. Crowning, profuse or long-range spotting.	X	
4. Weather forecast indicating no significant relief or worsening conditions.		X
Total	2	2

B. RESOURCES COMMITTED:	Yes	No
1. 200 or more personnel assigned.		X
2. Three or more divisions.		X
3. Wide variety of special support personnel.		X
4. Substantial air operation which is not properly staffed.		X
5. Majority of initial attack resources committed.	X	
Total	1	4

C. RESOURCES THREATENED:	Yes	No
1. Urban interface.		X
2. Developments and facilities.		X
3. Restricted, threatened or endangered species habitat.	X	
4. Cultural sites.	X	
5. Unique natural resources, special designation zones or wilderness.		X
6. Other special resources.		X
Total	2	4

D. SAFETY:	Yes	No
1. Unusually hazardous fire line conditions.		X
2. Serious accidents or fatalities.		X
3. Threat to safety of visitors from fire and related operations.	X	
4. Restrictions and/or closures in effect or being considered.		X
5. No night operations in place for safety reasons.		X
Total	1	4

	Yes	No
E. OWNERSHIP:		
1. Fire burning or threatening more than one jurisdiction.	X	
2. Potential for claims (damages).		X
3. Different or conflicting management objectives.		X
4. Dispute over fire management responsibility.		X
5. Potential for unified command.		X
Total	1	4
F. EXTERNAL INFLUENCES:		
1. Controversial wildland fire management policy.		X
2. Pre-existing controversies/relationships.		X
3. Sensitive media relationships.		X
4. Smoke management problems.	X	
5. Sensitive political interests.	X	
6. Other external influences.		X
Total	2	4
G. CHANGE IN STRATEGY		
1. Change in strategy (from lower to higher intensity management).		X
2. Large amounts of unburned fuel within planned perimeter.	X	
3. WFSA invalid or requires updating.		X
Total	1	2
H. EXISTING OVERHEAD:		
1. Worked two operational periods without achieving initial objectives.		X
2. Existing management organization ineffective.		X
3. IMT overextended themselves mentally and/or physically.		X
4. Incident actions plans, briefings, etc., missing or poorly prepared.		X
Total		4

Signature	Paul A. Mason		
Date	5/5/00	Time	8:15 p.

Section VII. Daily Review

The Agency Administrator(s), or designate complete(s) this page.

The date, time and signature of reviewing officials are reported in each column for each day of the Incident. The status of Preparedness Level, Incident Priority, Resource Availability, Weather Forecast, and WFSA Validity is completed for each day reviewed. Ratings for the Preparedness Level, Incident Priority, Resource Availability, Fire Behavior, and Weather Forecast are addressed on page five, section V.C. Assign a "yes" under "WFSA Valid" to continue use of this WFSA. A "no" indicates this WFSA is no longer valid and another WFSA must be prepared or the original revised.

VII. DAILY REVIEW

SELECTED ALTERNATIVE TO BE REVIEWED DAILY TO DETERMINE IF STILL VALID UNTIL CONTAINMENT OR CONTROL

DATE	TIME	BY	PREPAREDNESS LEVEL	INCIDENT PRIORITY	RESOURCE AVAILABILITY	WEATHER FORECAST	FIRE BEHAVIOR PROJECTIONS	WFSA VALID
5/6/00	0730	Chaussi Sydoriak	3	N/A	ok	ok	ok	YES
5/7/00	1600		3	High	NO	ok	NO	NO

IF WFSA IS NO LONGER VALID, A NEW WFSA WILL BE COMPLETED

SOUTHWEST FIRE USE TRAINING ACADEMY

"Training for the Future"

Calculation of Resource Requirements:

Friday 5/5
- 2 Handcrews to build ½ mile of handline in heavy dead & down
- 2 archeologist and 2 fire effect monitors to mitigate negative impacts and record effects
- helicopter module bucket drops & crew logistics

Saturday 5/6
- 2 Handcrews to prep and burnout firelines (east & west) to road 4
- 2 archeologist and 2 fire effects monitors
- helicopter module: bucket drops & crew logistics
- 2 Type VII engines to support firing operations

Sunday 5/7
- 2 Handcrews to complete firing operations and holding
- helicopter module:
- 2 Type VII engines to support holding operations
- water tender

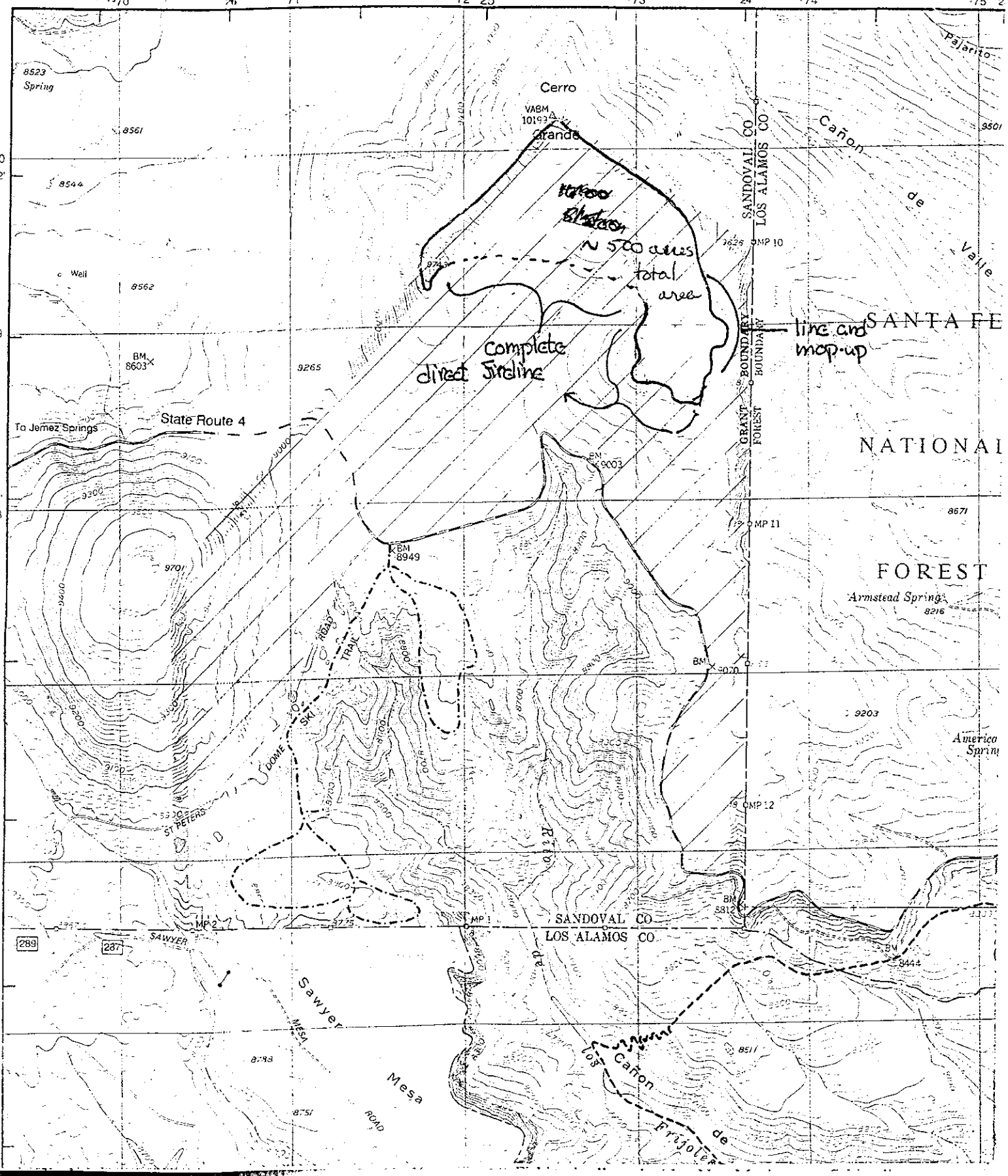
Monday 5/8
- 1 Handcrew to patrol handline
- helicopter module:
- 2 Type VII engines

2113 Osuna RD NE * Albuquerque, NM 87113 * PH 505-346-2650 * FAX 505-346-2633

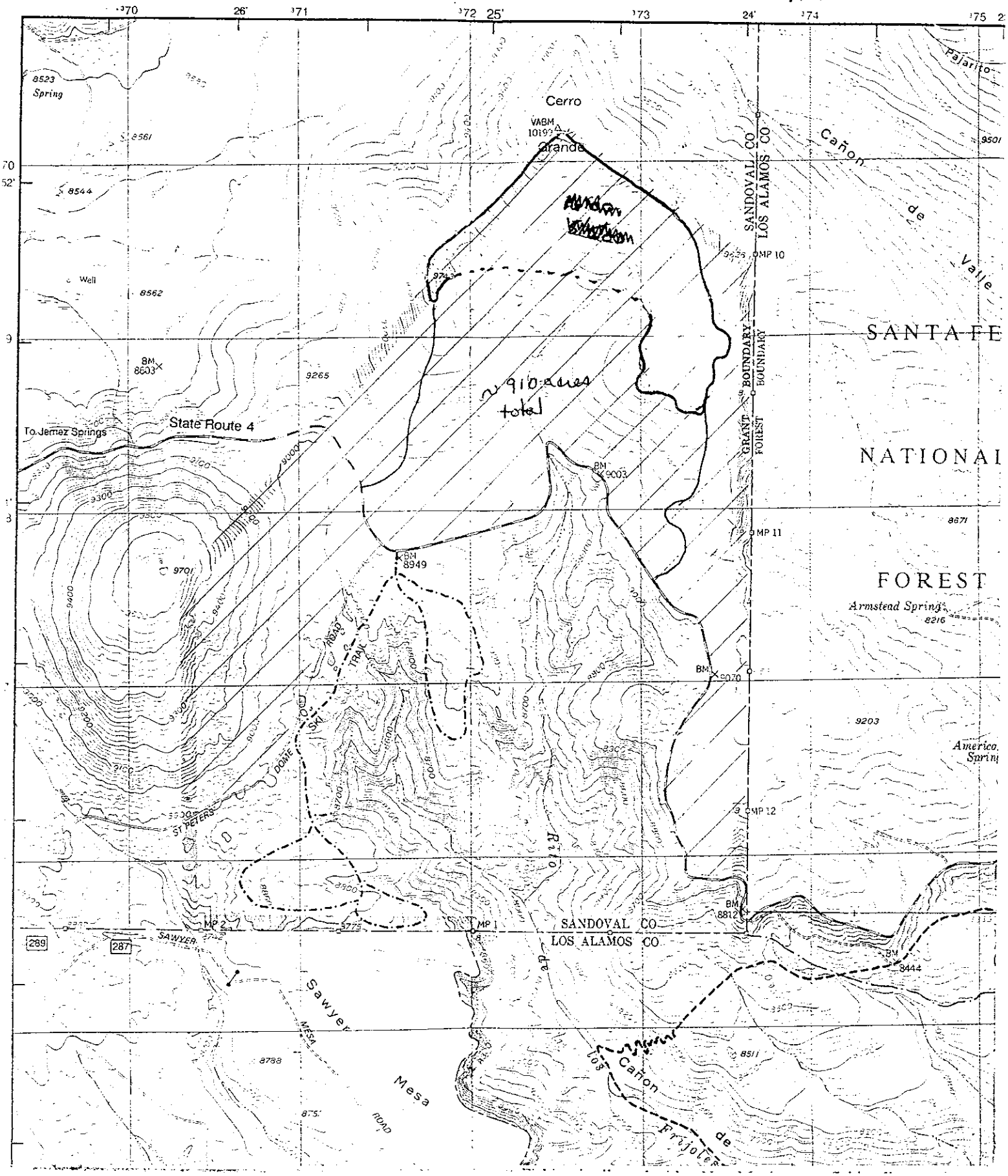
Fire Behavior Projection

Over the entire fire area the fire will back down slope with minor flanking and head runs as stringers of fire back. Torching will be likely and common in trees with sufficient ladder fuels or near concentrations of heavy down and dead material. Fire behavior will be similar to previous days with increased behavior with increasing winds. Low RH recovery during nighttime will encourage active fire behavior through the night.

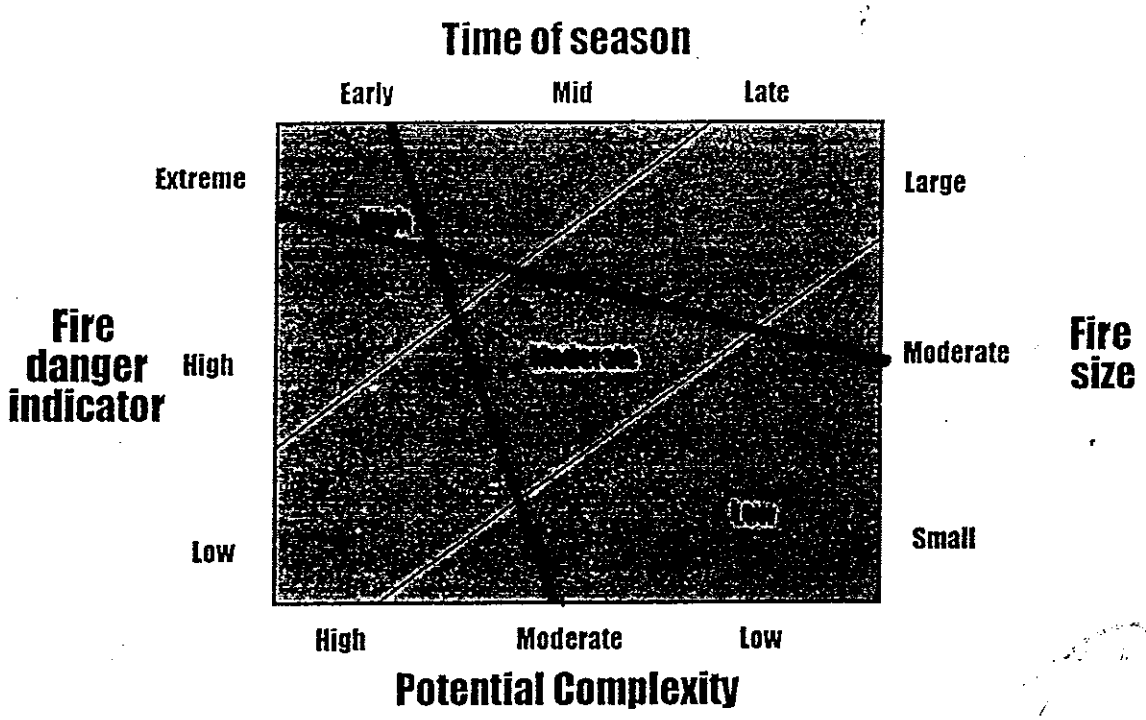
Alternative A



Alternative B



Wildland Fire Relative Risk Rating

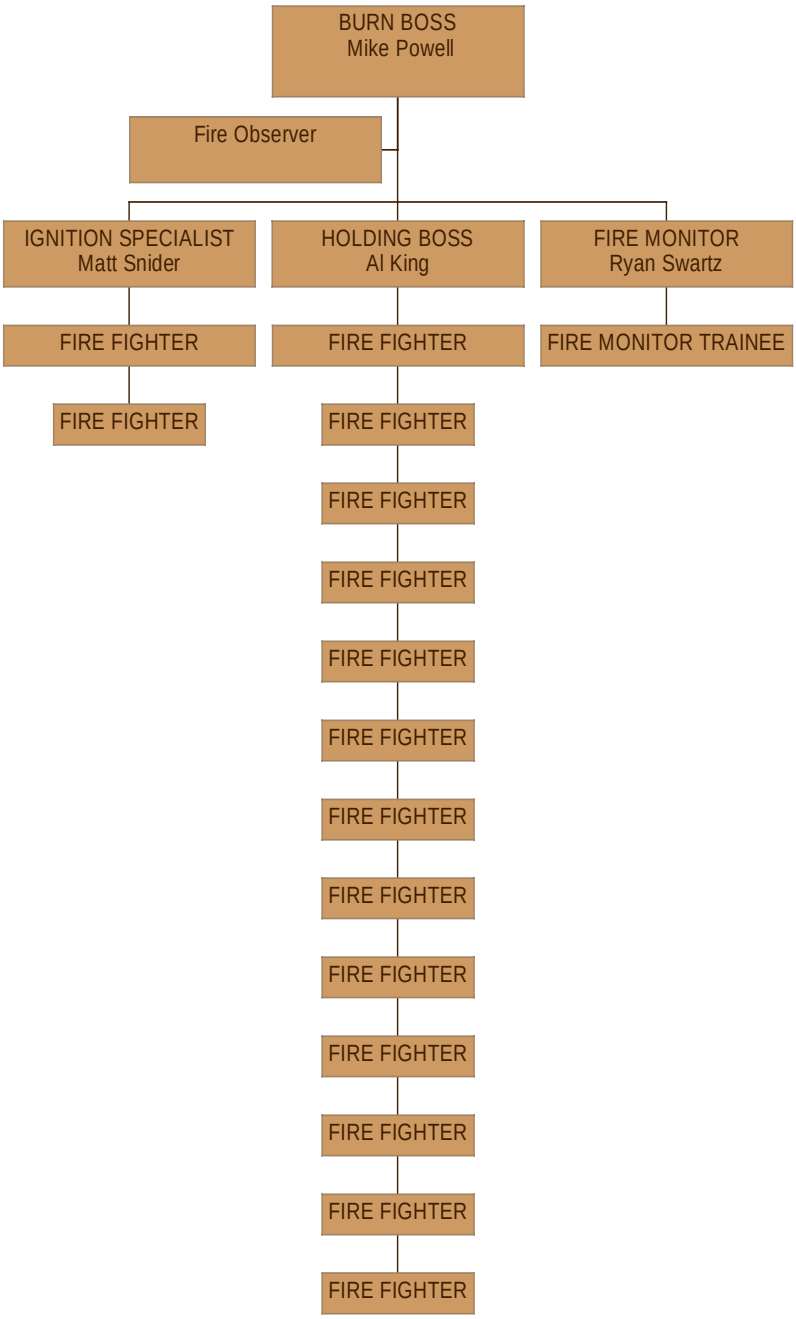


Determination of Relative Risk Rating for Wildland Fires. To obtain relative risk, connect lines between the top and bottom variables and the left and right hand variables. Where these lines cross represents the relative risk for this specific fire.

APPENDIX 5. STAFF ORGANIZATION CHARTS FOR BANDELIER NATIONAL MONUMENT.

CERRO GRANDE RX BURN

ORGANIZATIONAL CHART 5/4/00
FROM ORIGINAL BURN PLAN



APPENDIX 6. VALIDATION OF PRESCRIPTION PARAMETERS FOR UPPER FRIJOLES UNITS 1 AND 5 PRESCRIBED FIRE.

A Validation of Prescription Parameters
Bandelier National Monument
Management Ignited Prescribed Fire
Upper Frijoles Units 1 and 5
May 16, 2000

Abstract: Prescription parameters for the Upper Frijoles Units 1 and 5 Prescribed Fire Plan were set to establish a relatively wide window of opportunity to facilitate burning across a diverse vegetative profile. Prescriptive parameters were found to be generally sound and applicable towards achieving project objectives, except in some extreme cases. Strictly from a fire behavior and fire effect perspective, the fire plan was adequate and appropriately implemented.

Introduction

Upper Frijoles Units 1 and 5 are located in the northwest corner of Bandelier National Monument, encompassing approximately 1,000 acres of ponderosa pine/mixed conifer and montaine grasslands situated between 9,000 and 10,000 feet MSL.

The purpose of the project was to reduce hazardous fuels and allow fire to be restored as a natural process. Project objectives sought to remove dead surface fuels and cured herbaceous material and modify the mid-story structure of the existing stands. Fire behavior indicators were the means of determining if prescription parameters were met.

The intent of this report is to document the validity of the prescription parameters of the Upper Frijoles 1 and 5 Fire Plan, based on fire behavior/weather relationships and the ability of prescribed burning conditions to meet project objectives.

I. Prescription Parameters

Fire Behavior Prediction System Fuel Models
Four fuel models were used in developing the fire plan prescription:

Fuel Model 1: Short grass, cured and 1 foot or less in height.

Fuel Model 2: Open timber stand, typically ponderosa pine, with grass understory.

Fuel Model 8: Timber litter beneath a closed stand of short-needled conifer.

Fuel Model 9: Loosely compacted needle litter from a closed stand of long-needled conifer.

Weather
Prescriptive weather and fuel moisture conditions established in the fire plan are listed below.

Temperature:	40 to 90 degrees Fahrenheit
Relative Humidity:	15 to 50 percent
Wind Speed:	0 to 8 miles per hour
Wind Direction:	Any

1 Hour:	3 to 8 percent
10 Hour:	4 to 10 percent
100 Hour:	7 to 12 percent
1000 Hour:	8 to 12 percent

Live Herbaceous:	50 to 150 percent
Live Woody:	50 to 150 percent

Fire Behavior

Prescriptive parameters for fire behavior are also listed, determined by the fire behavior characteristics of the fuel models used in the plan. Rate of Spread is measured in chains (66 feet) per hour and flame length is measure in feet.

Fuel Model	Rate of Spread	Flame Length
1	<160	1” to 9’
2	<60	1” to 9’
8	<10	1” to 6’
9	<10	1” to 6’

Project Objectives

Several objectives were listed in the fire plan. Objectives directly associated with fire behavior include those speaking to tree mortality, consumption, air quality and containment. For brevity, these objectives are paraphrased below.

Reduce poles (trees less than 6” dbh) by 30 to 70% within 5 years post-burn.

- Reduce 6 to 20” dbh overstory trees by no more than 25% within 5 years post-burn.
- Retain 80% or greater overstory trees 20” or greater dbh.
- Reduce total fuel load by 40 to 80%.
- Emissions will not violate 90% NAAQS in Los Alamos and White Rock.
- Contain spots/slopovers at 5 acres or less with burn personnel within one burn period.
- Reduce spotting distances to ¼ mile or less by altering ignition sequence and timing.

II. Findings

Prescription Parameters

Fuel models used in developing the fire plan are appropriate for fuel conditions on the ground. A fuel model 10 may be appropriate in some areas under very dry conditions.

Some conflicts do exist in the prescription between different sets of parameters. The desired maximum temperature and minimum relative humidity values can result in a corrected 1 hour fuel moisture that is outside of prescription (2%) if calculated on unshaded south slopes after 1400 hours.

The fire plan did not specify whether a head or backing fire would be used, though it was stated that ignition techniques could be modified to meet immediate needs on the fire ground. Calculations performed for this analysis assume a running head fire for all worst case scenarios.

The fire plan prescription is built into "square" parameters, i.e., a linear set of high and low values that form a conceptual box that creates the prescription window. This configuration can be problematic when extreme values for each parameter are linked, as calculated fire behavior often exceeds prescribed values. See Figure 1.

Figure 1
Predicted Fire Behavior Under Extreme High End Prescription*

Fuel Model	Desired Flame Length	Predicted Flame Length	Desired Rate of Spread	Predicted Rate of Spread
1	1" – 9'	8.5	<160	**316**
2	1" – 9'	**12**	<160	**123**
8	1" – 6'	1.9	<10	5
9	1" – 6'	5.3	<10	**26**

*Boldface indicates values outside of prescription. Flame lengths are in feet. Rates of Spread are in chains per hour.

At least three distinct vegetation types exist on the landscape: grass, pine-mixed conifer and mixed conifer-aspen. These loosely correlate to the geographic locations of Phase 1, 2 and 3 respectively, as identified in the fire plan. The prescription window in the fire plan is written to allow for a wide range of burning conditions in order to meet the necessary burning conditions to meet objectives in all three fuel types. A considerable amount of local knowledge and expertise would be needed to appropriately apply the prescription in the right amount in the right locations. A better method is to construct distinct prescriptions for each vegetation type, especially if ignitions are separately applied. This would also allow for better understanding of fire behavior and effects between each type.

Observed weather at the time of ignition was solidly within prescribed boundaries for the fuel/vegetation type in which burning occurred. Temperature at ignition was 52 degrees, with 31% relative humidity and upslope winds at 1 to 3 miles per hour. Predicted and observed fire behavior at the time of ignition is exhibited in Figure 2.

Figure 2
Predicted and Observed Fire Behavior at the 2000 Hours on May 4, 2000

	Predicted Rate of Spread	Observed Rate of Spread	Predicted Flame Length	Observed Flame Length
Head Fire	17	16	4.4	3
Backing Fire	2	3	1.4	2

*Rate of Spread is in chains per hour. Flame length is in feet.

The spot weather forecast dated 5/4 at 1220 hours states that weather conditions during the next day's burning period would have temperatures in the low 70's, relative humidities 13 to 15% and (corrected to mid-flame) winds west to southwest at 1 to 5 miles per hour. These conditions are well within prescribed values.

Objectives

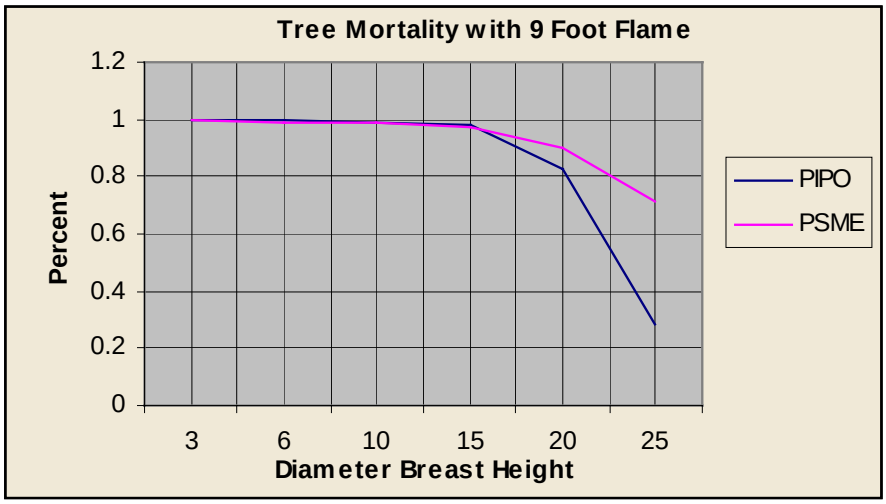
Not all objectives are appropriate for all fuel models indicated in the fire plan. For instance, tree mortality is not considered for fuel model 1, a grass model. Consumption objectives may not apply in fuel models 1 and 2 since the bulk of the fuel in the model is in the fine fuel classes, which typically consume completely in the course of a burn.

Mortality will vary by tree species and fire intensity. It is difficult to predict tree mortality in real terms because of the variable arrangement of available fuels and subsequent fire intensities across the landscape. Given this, accomplishment of mortality objectives over a range of tree species and tree diameters with a single prescription can be difficult.

Note: Analysis of aspen objectives was deleted from this analysis to facilitate timeliness of this report.

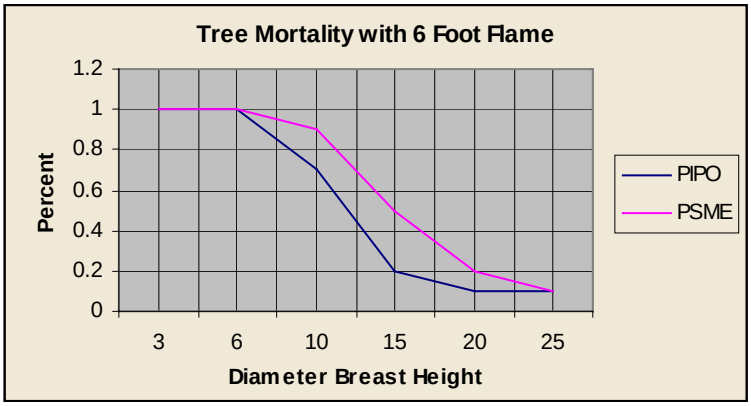
Flame lengths of 9 feet (fuel model 2 max. flame) will over achieve mortality in all but the largest size classes ponderosa pine and Douglas fir. See Figure 3.

Figure 3



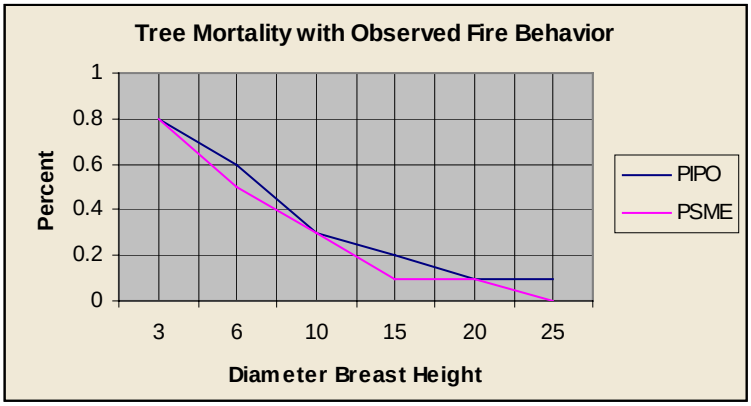
Flame lengths of 6 feet (fuel model 8 and 9 max flame) produces better results. Desirable results are achievable in stands with trees in a 15" diameter class and larger, but overachievement still occurs in trees in the 6 to 15 inch diameter classes. Mortality reaches 100% in trees less than 6 inches in diameter. See Figure 4.

Figure 4



Flame lengths during ignition were observed to be from 6 inches to 3 feet in length. An average flame length of 2 feet produces very desirable results. See Figure 5.

Figure 5



To summarize, the prescription as written will tend to discriminate against young trees, leaving an older, more open stand. This type of stand will be less conducive to sustained torching and crowning and thus mortality objectives are appropriate in that context. If the intent is to leave a stand of diverse size and age classes, then mortality objectives will likely be overachieved under high-end prescription burning conditions. The prescribed burn as it was implemented exhibited very low intensities and mortality objectives were not accomplished.

Thousand-hour fuel moisture is used prescriptively to track fuel consumption. Measured 1000 hour fuel moistures averaged 12% the week before the burn, the low-end prescription value. Fuel consumption was modeled using the FOFEM (First Order Fire Effects Model), a 12% measured 1000-hour fuel moisture value and a fuel-loading representative of the burn site. The model calculated a total fuel reduction of pre-burn loadings by 73%, a value within the desired prescription range. Actual consumption on the fire ground was considerably less, indicating fuel moisture levels as being higher than expected.

National Ambient Air Quality Standards (NAAQS) are affected by the amount and duration of emissions produced by a burn and the transport direction of the smoke column. Little effect to smoke sensitive areas (Los Alamos, White Rock) is likely, given the short duration of the prescribed burn project. In any case, emissions and transport direction were not monitored and so results are inconclusive.

Containment runs were modeled in BEHAVE to test the validity of the objective to contain spots and slopovers with project personnel at 5 acres or less. Rates of spread and production rates for a hand crew in a fuel model 9 were used. Burning conditions during ignition produced rates of spread in a fuel model 9 requiring a production rate 7 chains per hour to contain a 5 acre spot. The combined production rate for personnel on the project the first night was 38 chains per hour, thus this objective was achievable. A production rate of 28 chains per hour (for a running head fire) was required for given predicted rates of spread for the next afternoon's forecasted burning conditions. This would have exceeded the ability of Hiatt and Snyder, but was well within the ability of the Santa Fe Hotshots (40 chains per hour).

Potential spotting distances were computed assuming a surface fire on a ridgetop. A surface fire featuring a 9 foot flame length has the ability to spot 0.3 miles but only at the extreme high end of the prescribed windspeed (8 miles per hour). Lesser windspeeds or flame lengths modeled spotting distances no greater than 0.2 miles. Observed burning conditions during ignition and the next burn period had potential spotting distances of 0.1 miles and less.

Summary

Improvements could be made in the format and content of the Upper Frijoles Unit 1 and 5 fire plan. Prescription parameters need to be tightened down to limit tree mortality, and large fuel moistures more closely monitored to better measure unit consumption. Given the multiple fuel profiles existing in the unit, prescriptions specific to each profile would better serve to implement and monitor ignitions on the ground. Spotting and containment calculations also need to be added to the fire plan to provide a sound, scientific basis for establishing containment and contingency objectives. As it is currently written, the plan is implementable given a burn boss with local expertise and experience who understands the plans intent. A burn boss without this background would have more difficulty in appropriately implementing the plan.

/s/Daniel O'Brien, FBAN
May 16, 2000

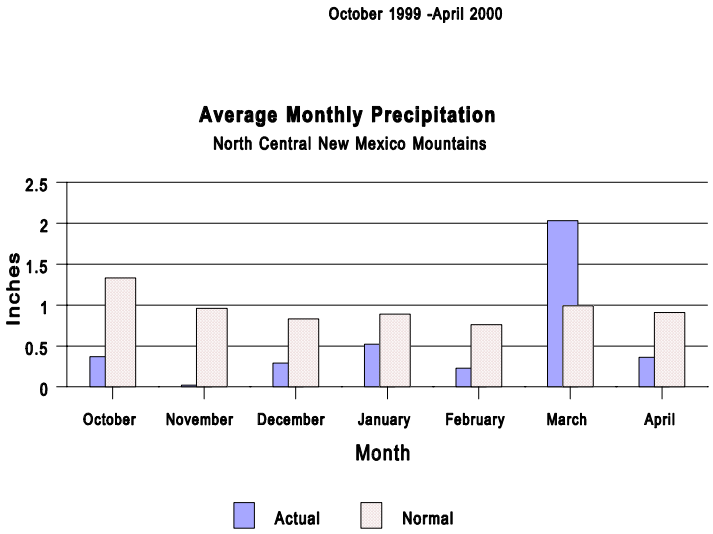
APPENDIX 7. SUMMARY OF WEATHER INFORMATION FOR CERRO GRANDE PRESCRIBED FIRE.

Summary of Weather Information on Cerro Grande Prescribed Fire

I Climatology

Bandelier National Monument is located in the Jemez Mountains of north-central New Mexico. The climate is a temperate mountain type, with about 16" annual precipitation at the Monument. Over half of the total annual precipitation falls in the four months from June through October. Maximum temperatures average near 70 for early May, with minimums in the low 30s. A good wind climatology was not available for Bandelier, but was available for nearby Los Alamos. There, winds are fairly light much of the year, but climatogically mid-March through June is apt to be windy. During this period, sustained wind speeds exceeding 8.8 mph (4 mps) occur about 20% of the time.

Northern New Mexico, as well as much of the Southwestern U.S., has been in a drought during the early months of year 2000. The Palmer Drought Index for early May shows northern New Mexico to be in a moderate drought (Palmer Index between -2.0 and -2.9). Several stations near Bandelier had below normal precipitation for every month from October 1999 through April 2000, except for a significant wet spell in late March. (See Figure 1). Winter snowpack was well below normal, with a local ski area not opening at all during the entire season.



II Observed weather during the Cerro Grande Prescribed Fire

A light amount (.22") of precipitation was received at the prescribed fire site on April 29-May 1. Otherwise April had been warmer and drier than normal, under persistent high pressure aloft. The high pressure ridge intensified during the first four days of May, reaching its greatest strength on Thursday May 4th, then holding similarly strong through Saturday May 7th. The weather on the day of the prescribed fire was warm and dry under sunny skies. Maximum and minimum temperatures were 72 and 48 at a portable weather station onsite site at 9170' elevation. The weather for the evening of May 4th when the prescribed fire was ignited, came from weather monitors using belt weather kits. At the time of test fire/ignition readings were in the 50s on the upper elevations of the site, with relative humidity (RH) in a 25-30% range. Evening winds were NW 8-12 mph at the ridgetop, with lighter downslope winds on the slopes, mainly 1-5 mph. An eye-level gust of 11 mph at 9300' on a ridgetop was the strongest reported wind.

Friday May 5th saw mostly sunny skies through midday, with some clouds later. Minimum RH ranged from 14-18%, with warm temps and winds West to SW increasing to 15-

18 mph in the afternoon, gusts 20-22 mph on ridgetops. Remote Automatic Weather Stations (RAWS) in the area showed peak 20' wind gusts of 22-34 mph Friday afternoon. Saturday was similar to Friday both wind and humidity-wise, but was cloudier and a little cooler than Friday. Afternoon eye-level winds were mainly SW to West 1-5 mph, with gusts 8-11 mph.

Sunday May 7th had similar temps to Saturday, with further cooling Monday. Minimum relative humidities remained low on Sunday, rising into the 20-30% range under variably cloudy skies. There were no belt weather observations available to the Type 1 Incident Management Team for Sunday May 7th. Area RAWS stations reported SW winds increasing to 10-15 mph (10-minute average) with gusts 28-40 mph. On Monday, winds were again fairly strong and gusty. Some RAWS stations showed a shift in winds from SSW to West or NW about mid-afternoon. The table below shows strongest gusts at nearby Los Alamos National Laboratory for May 4th through May 8th.

Maximum Reported Wind Gusts
Los Alamos National Laboratory
May 4-8, 2000

	May 4	May 5	May 6	May 7	May 8
Wind (mph)	NE 30	W 37	W 30	WSW 35	SW 40
Time	2:12 p.m.	10:25 p.m.	1:15 a.m.	1:57 p.m.	2:37 p.m

Note: Winds measured at Los Alamos station TA-6, 36 feet above the ground.

III Recent Study from Los Alamos National Labs regarding large wildland fires

LANL meteorologist Jeff Baars (personal communications, Los Alamos National Laboratory, May 16, 2000) did a recent study that examined the joint probability of occurrence of strong winds and High to Very High fire danger. He used April through June data covering 1980-1998. Fire danger was determined using Bandelier NM Energy Release Component (ERC). Average afternoon wind speeds of greater than 10 mph (averaged over 15 minutes) were used to represent strong winds. On those days peak wind gusts were commonly 30-40 mph. Wind directions examined were confined to a South to West-NW range.

The study results show that this combination of fire danger, wind direction, and wind speed occurred over a three-day period about once every four years. When such three-day periods occur, it is likely that there will be more than one within that year. The analysis concluded that a major fire moving up to the edge of the laboratory is not only credible but likely, with a return frequency of about 0.1, that is averaging one occurrence per ten years.

IV Forecasts

Bandelier NM lies within the County Warning Area of the Albuquerque National Weather Service (NWS) office. The Meteorologist in Charge is Charlie Liles. The primary Fire Weather contact for land management agencies is Chuck Maxwell, who works the bulk of Fire Weather shifts during the April to October fire season. Several others in the office have some fire weather experience, and all forecasters have completed all or part of the correspondence Intermediate Fire Behavior course. The office staff feels they work together well, discussing and coordinating forecasts as needed between the various forecast desks such as Public, Aviation, Severe Weather, and Fire Weather.

Preparedness forecasts are routinely issued twice daily at 9:30 a.m. and 2:30 pm. Land managers typically request site-specific (spot) forecasts via fax, and occasionally via telephone. Completed spot forecasts are returned to the requestor via fax, usually within 30-60 minutes. This was the case for all Cerro Grande Prescribed Fire spot forecasts, which generally verified well with observed weather. Copies of pertinent preparedness and spot forecasts as well as onsite weather observations are attached at the end of this narrative.

The Type 1 Incident Management Team did, however, note two areas of concern: 1) The majority of preparedness forecasts lacked any wind forecast in the 3-5 Day extended period. On Friday May 5th, there was no forecast regarding winds for the Sunday through Tuesday outlook period. 2) There were also some concerns in how Fire Weather Watch and Red Flag Headers were used (See Section 6).

V Haines Index Analysis

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Haines Index May 1- 8, 2000		
Date	Morning	Afternoon
May 1	3	2
May 2	3	4
May 3	6	6
May 4	5	6
May 5	5	6
May 6	5	6
May 7	3	6
May 8	3	5

Land management agencies and fire weather forecasters have used the Haines Index operationally since the early 1990s as an indicator for the potential of extreme fire behavior (e.g., high rates of spread, extensive spotting, and running crown fires) associated with plume dominated fires. The Haines Index combines two atmospheric parameters- stability and dryness - that can potentially effect the growth of wildland fires. The index varies between 2 and 6. A Haines Index of 2 indicates moist, stable air with very low potential for large fire growth while a

6 indicates dry, unstable air with an increasing potential for plume dominated fires. However, other factors such as slope, fuel moisture, fuel loadings, and wind also play a crucial role in the development of plume dominated wildfires and large fire growth.

Climatologically, a Haines Index of 5 or 6 is not uncommon in northern New Mexico during May. It occurs about 22% of the days during the morning hours and 54% of the days during the late afternoon and evening hours. The table above shows calculated values of the Haines Index taken from the Albuquerque, New Mexico upper air sounding from May 1, 2000 through May 8, 2000. The index was a 5 or 6 from May 3rd to May 6th and also on the afternoons of May 7th and May 8th, which indicated a moderate to high potential for a plume dominated fire or large wildfire growth. However, information gathered by the Cerro Grande Type 1 Incident Management Team failed to show any evidence of extreme fire behavior or large fire growth on May 4th, 5th and 6th. Further evidence shows that the large fire growth that occurred on Sunday, May 7th was due to very strong, gusty winds that fanned the Cerro Grande Prescribe Fire into a wind-driven, crown fire.

VI **Review of Red Flag warnings**

The fire weather Red Flag program is used to alert the user agencies of weather conditions in combination with critically dry or volatile fuel conditions either occurring or expected to occur that could lead to the rapid development and/or increase in wildfire activity.. Three phases are used: 1) Fire Weather Watch (FWW), 2) Red Flag Warning (RFW), and 3) Cancellation. A Fire Weather Watch will be issued when the fire weather forecaster is reasonably confident a Red Flag event will occur within the next 24 to 72 hours. A Red Flag Warning is issued to warn land management agencies of an impending or already occurring Red Flag event. Red Flag warnings will remain in effect until the critical weather pattern ceases or the conditions fail to develop as forecast.

Several FWW's and RFW's were issued by Albuquerque NWS during the course of the Cerro Grande Prescribed Fire. The Type 1 Incident Management Team noted several instances where a FWW or RFW headlined a forecast zone, but had no reference to location, weather event, or valid time period. The Type 1 Incident Management Team also noted several instances when RFW's were cancelled overnight, but immediately reissued with the following day's Morning preparedness forecast. When the event seems to be diurnal in nature, but the large-scale governing weather pattern hasn't changed, it would be prudent and less confusing to the fire community to continue the RFW until the weather pattern changes.

FNUS55 KABQ 032029
FWFABQ

FIRE WEATHER FORECAST FOR NORTH AND CENTRAL NEW MEXICO
NATIONAL WEATHER SERVICE ALBUQUERQUE NM
230 PM MDT WED MAY 3 2000

...MODERATE AND HIGH HAINES INDEX THROUGH THURSDAY...

.SYNOPSIS...CONTINUED VERY DRY AND UNSEASONABLY WARM THROUGH THE REMAINDER OF THE WEEK AS AN UPPER LEVEL RIDGE OF HIGH PRESSURE REMAINS OVER THE AREA. THE VERY WARM AND DRY AIR WILL MAINTAIN MODERATE AND HIGH HAINES INDEX VALUES AREA-WIDE...LEADING TO THE POTENTIAL FOR PLUME DOMINATED FIRES IN HEAVIER FUEL TYPES. LOCAL SLOPE AND VALLEY WIND SYSTEMS WILL CONTROL THE 20 FOOT WINDS DUE TO STRONG SURFACE HEATING DURING THE DAY AND RAPID COOLING AT NIGHT. CLASSIC NIGHTTIME INVERSIONS ARE EXPECTED...WITH GOOD HUMIDITY RECOVERY IN THE COOLER VALLEY LOCATIONS AND POOR RECOVERY AT MID SLOPE AND ABOVE. A WEAK SYSTEM PASSING NORTH OF THE AREA OVER THE WEEKEND COULD BRING WESTERLY AFTERNOON BREEZES AND A SLIGHT COOL DOWN.

WHERE WINDS ARE OMITTED THEY ARE UPSLOPE/UPVALLEY DURING THE DAY AND DOWNSLOPE/DOWNVALLEY AT NIGHT WITH SPEEDS GENERALLY LESS THAN 10 MPH.

NMZ001-041600-
NEW MEXICO FIRE WEATHER ZONE 1
NORTHWEST PLATEAU/FARMINGTON BLM/ABZ-
230 PM MDT WED MAY 3 2000

.TONIGHT...CLEAR AND COOL.
.THURSDAY...MOSTLY SUNNY AND WARM.

.<	TEMPERATURES	/ CHC.	WETTING RAIN
FARMINGTON	U40S M80S	/ 0	0

REGIONAL DATA...
NORTHWEST PLATEAU

RELATIVE HUMIDITY.....	40	8
LAL.....	1	1
HAINES INDEX.....	5	6
10000FT WINDS.....	VRB7	W10

$$

NMZ002-003-041600-
NEW MEXICO FIRE WEATHER ZONE 2
NORTHWEST MOUNTAINS/WESTERN CARSON-SANTA FE NF/SNZ-TAZ-
230 PM MDT WED MAY 3 2000

.TONIGHT...MOSTLY CLEAR AND COOL.
.THURSDAY...SUNNY AND WARM.

.<	TEMPERATURES	/ CHC.	WETTING RAIN
6000FT (ESPANOLA)	L40S U80S	/ 0	0
7000FT (LOS ALAMOS)	M40S U70S	/ 0	0
8000FT (CHAMA)	L30S M70S	/ 0	0

REGIONAL DATA...
NORTHWEST MTNS

RELATIVE HUMIDITY.....	35	10
LAL.....	1	1
HAINES INDEX.....	5	6
10000FT WINDS.....	VRB7	W10

$$

NMZ004-041600-
NEW MEXICO FIRE WEATHER ZONE 3
SANGRE DE CRISTO MOUNTAINS/EASTERN CARSON AND SANTA FE NF/SNZ-TAZ-
230 PM MDT WED MAY 3 2000

2

FNUS55 KABQ 041521
FWFABQ

FIRE WEATHER FORECAST FOR NORTH AND CENTRAL NEW MEXICO
NATIONAL WEATHER SERVICE ALBUQUERQUE NM
930 AM MDT THU MAY 4 2000

...VERY DRY WITH NEAR RECORD WARMTH AND HIGH HAINES INDEX MOST AREAS TODAY AND FRIDAY...

.SYNOPSIS...CONTINUED VERY DRY AND UNSEASONABLY WARM THROUGH THE REMAINDER OF THE WEEK AS AN UPPER LEVEL RIDGE OF HIGH PRESSURE REMAINS OVER THE AREA. THE VERY WARM AND DRY AIR WILL MAINTAIN HIGH HAINES INDEX VALUES AREA-WIDE AND WILL CONTINUE TO BRING POOR NIGHTTIME HUMIDITY RECOVERY TO LOCATIONS AT MID SLOPE AND ABOVE. LOCAL SLOPE AND VALLEY WIND SYSTEMS ARE EXPECTED TO CONTROL THE 20 FOOT WINDS FOR THE MOST PART TODAY...BUT A SLIGHT INCREASE IN WEST WINDS ALOFT WILL PRODUCE MORE WESTERLY SURFACE WINDS ON FRIDAY. THIS WESTERLY FLOW WILL ALSO BRING DRYING TO THE EASTERN PLAINS BEHIND A SURFACE LOW PRESSURE TROUGH WHICH WILL DEVELOP NEAR THE TEXAS BORDER. SOME AFTERNOON BREEZES AND A SLIGHT COOL DOWN ARE FORECAST FOR LATER THIS WEEKEND...WITH CONTINUED WARM AND DRY CONDITIONS EXPECTED NEXT WEEK.

WHERE WINDS ARE OMITTED THEY ARE UPSLOPE/UPVALLEY DURING THE DAY AND DOWNSLOPE/DOWNVALLEY AT NIGHT WITH SPEEDS GENERALLY LESS THAN 10 MPH.

NMZ001-042100-
NEW MEXICO FIRE WEATHER ZONE 1
NORTHWEST PLATEAU/FARMINGTON BLM/ABZ-
930 AM MDT THU MAY 4 2000

.TODAY...SUNNY WITH RECORD WARMTH. WEST WIND 10-15 MPH IN THE AFTERNOON.
.TONIGHT...MOSTLY CLEAR SKIES AND COOL.
.FRIDAY...MOSTLY SUNNY WITH RECORD WARMTH. WEST WIND 10-20 MPH IN THE AFTERNOON.

.<	TEMPERATURES			/ CHC.	WETTING	RAIN
FARMINGTON	U80S	L40S	M80S	/ 0	0	0
REGIONAL DATA...						
NORTHWEST PLATEAU						
RELATIVE HUMIDITY.....	8	40	8			
LAL.....	1	1	1			
HAINES INDEX.....	6	5	6			
10000FT WINDS.....	W15	W15	W18			

$$

NMZ002-003-042100-
NEW MEXICO FIRE WEATHER ZONE 2
NORTHWEST MOUNTAINS/WESTERN CARSON-SANTA FE NF/SNZ-TAZ-
930 AM MDT THU MAY 4 2000

.TODAY...MOSTLY SUNNY WITH SOME AFTERNOON CUMULUS CLOUDS. NEAR RECORD WARMTH.
.TONIGHT...MOSTLY CLEAR SKIES AND MILD.
.FRIDAY...MOSTLY SUNNY WITH NEAR RECORD WARMTH. WEST TO SOUTHWEST WINDS 10-15 MPH IN THE AFTERNOON.

.<	TEMPERATURES			/ CHC.	WETTING	RAIN
6000FT (ESPANOLA)	N90	M40S	L90S	/ 0	0	0
7000FT (LOS ALAMOS)	L80S	U40S	L80S	/ 0	0	0
8000FT (CHAMA)	N80	M30S	N80	/ 0	0	0
REGIONAL DATA...						
NORTHWEST MTNS						
RELATIVE HUMIDITY.....	10	30	10			
LAL.....	1	1	1			
HAINES INDEX.....	6	5	6			

3

10000FT WINDS..... W10 W10 W18

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NMZ004-042100-
NEW MEXICO FIRE WEATHER ZONE 3
SANGRE DE CRISTO MOUNTAINS/EASTERN CARSON AND SANTA FE NF/SNZ-TAZ-
930 AM MDT THU MAY 4 2000

.TODAY...MOSTLY SUNNY WITH SOME AFTERNOON CUMULUS CLOUDS. NEAR RECORD WARMTH. SOUTHERLY WINDS AROUND 10 MPH ALONG THE EAST SLOPES.
.TONIGHT...MOSTLY CLEAR SKIES AND MILD.
.FRIDAY...MOSTLY SUNNY WITH NEAR RECORD WARMTH. WEST TO SOUTHWEST WINDS 10-20 MPH IN THE AFTERNOON...STRONGEST ALONG THE EAST SLOPES.

.<	TEMPERATURES			/ CHC.	WETTING	RAIN
7000FT EAST (LAS VEGAS)	N80	M40S	N80	/ 0	0	0
7000FT WEST (SANTA FE)	U80S	M40S	N90	/ 0	0	0
8500FT (RED RIVER)	N80	L30S	N80	/ 0	0	0

REGIONAL DATA...
SANGRE DE CRISTO MTNS

RELATIVE HUMIDITY.....	12	45	10
LAL.....	1	1	1
HAINES INDEX.....	6	5	6
10000FT WINDS.....	W10	W10	W15

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NMZ007-042100-
NEW MEXICO FIRE WEATHER ZONE 4
NORTHEAST PLAINS/EASTERN KIOWA AND RITA BLANCA GRASSLANDS/ABZ-TNZ-
930 AM MDT THU MAY 4 2000

.TODAY...MOSTLY SUNNY SKIES AND WARM. SOUTH TO SOUTHWEST WIND 10-15 MPH IN THE AFTERNOON.
.TONIGHT...MOSTLY CLEAR AND MILD. LIGHT AND VARIABLE WINDS.
.FRIDAY...MOSTLY SUNNY AND CONTINUED WARM. SOUTHWEST WINDS 10-20 MPH IN THE AFTERNOON.

.<	TEMPERATURES			/ CHC.	WETTING	RAIN
CLAYTON	M80S	N50	M80S	/ 0	0	0

REGIONAL DATA...
NORTHEAST PLAINS

RELATIVE HUMIDITY.....	20	60	15
LAL.....	1	1	1
HAINES INDEX.....	5	5	6
10000FT WINDS.....	W10	NW10	SW15

$$

NMZ008-042100-
NEW MEXICO FIRE WEATHER ZONE 5
WEST CENTRAL MOUNTAINS/WESTERN CIBOLA NF/ABZ-
930 AM MDT THU MAY 4 2000

.TODAY...SUNNY WITH RECORD WARMTH. WEST WIND AROUND 10 MPH IN THE AFTERNOON.
.TONIGHT...MOSTLY CLEAR SKIES AND COOL.
.FRIDAY...MOSTLY SUNNY WITH RECORD WARMTH. WEST TO SOUTHWEST WIND 10-20 MPH IN THE AFTERNOON.

.<	TEMPERATURES			/ CHC.	WETTING	RAIN
6500FT (GRANTS)	M80S	U30S	M80S	/ 0	0	0

REGIONAL DATA...
WEST CENTRAL MTNS

RELATIVE HUMIDITY.....	8	35	8
LAL.....	1	1	1
HAINES INDEX.....	6	6	6
10000FT WINDS.....	W10	W15	W18

#4

FNUS55 KABQ 042023
FWFABQ

FIRE WEATHER FORECAST FOR NORTH AND CENTRAL NEW MEXICO
NATIONAL WEATHER SERVICE ALBUQUERQUE NM
230 PM MDT THU MAY 4 2000

...CONTINUED VERY DRY WITH HIGH HAINES INDEX AND NEAR RECORD WARMTH AGAIN ON FRIDAY...

.SYNOPSIS...UNSEASONABLY WARM AND DRY CONDITIONS CONTINUE. THE VERY WARM AND DRY AIR WILL MAINTAIN HIGH HAINES INDEX VALUES AREA-WIDE AND WILL CONTINUE TO BRING POOR NIGHTTIME HUMIDITY RECOVERY TO LOCATIONS AT MID SLOPE AND ABOVE. LOCAL SLOPE AND VALLEY WIND SYSTEMS ARE EXPECTED TO CONTROL THE 20 FOOT WINDS THROUGH TONIGHT...BUT A SLIGHT INCREASE IN WEST WINDS ALOFT WILL PRODUCE MORE WESTERLY SURFACE WINDS ON FRIDAY. THIS WESTERLY FLOW WILL BRING DRYING TO THE EASTERN PLAINS BEHIND A SURFACE LOW PRESSURE TROUGH WHICH SHOULD PUSH EAST TO NEAR THE TEXAS BORDER FRIDAY AFTERNOON. SOME AFTERNOON BREEZES AND A SLIGHT COOL DOWN ARE FORECAST FOR LATER THIS WEEKEND...WITH CONTINUED WARM AND DRY CONDITIONS EXPECTED THROUGH MOST OF NEXT WEEK.

WHERE WINDS ARE OMITTED THEY ARE UPSLOPE/UPVALLEY DURING THE DAY AND DOWNSLOPE/DOWNVALLEY AT NIGHT WITH SPEEDS GENERALLY LESS THAN 10 MPH.

NMZ001-051600-
NEW MEXICO FIRE WEATHER ZONE 1
NORTHWEST PLATEAU/FARMINGTON BLM/ABZ-
230 PM MDT THU MAY 4 2000

.TONIGHT...MOSTLY CLEAR SKIES AND COOL.
.FRIDAY...MOSTLY SUNNY WITH RECORD WARMTH. WEST WIND 10-20 MPH IN THE AFTERNOON.

.<	TEMPERATURES	/ CHC.	WETTING RAIN
FARMINGTON	L40S M80S	/ 0	0

REGIONAL DATA...
NORTHWEST PLATEAU

RELATIVE HUMIDITY.....	40	8
LAL.....	1	1
HAINES INDEX.....	5	6
10000FT WINDS.....	W15	W18

$$

NMZ002-003-051600-
NEW MEXICO FIRE WEATHER ZONE 2
NORTHWEST MOUNTAINS/WESTERN CARSON-SANTA FE NF/SNZ-TAZ-
230 PM MDT THU MAY 4 2000

.TONIGHT...MOSTLY CLEAR SKIES AND MILD.
.FRIDAY...MOSTLY SUNNY WITH NEAR RECORD WARMTH. WEST TO SOUTHWEST WINDS 10-15 MPH IN THE AFTERNOON.

.<	TEMPERATURES	/ CHC.	WETTING RAIN
6000FT (ESPANOLA)	M40S L90S	/ 0	0
7000FT (LOS ALAMOS)	U40S L80S	/ 0	0
8000FT (CHAMA)	M30S N80	/ 0	0

REGIONAL DATA...
NORTHWEST MTNS

RELATIVE HUMIDITY.....	30	10
LAL.....	1	1
HAINES INDEX.....	5	6
10000FT WINDS.....	W10	W18

$$

NMZ004-051600-
NEW MEXICO FIRE WEATHER ZONE 3

5

ABQFWFABQ ALL
TTAA00 KABQ DDHHMM

FIRE WEATHER FORECAST FOR NORTH AND CENTRAL NEW MEXICO
NATIONAL WEATHER SERVICE ALBUQUERQUE NM
940 AM MDT FRI MAY 5 2000

.SYNOPSIS...CONTINUED WARM AND DRY WITH HIGH HAINES VALUES THROUGH THE WEEKEND. WINDS WILL INCREASE AS THE UPPER LEVEL RIDGE WEAKENS ON SATURDAY. A DISTURBANCE WILL PASS TO THE NORTH OF NEW MEXICO ON SUNDAY AND MONDAY. TEMPERATURES WILL DECREASE A FEW DEGREES... AFTERNOON BREEZES WILL DEVELOP AND CLOUDS WILL MOVE OVER THE NORTHERN PORTION OF THE STATE BUT NO PRECIPITATION IS EXPECTED.

WHERE WINDS ARE OMITTED THEY ARE UPSLOPE/UPVALLEY DURING THE DAY AND DOWNSLOPE/DOWNVALLEY AT NIGHT WITH SPEEDS GENERALLY LESS THAN 10 MPH.

NMZ001-052100-
NEW MEXICO FIRE WEATHER ZONE 1
NORTHWEST PLATEAU/FARMINGTON BLM/ABZ-
940 AM MDT FRI MAY 5 2000

.TODAY...MOSTLY SUNNY AND CONTINUED UNSEASONABLY WARM. RECORD HIGH TEMPERATURES. WEST TO SOUTHWEST WIND 10-20 MPH IN THE AFTERNOON.
.TONIGHT AND SATURDAY...MOSTLY CLEAR. NEAR RECORD HIGH TEMPERATURES POSSIBLE SATURDAY. AFTERNOON WINDS SOUTHWEST 15-20 MPH.

.<	TEMPERATURES			/ CHC.	WETTING	RAIN
FARMINGTON	M80S	U40S	M80S	/ 0	0	0

REGIONAL DATA...
NORTHWEST PLATEAU

RELATIVE HUMIDITY.....	10	38	11
LAL.....	1	1	1
HAINES INDEX.....	6	5	6
10000FT WINDS.....	W20	W25	SW25

$$

NMZ002-003-052100-
NEW MEXICO FIRE WEATHER ZONE 2
NORTHWEST MOUNTAINS/WESTERN CARSON-SANTA FE NF/SNZ-TAZ-
940 AM MDT FRI MAY 5 2000

.TODAY...MOSTLY SUNNY AND CONTINUED UNSEASONABLY WARM. RECORD HIGH TEMPERATURES. SOUTHWEST WIND 10-20 MPH IN THE AFTERNOON.
.TONIGHT AND SATURDAY...MOSTLY CLEAR. NEAR RECORD HIGH TEMPERATURES POSSIBLE SATURDAY. AFTERNOON WINDS SOUTHWEST 15-20 MPH.

.<	TEMPERATURES			/ CHC.	WETTING	RAIN
6000FT (ESPANOLA)	N90	U40S	U80S	/ 0	0	0
7000FT (LOS ALAMOS)	L80S	U40S	N80	/ 0	0	0
8000FT (CHAMA)	U70S	M30S	U70S	/ 0	0	0

REGIONAL DATA...
NORTHWEST MTNS

RELATIVE HUMIDITY.....	12	30	15
LAL.....	1	1	1
HAINES INDEX.....	6	5	6
10000FT WINDS.....	W20	W25	SW25

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NMZ004-052100-
NEW MEXICO FIRE WEATHER ZONE 3
SANGRE DE CRISTO MOUNTAINS/EASTERN CARSON AND SANTA FE NF/SNZ-TAZ-
940 AM MDT FRI MAY 5 2000

.TODAY...MOSTLY SUNNY AND CONTINUED UNSEASONABLY WARM. RECORD HIGH TEMPERATURES. SOUTHWEST WIND 10-20 MPH IN THE AFTERNOON.
.TONIGHT AND SATURDAY...MOSTLY CLEAR. NEAR RECORD HIGH TEMPERATURES

6

FNUS55 KABQ 052035
FWFABQ

FIRE WEATHER FORECAST FOR NORTH AND CENTRAL NEW MEXICO
NATIONAL WEATHER SERVICE ALBUQUERQUE NM
230 PM MDT FRI MAY 5 2000

.SYNOPSIS...CONTINUED WARM AND DRY WITH HIGH HAINES VALUES AND VERY LOW AFTERNOON RH VALUES THROUGH THE WEEKEND. SURFACE WINDS WILL PICK UP SOME SATURDAY OVER TODAY...AND COULD APPROACH RED FLAG CRITERIA SPEEDS...WHICH ARE SUSTAINED 25 MPH OR GREATER...ACROSS PORTIONS OF THE NORTH AND EASTCENTRAL IN THE AFTERNOON.

WHERE WINDS ARE OMITTED THEY ARE UPSLOPE/UPVALLEY DURING THE DAY AND DOWNSLOPE/DOWNVALLEY AT NIGHT WITH SPEEDS GENERALLY LESS THAN 10 MPH.

NMZ001-061600-
NEW MEXICO FIRE WEATHER ZONE 1
NORTHWEST PLATEAU/FARMINGTON BLM/ABZ-
230 PM MDT FRI MAY 5 2000

.TONIGHT AND SATURDAY...MOSTLY CLEAR. NEAR RECORD HIGH TEMPERATURES POSSIBLE SATURDAY. AFTERNOON WINDS SOUTHWEST 15-20 MPH AND GUSTY BETWEEN 20 AND 30 MPH.

.<	TEMPERATURES	/ CHC.	WETTING RAIN
FARMINGTON	U40S M80S	/ 0	0

REGIONAL DATA...
NORTHWEST PLATEAU

RELATIVE HUMIDITY.....	35	9
LAL.....	1	1
HAINES INDEX.....	5	6
10000FT WINDS.....	W25	SW25

DK/MAF

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NMZ002-003-061600-
NEW MEXICO FIRE WEATHER ZONE 2
NORTHWEST MOUNTAINS/WESTERN CARSON-SANTA FE NF/SNZ-TAZ-
230 PM MDT FRI MAY 5 2000

.TONIGHT AND SATURDAY...MOSTLY CLEAR. NEAR RECORD HIGH TEMPERATURES POSSIBLE SATURDAY. AFTERNOON WINDS SOUTHWEST 15-20 MPH AND GUSTY.

.<	TEMPERATURES	/ CHC.	WETTING RAIN
6000FT (ESPANOLA)	U40S U80S	/ 0	0
7000FT (LOS ALAMOS)	U40S N80	/ 0	0
8000FT (CHAMA)	M30S U70S	/ 0	0

REGIONAL DATA...
NORTHWEST MTNS

RELATIVE HUMIDITY.....	30	12
LAL.....	1	1
HAINES INDEX.....	5	6
10000FT WINDS.....	W25	SW25

$$

NMZ004-061600-
NEW MEXICO FIRE WEATHER ZONE 3
SANGRE DE CRISTO MOUNTAINS/EASTERN CARSON AND SANTA FE NF/SNZ-TAZ-
230 PM MDT FRI MAY 5 2000

.TONIGHT AND SATURDAY...MOSTLY CLEAR. NEAR RECORD HIGH TEMPERATURES POSSIBLE SATURDAY WITH AFTERNOON WINDS SOUTHWEST 15-25 MPH AND GUSTY.

.<	TEMPERATURES	/ CHC.	WETTING RAIN
7000FT EAST (LAS VEGAS)	U40S N80	/ 0	0
7000FT WEST (SANTA FE)	U40S U80S	/ 0	0
8500FT (RED RIVER)	L30S M70S	/ 0	0

REGIONAL DATA...
SANGRE DE CRISTO MTNS

RELATIVE HUMIDITY.....	40	12
LAL.....	1	1
HAINES INDEX.....	5	6
10000FT WINDS.....	W28	SW28

$$

NMZ007-061600-
NEW MEXICO FIRE WEATHER ZONE 4
NORTHEAST PLAINS/EASTERN KIOWA AND RITA BLANCA GRASSLANDS/ABZ-TNZ-

USDA Forest Service

7

Spot weather forecast

FIRE WEATHER SPECIAL FORECAST REQUEST
(REF. FSM 5125)

I. REQUESTING AGENCY WILL FURNISH:

1. NAME OF FIRE OR OTHER PROJECT	2. FOREST/AREA	3. REQUEST MADE TIME	DATE
Unit 1 -RX Burn	Bandelier Nat'l Park	1600	5/3/00

4. LOCATION (By 1/4 Sec - Sec - Twp - Range)	5. DRAINAGE NAME	6. EXPOSURE (NE, E, SE, etc.)
T19N R5E S21/22	Upper frijoles	S

7. SIZE OF PROJECT (Acres)	8. ELEVATION TOP	BOTTOM	9. FUEL TYPE	10. PROJECT ON:
~1000	10,000	9,000	mc/pp	☒ GROUND ☐ CROWNING

11. WEATHER CONDITIONS AT PROJECT OR FROM NEARBY STATIONS

OBS	PLACE	ELEVATION	OB TIME	WIND DIR.-VEL. 20 FT.	WIND DIR.-VEL. EYELEVEL	TEMP. DRY	TEMP. WET	(Lv. Blank) RH	(Lv. Blank) DP	REMARKS (Indicate rain, thunderstorms, etc. Also wind condition and 10ths of cloud cover.)
TODAY	nr ridgetop	9700	1200	1	+V	65	43	17	20	0% CC
PREVIOUS 24 HR.	ridgetop	9800	1300	1	+V	62	42	20	21	10% CC
PREVIOUS 48 HR.	nr Hwy 4	9000	1400	1	+V	69	46	19	25	20% CC

12. SEND FORECAST TO:	PLACE	VIA	ATTN: (Name, if applicable)
	Bandelier SAF NF	672-9607 FAX	Mike Powell

II. FIRE WEATHER FORECASTER WILL FURNISH:

13. FORECAST AND OUTLOOK:

ZCZC ABQSPOT
TTAA00 KABQ DDHHMM

SPOT FORECAST FOR UNIT 1 BURN...BANDELIER NP...SANTA FE NF
NATIONAL WEATHER SERVICE ALBUQUERQUE NM
440 PM MDT WED MAY 3 2000

...HIGH HAINES INDEX THURSDAY...

.OUTLOOK FOR THURSDAY...MOSTLY SUNNY...WARM AND DRY. MAX TEMPS 72-76. MIN RH NEAR 14 PERCENT. 20 FT WINDS...DOWNVALLEY WINDS EARLY...THEN BECOMING SOUTH TO SOUTHWEST 8-16 MPH BY MID AFTERNOON.

.OUTLOOK FOR THURSDAY EVENING...MOSTLY CLEAR...MILD AND DRY. TEMPS FALLING THROUGH THE 60S EARLY EVENING (600-900 PM) AND THROUGH THE 50S LATE EVENING (AFTER 9 PM). RH RECOVERY TO AROUND 35 PERCENT BY MIDNIGHT. SOUTHWEST WINDS 7-14 MPH EARLY...LOCAL DOWNSLOPE WINDS DEVELOPING TOWARD MIDNIGHT.

FCSTR...C. JONES

****
PLEASE CONTACT US AND PROVIDE US WITH FEEDBACK ON THIS SPOT FORECAST.
WE WOULD ESPECIALLY LIKE TO KNOW ABOUT WINDS AND MAX AND MIN TEMPS
AND RH/S. PHONE: 505-244-9148 FAX: 505-842-9162
*THANK YOU FOR HELPING US TO MAKE BETTER FORECASTS FOR YOU!
****

14. REMAR

NAME OF

USDA Forest Service

Spot weather forecast

FIRE WEATHER SPECIAL FORECAST REQUEST
(REF. FSM 5125)

8

I. REQUESTING AGENCY WILL FURNISH:

1. NAME OF FIRE OR OTHER PROJECT	2. FOREST/AREA	3. REQUEST MADE TIME	DATE
Unit 1 Rx	NPS - Bandelier NM	1135	5/4/00

4. LOCATION (By 1/4 Sec - Sec - Twp - Range)	5. DRAINAGE NAME	6. EXPOSURE (NE, E, SE, etc.)
T19N R5E S 21/22	Upper Frijoles	S

7. SIZE OF PROJECT (Acres)	8. ELEVATION TOP	BOTTOM	9. FUEL TYPE	10. PROJECT ON:
~1000 ac.	10,000	9,000	MC/PP	☒ GROUND ☐ CROWNING

11. WEATHER CONDITIONS AT PROJECT OR FROM NEARBY STATIONS

OBS	PLACE	ELEVATION	OB TIME	WIND DIR-VEL 20 FT.	EYELEVEL	TEMP. DRY	WET	(Lv. Blank) RH	DP	REMARKS (Indicate rain, thunderstorms, etc. Also wind condition and 10ths of cloud cover.)
TODAY	Cerro Grande	10,000	1100		WNW 2-4	60	42	23	23	0% CC
PREVIOUS 24 HR.	S Slope Cerro	9,700	1100		L/V	65	44	19	23	0% CC
PREVIOUS 48 HR.										

12. SEND FORECAST TO:	PLACE	VIA	ATTN: (Name, if applicable)
	Bandelier NM	Fax 672-9607	Mike Powell

II. FIRE WEATHER FORECASTER WILL FURNISH:

13. FORECAST AND OUTLOOK:

5G 10-12

SPOT FORECAST FOR UNIT 1 RX...NPS/BANDELIER NM
NATIONAL WEATHER SERVICE ALBUQUERQUE NM
1220 PM MDT THU MAY 4 2000

...6 HAINES INDEX THROUGH FRIDAY WITH POOR NIGHTTIME RH RECOVERY...

.DISCUSSION...FREE-AIR WINDS WILL INCREASE SLIGHTLY OUT OF THE WEST TONIGHT AND ON FRIDAY WHICH WILL MAKE SURFACE WINDS STRONGER AND MORE WESTERLY ON FRIDAY AFTERNOON.

.THIS AFTERNOON...MOSTLY SUNNY...WARM AND DRY WITH A FEW CUMULUS CLOUDS. CLOUD COVER LESS THEN 2/10. MAX TEMPS 68-72. MIN RH 14-18 PERCENT. 20 FT WINDS...WEST AROUND 10 MPH RIDGETOPS, SOUTH TO SOUTHWEST 5-10 MPH LOWER ELEVATIONS.

.TONIGHT...CLEAR AND MILD WITH POOR RH RECOVERY. MIN TEMPS NEAR 45. RH REMAINING IN 15-20 PERCENT RANGE TROUGH ABOUT 2000, WITH MAX OF 25-30 PERCENT FROM MIDNIGHT ON. 20 FT WINDS...NORTHWEST 10-15 MPH RIDGETOPS, DOWNSLOPE 4-8 MPH REMAINDER.

.OUTLOOK FOR FRIDAY...SUNNY. CONTINUED VERY WARM AND DRY. LITTLE CHANGE IN TEMPS. MIN RH DOWN 1-3 PERCENT. 20 FT WINDS...WESTERLY 10-15 MPH WITH AFTERNOON GUSTS TO NEAR 20 MPH RIDGETOPS, BECOMING SOUTHWEST 10-15 MPH AT LOWER ELEVATIONS.

FCSTR...C.MAXWELL

14. REMARK

****
PLEASE CONTACT US AND PROVIDE US WITH FEEDBACK ON THIS SPOT FORECAST.
WE WOULD ESPECIALLY LIKE TO KNOW ABOUT WINDS AND MAX AND MIN TEMPS
AND RH/S. PHONE: 505-244-9148 FAX: 505-842-9162
*THANK YOU FOR HELPING US TO MAKE BETTER FORECASTS FOR YOU!
****

NAME OF F

III. FORECAST RECEIVED:	TIME	DATE	NAME

RJ FS 5100 52 (5-85)

[redacted]

Verbal Brief
Thur day 5/4

Received call from nps [redacted] at around 7:40 pm. He said winds were in 10-15 mph range, as predicted, but wanted to know when they would die down. Told him around 9pm. at which time they would become downslope /downvalley. He also asked if spot issued at 1220 pm (CSM) was still valid overnight (RE: RH/wind) told him it was. [redacted] nws

APPENDIX C - SPOT FORECAST REQUEST FORM (D-1)

USDA Forest Service

Spot Weather forecast

FIRE WEATHER SPECIAL FORECAST REQUEST
(REF. FSM 5125)

10

I. REQUESTING AGENCY WILL FURNISH:

1. NAME OF FIRE OR OTHER PROJECT		2. FOREST/AREA	3. REQUEST MADE	
Upper Frioles Unit 1	☐ Wildfire ☑ R_x	Bandelier NM	TIME ~8:30	DATE 5/5/00

4. LOCATION (By 1/4 Sec - Sec - Twp - Range)	5. DRAINAGE NAME	6. EXPOSURE (NE, E, SE, etc.)

7. SIZE OF PROJECT (Acres)	8. ELEVATION TOP	BOTTOM	9. FUEL TYPE	10. PROJECT ON: ☐ GROUND ☐ CROWNING
300-400				

11. WEATHER CONDITIONS AT PROJECT OR FROM NEARBY STATIONS

OBS	PLACE	ELEVATION	OB TIME	WIND DIR-VEL 20 FT.	WIND DIR-VEL EYELEVEL	TEMP. DRY	TEMP. WET	(Lv. Blank) RH	(Lv. Blank) DP	REMARKS (Indicate rain, thunderstorms, etc. Also wind condition and 10ths of cloud cover.)
TODAY		? 9400	0500		1-2 NW	47	34	29	16	
PREVIOUS 24 HR.			0600		2-3 NW	48	34	26	15	02 CC
PREVIOUS 48 HR.			0700		1-2 NW	49	34	23	13	

12. SEND FORECAST TO:	PLACE 30 2-3 NW 49	VIA 30 24 13 662-3935	ATTN: (Name, if applicable) 672-3861 x 551 Mike Powell

II. FIRE WEATHER FORECASTER WILL FURNISH:

13. FORECAST AND OUTLOOK:

ZCZC ABQSPOT
TTAA00 KABQ DDHHMM

SPOT FORECAST FOR UNIT 1 RX...NPS/BANDELIER NM
NATIONAL WEATHER SERVICE ALBUQUERQUE NM
900 AM MDT FRI MAY 5 2000

...CONTINUED HIGH HAINES INDEX (6) THROUGH SATURDAY WITH POOR NIGHTTIME RH RECOVERY...

.DISCUSSION...10000FT WINDS WILL BE INCREASING OVER THE NEXT 24 HOURS RESULTING IN STRONGER WEST TO SOUTHWEST WINDS TODAY AND SATURDAY.

.TODAY...MOSTLY SUNNY...WARM AND DRY WITH 1/10-2/10 CUMULUS CLOUDS BY AFTERNOON. MAX TEMPS 68-72. MIN RH 14-18 PERCENT. 20 FT WINDS... LIGHT WEST TO NORTHWEST WINDS THIS MORNING BECOMING WEST TO SOUTHWEST 15-18 MPH THIS AFTERNOON...20-22 MPH RIGDETOPS.

.TONIGHT...CLEAR AND MILD WITH POOR RH RECOVERY. MIN TEMPS NEAR 47. RH NEAR 20 PERCENT THROUGH LATE EVENING... WITH MAX NEAR 30 PERCENT EARLY MORNING. 20 FT WINDS...WEST 12-18 MPH RIDGETOPS...DOWNSLOPE 5-8 MPH AFTER MIDNIGHT.

.OUTLOOK FOR SATURDAY...MOSTLY SUNNY. CONTINUED WARM AND DRY. TEMPS DECREASING 1-3 DEGREES WITH ONLY A SLIGHT INCREASE IN MIN RH. 20 FT WINDS...SOUTHWEST 17-22 MPH BY AFTERNOON...22-25 MPH RIDGETOPS.

FCSTR...DK

****
PLEASE CONTACT US AND PROVIDE US WITH FEEDBACK ON THIS SPOT FORECAST.
WE WOULD ESPECIALLY LIKE TO KNOW ABOUT WINDS AND MAX AND MIN TEMPS
AND RH/S. PHONE: 505-244-9148 FAX: 505-842-9162
*THANK YOU FOR HELPING US TO MAKE BETTER FORECASTS FOR YOU!
****

ON-SITE WEATHER OBSERVATIONS

Fire Name: **Cerro Grande** Monitors: [redacted] Date: **5/4/00-5/5/00**

TIME	LOCATION	ELEV.	ASP.	DB	WB	DP/ RH	WINDSPEED (GUSTS)	WIND DIR.	% CLOUD COVER	SHADED Y/N	FDFM/ PI	COMMENTS (PRECIP, SMOKE, RH/DB CHANGE, ETC)
1735	Cerro Grande summit	10000	S	68	45	22/18	5 (8)	W	0	N	5/60	
1830	Cerro Grande summit	10200	S	58	41	23/26	4 (7)	W	0	N	9/30	Significant decrease in DB and PI, increase in RH and FDFM
2000	Just below summit; meadow	10000	S	52	38	22/31	1-3 (5)	Up-slope	0	Y	10/30	20 foot winds pushing smoke E; upslope winds shifting occasionally; RH increase (note obs. Location change).; FDFM increase.
2100	East line; down ridge	9900	S	54	38	19/25	0-2	N-NW	0	Y	10/30	Winds slightly variable, now N-NW; DB and RH increase (note change in obs location/elevation).
2200	Snag at flagged high fuel drop ?	9000	S	53	38	21/28	5-6 (11)	N-NW	0	Y	10/30	Increase in windspeed/gusts (exposed obs location); RH increase of 3 (note change in location/elevation)
2300	Midslope between summit & saddle	9600	SW	51	36	17/26	1-4 (6)	SW-NW	0	Y	10/30	Note large change in obs. Location and relativity to fire location. Decrease in DB and RH; winds variable.
2400	Saddle-SW of summit	9600	N/A	44	33	18/36	0-1	NW	0	Y	11/20	DB decrease of 7, increase in RH of 10; increase in FDFM, decrease in PI; winds very calm at this location, consistently NW.
0100	Knob--SW of summit	9740	NE	50	35	15/24	3	NW	0	Y	9/30	Sig. Drop in FDFM and RH , increase in DB and PI (note change of location/elevation/aspect. Also, top of knob sheltered by trees)
0200	Saddle- SW of summit	9700	N/A	50	35	15/24	1	NW	0	Y	9/30	Ignition of SW slope in process. No change in RH, DB, PI, FDFM.
0300	Midslope between saddle and knob	9600	NE	50	35	15/24	2-3	NW	0	Y	9/30	No change in DB, RH, FDFM, PI.
0400	Top of knob in trees	9740	NE	51	35	13/21	1	NW	0	Y	9/30	Increase in RH due to increase in DB. Note that all obs on knob are taken in trees. Winds may be higher in more exposed locations.
0500	Top of knob in trees	9740	NW	47	34	16/29	1-2	NW	0	Y	10/30	Significant decrease in DB, increase in RH.
0600	Top of knob in trees	9740	NW	48	34	15/26	2-3	NW	0	Y	9/30	Increase in DB of 1, decrease in RH of 3, decrease in FDFM of 1. Attempted burn not active or spreading.
0700	Top of knob in trees	9740	NE	49	34	13/23	1-2	NW	0	Y	9/30	Increase in DB of 1, decrease in RH of 3. Sun hitting SW slope of the knob.
0730	Top of knob in trees	9740	N/A	49	34	13/23	2-3	NW	0	Y	9/30	Upper winds generally downslope, variable.
0800	Top of knob in trees	9740	NW	51	35	13/21	2-3	NW	0	Y	9/30	DB increase of 2, RH drop of 2.
0900	Midslope between saddle and knob	9600	NE	55	37	13/19	2-3 (6)	N-NW	0	Y	7/40	Note change of obs location. Winds variable. DB increase of 4, RH decrease of 2, FDFM down by 2, PI up to 40

[redacted]

Continued Cerro Grande fire on-site weather observations from 1575 on 5/4/00 to 1200 on 5/5/00

TIME	LOCATION	ELEV.	ASP.	DB	WB	DP/ RH	WINDSPEED (GUSTS)	WIND DIR.	% CLOUD COVER	SHADED Y/N	FDFM/ PI	COMMENTS (PRECIP, SMOKE, RH/DB CHANGE, ETC)
1000	Top of knob in trees	9740	W	56	38	15/20	1-3	W-NW	0	Y	6/50	PI increase of 10%, FDFM decrease. Ed requested helicopter, fire running through grass on east ridge.
1100	Top of knob above rocks	9740	E-NE	62	42	21/20	0-1	NW	0	Y	6/50	Winds variable.
1200	Just below top of knob on S ridge	9740	E-NE	64	42	17/16	2-4	W-SW	0	Y	4/70	Upper winds still pushing smoke NW.

TIME OF **MIN TEMP** & **MAX RH** OBSERVED: **2400 (5/4/00)**
TIME OF **MAX TEMP** & **MIN RH: 1575 (5/4/00)**
TEMP MIN: 2400 (5/4/00)
TEMP MAX: 1575 (5/4/00)
RH MIN: 1575 (5/4/00)

SPOT FEEDBACK: 5/5/00
TEMPS: max 68-72
RH: min 14-18
WINDS: W-SW, 15-18 in afternoon, 20-22 on ridge tops
OTHER: tonight- max RH 20, 30 by morning; downslope winds 20.

Fire Name: **Cerro Grande** Monitors: [redacted] Date: **5/6/00**

TIME	LOCATION	ELEV.	ASP.	DB	WB	DP/ RH	WINDSPEED (GUSTS)	WIND DIR.	% CLOUD COVER	SHADED Y/N	FDFM/ PI	COMMENTS (PRECIP, SMOKE, RH/DB CHANGE, ETC)
1200	Just NE of road where handline goes up East ridge	9100	Flat	45	68	22/18	2 (6)	N-NW	40	Y	6/50	Obs on road. Winds variable, upper winds appear to be stronger.
1300	About 1/4 of the way up the East ridge handline	9400	SW	43	65	20/17	1 (5)	S	60	Y	6/50	Significant cloud cover increase.
1400	Same as 1300 obs location.	9400	SW	43	67	16/14	2 (11)	SW	70	Y	5/60	Obs had to be taken in smoke. Significant decrease in RH and FDFM, increase in PI.
1500	West side of first meadow about 1/2 way up E ridge	9600	SW	42	64	17/16	3 (8)	SW	90	Y	6/50	FDFM back down to 6, PI to 50.
1530	Same location as 1500 obs.	9600	SW	41	62	17/17	3 (8)	SW	90	Y	6/50	Slight decrease in DB, increase in RH.
1630	West of meadow just south of summit.	10000	S	38	57	13/18	1-6 (11)	SW-NW	98	Y	7/40	Note increase in elevation.
1900	Just NE of road, just E of 1200 obs location.	9100	W	41	58	23/26	1 (3)	W-SW	95	Y	9/30	Significant increase in RH and FDFM and PI down to 30 (note change of obs location and elevation, and time lapse of 2.5 hrs).
2030	Several 100 yds up W handline on SW slope of knob.	9200	SW	38	53	21/28	1-2	W-SW	5	Y	9/30	Note change of obs location from East line to West line. Significant decrease in DB and increase in RH.
2130	Just below top of knob at blackline from 5/5	9700	E	37	52	19/27	3	SW	60	Y	7/40	Ignition at 2145. FDFM decrease of 2, PI up to 40. Upper winds appear higher than 3.
2230	Few hundred yards down line below 2130 obs.	9700	E	36	50	16/29	3 (6)	W-SW	10	Y	7/40	RH increase to 29 (forcast predicts 30 maz). DB down to 36. Winds slightly variable, occasionally upslope.
2330	Below 2230 obs. About 25 chains	9500	E	36	50	16/29	2-3 (5)	W-SW	10	Y	7/40	No change in RH, DB, FDFM, PI.

[redacted]

APPENDIX 8. EVENTS LEADING UP TO THE ESCAPE OF THE UPPER FRIJOLES UNITS 1 AND 5 PRESCRIBED FIRE.

Events leading up the escape of the Frijoles Upper Units 1 and 5 Prescribed Fire

On May 4, 2000 the Bandelier National Monument conducted a prescribed fire near the top of Cerro Grande. On May 5, at approximately 1300, the prescribed burn was declared a wildfire under the management of a locally staffed Type 3 Interagency Management Team. On May 7, 2000 at approximately 1230 hours a Type 1 Interagency Management Team is ordered when the fire burns off of the National Monument. The fire is transitioned to the team at 0600 on May 8, 2000.

Finding:
Wildfire suppression actions led to the significant fire spread to the west on May 7.

This is a discussion of how fire behavior and management of the prescribed fire and subsequent wildfire actions led to the escape of the fire.

The description below is a compilation of observations and interviews with individuals involved in the incident as well as an onsite visit accompanied by firefighters who were involved in the burn and subsequent suppression action. On May 15, 2000 Dan O'Brien and John Robertson visited the scene. Photo documentation was made of the site visit.

At about 1920 hours on May 4, 2000 a test burn was conducted near the top of Cerro Grande on National Monument lands. The plan was to light the grasses on fire and let fire spread to observe fire behavior. During this operation the exterior edge (outer perimeter) is extinguished using water from back pack pumps or by swatting the edge with spruce or fir tree branches. The lower edge (inner edge of the fire) was extinguished after the fire had spread about 130 feet (2 chains). This created a black strip with the grass fuels burned that was about 400 feet long by 130 wide. Roughly one acre in size. The test fire confirmed that the fire would spread and that it could be controlled thus meeting the objective of creating an effective black line. At this time the black line operation began and proceeded down to the southeast along a ridge (this is down hill). Burning took place in grass with both the exterior and interior edges being extinguished. This processes continued for several hundred feet further down the ridge to the southeast.

Observations of the fire behavior within the black lined area indicated that the objectives identified for Phase One of the burn were also being meet. In addition, extinguishing the interior fire edge was taking more time, water and effort than expected. It was decided to discontinue extinguishing the interior edge of the black line allowing it to back further into the unit down slope and to the west. This then became a free burning fire, contained by the black line, up hill and the east. This allowed for a much faster operation. This process continued down the ridge to the southeast.

Fuels change from a grass fuels to a fuels made up of leaves, needles, branches, twigs and logs (timber fuels) about half way down the southeast edge. A handline (a cleared area 1 to 3 feet wide where all burnable material has been removed) had been constructed from this point down to Road 4.

Approximately two hundred yards above the fuel transition the black lining operation was halted and all but two crew members were directed back up to the top of the burn. The two folks left on the east side were to watch for and extinguish any fire outside of the black line. They remained at this area watching for spot fires because of unfavorable winds from 2200 hours until shortly after dawn.

In the meantime, the rest of the crew worked on a small (30 by 30 foot) fire that had spread outside the black line at the top of the project. It was also observed that the free burning fire from the eastern line was working its way across the slope to the west. Eventually this fire could threaten the western perimeter that did not have a constructed handline. Black lining was then started down the west line to the south (this is down hill) at 2300 hours. The same procedure used on the east edge was employed on the west line. The grasses were ignited and the exterior edges are immediately extinguished. The fire was then allowed to freely spread down slope within the unit and towards the east where it would meet up with the fire spreading from the east.

About a third of the way down the west line is a saddle. This is an area along a ridge where the line down the ridge dips down and then rises back up again. There was a concern as the black lining approached this area that fire would want to run rapidly up the far side of the saddle and into the timber fuels at the top of knob just south of the saddle. Efforts to ignite the fuels in the timber fuels were unsuccessful however, they were unable to get the timber fuels to carry fire. They subsequently dropped below the knob to the north and black lined the grass fuels down slope (to the north) into the saddle. They met up with the people who were burning down from the top of the burn in the bottom of the saddle. This took the rest of the night. After a long difficult work shift, all but six people are released from the burn. Two on the east side and four on the west side. At dawn efforts to burn the timber fuels on the west side was again attempted unsuccessfully.

It should be pointed out that no handline had been constructed in the timber fuels below the grass on the west line. A saw line had been constructed. This is a line where all of the logs or branches that can be cut with a chainsaw are cut and removed. This activity is physically the first stage in the construction of a handline in timber fuels.

Once the Burn boss made the decision to allow the fire to freely spread towards the interior of the burn they were no longer capable of stopping the spread down hill into the timber fuels. With the exception of the attempts to fire the knob on the west line there had been no firing in the timber fuels.

At about 0300 hours on May 5, resources are requested by the burn boss to be on the burn in the morning. The dispatch center can not order resources for a prescribed fire without approval. This does not take place until the morning.

At about 0600 on May 5, personnel back at the Park Headquarters begin to determine the status of the ordered resources. It turns out that no resources are yet in route. There is a discussion with higher Park Service agency personnel regarding the funding of resources available to be used on this project. It is understood that there is a limitation on available funds for this project. It is understood that one load of fire retardant from an air tanker, the 20 person crew and a helicopter and crew can be funded by the project. This ultimately turns out to be incorrect, there is no funding limitation for prescribed fires. This misunderstanding is critical to events leading up to the escape.

It is now about 0700 on May 5. There are four firefighters on the east line having been joined by two fire fighters from the Bandelier engine. Two fire fighters remain on the west line. There is some concern that the fire will back down hill and get below where the black line ends on the east line. The four fire fighters on the east line are directed to continue the black lining down the ridge to the south, in

the grass fuels. After burning out about 200 yards they rest at a small pond, located about 200 hundred yards above the handline. Around 1030 hours on May 5, a fire outside the black line above the small pond is observed. The four fire fighters on the east line begin extinguishing the fire but are unable to and call for help.

By this time the confusion over the resource orders has been resolved and a helicopter is already in route. It arrives at 1135 hours and drops off two more fire fighters and returns to the helibase to get the bucket to use for dropping water. At 1230 hours, thirteen fire fighters from a Type 1 crew arrive at the fire slop-over near the top of the handline and take action on the escape by building line around the fire. At the same time five crew members from the same crew hike up the west saw line. The fire fighters on the east line have a difficult time holding the fire and order two air tankers to drop retardant on the slop-over and a spot in a patch of dead trees (snag patch). The crew also attacks another small spot fire that was detected by the Air Attack. The airtankers are returned to Albuquerque to standby by lead plane pilot. The slop-over and spot fire are contained with 20 to 30 acres burned. The one acre spot fire is located on National Forest.

Based on previous discussions regarding the funding limitation the prescribed fire is declared a wildfire.

Since the fire is now a wildfire, immediate action is taken to suppress the fire. There are two alternatives considered. One option is to build fireline across the bottom of the burn stopping the spread of the fire to the south. This alternative is discarded as it will require crews working in an unsafe area with dead trees (snags) and require more resources than are currently available. The selected alternative is to use the existing lines for the prescribed fire where possible and burnout both the east and west lines south to Road 4.

At 0900 on May 6, the fire is estimated to be 490 acres in size. With the southern most edge roughly on a line from the top of the handline (below the southern edge of the slop-over) running northeast to the saddle on the west line.

The handline for the east side is improved and a hose lay is laid up along part of the handline on the east side. On the west side handline is built following the saw line up to the rock knob. Burnout of the west line follows the line construction to the south. The burnout on the east proceeds to the south towards Road 4. This is followed up by slowly burning out the fuels along Road 4 from the east to the west.

About 1000 hours on May 7, a helicopter attempts to widen out the fireline along the west line in the area east of the rock knob. At about 1200 hours, fire activity picks dramatically as strong winds hit the fire. Gusts of up to 50 miles per hour are observed at Los Alamos National Laboratory. The fire spreads rapidly through the trees from west to east paralleling Road 4. A large spot fire is seen in the upper end of Frijoles Canyon below Road 4 south of the project area. Crews are unable to attack the fire due to extreme fire intensity. This spot fire triggers additional crowning (fire spreading in the trees) that causes spot fires to the east above Road 4. These areas also crown causing additional spot fires and crowning to the east of the project area. Crown fire travels rapidly to the east. The spot below the Road 4 in Frijoles Canyon is contained around 1700 hours on May 7.

Again suppression alternatives are developed and analyzed. The preferred alternative is to use Road 4, the Camp May Road and Hwy 501 as anchor lines (roads to burn out from). Burnout of these roads

proceeds and by the morning of May 8, burnout is completed. A Type 1 Interagency Management Team takes over the fire at 0600. The fire remains relatively inactive until May 11.

Critical factors:
The decision to stop extinguishing the interior edge of the black line commits the personnel to continuing the operations.

There are insufficient fire fighting resources available on site on May 5.

Aggressive burnout of the firelines particularly on the flat near Road 4 provided an ignition source as well as preheated the tree canopy making it more susceptible to a crown fire.

Rationale:
The grass fuels burned readily, particularly in the upper third of the project area. When ignition of the black line (with interior edge extinguished) reached the timber fuels it is likely burning would have been stopped at the top of the handline on the east side because the timber fuels would not carry fire.

The crew had not ignited fire in the timber fuels, as these fuels were not burning well. The only exception is the slop-over on the east line where fire did carry in the timber fuels. In this situation the fuels are much more exposed to both wind and sun and are drier and ignite and spread more easily. Down in the lower portion of the project area the tree canopy is dense. This limits drying from the sun and wind and the fuels are wetter and less easily ignited.

It is probable that if contingency resources were at the burn site on May 5 these resources would have been able to contain the slop-over without the need to convert the prescribed fire to a wildfire. Instead, the prescribed fire would have progressed to the timber fuels where it is probable that ignition of the lines would have slowed or stopped completely as burn objectives would not have been met. It is very unlikely that fire would have spread down the west line into the flats (along Road 4), so little if any burnout of the west line that have taken place. Even if fire had managed to work its way along the west line it would have done so slowly and been easily contained. Large patches of aspen trees (that don't burn well) exist in the interior and along the west line that would have further reduced fire spread to the south. Thus, there would have been no fire approaching the road and no need to burnout along Road 4. Therefore, the fuels would not have been preheated and dried out and no ignition source would have existed to initiate the crown fire that resulted in the spotting outside the project area to the west.

The strong winds do not appear to have created active fire spread in the grass fuels or timber fuels that had been burned the night and early morning of May 5 (upper third of the project area). There is no indication that the source of the escape fire came from this area of the burn.

In summary, it is believed that had sufficient contingency resources been available on site the morning of May 5th, they would have been able to control the slop-over fire and the need to convert to a wildfire would not have occurred. It was the suppression action that put fire along Road 4 that resulted in the escape from the project area.

John Robertson
Fire Behavior Analyst