Draft Final

Prescribed Burn 2006
MRS-16
After Action Report
Former Fort Ord, Monterey County, California

Presidio of Monterey

Fire Department

April 15, 2007

United States Department of the Army

Base Realignment and Closure (BRAC) Field Office, former Fort Ord

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ACRONYMS AND ABBREVIATIONS

AAR	After-Action Report
ASR	Archive Search Report
BRAC	Base Realignment and Closure
CARB	California Air Resources Board
CDF	California Department of Forestry
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
EE/CA	Engineering Evaluation/Cost Analysis
GPM	Gallons Per Minute
IA	Interim Action
ICP	Incident Command Post
MBUAPCD	Monterey Bay Unified Air Pollution Control District
MEC	Munitions and Explosives of Concern
MRS	Munitions Response Site
NPL	National Priorities List
NPS	Naval Post Graduate School
NWS	National Weather Service
OE RI/FS	Ordnance and Explosives Remedial Investigation and Feasibility Study
POMFD	Presidio of Monterey Fire Department
POMPD	Presidio of Monterey Police Department
PSI	Pounds per Square Inch
RAWS	Remote Automated Weather Station
TCRA	Time-Critical Removal Action

DEFINITIONS AND TERMS
Wildland Fire

Aerial Ignition	Ignition of fuels by dropping incendiary devices or materials from aircraft
Anchor	An advantageous location, usually a barrier to fire spread, from which to start constructing a fire line. The anchor point is used to minimize the chance of being overtaken by the fire while the line is being constructed.
Back Firing	Fire burning against the wind, resulting in a relatively cool, slow-moving fire with low flame height.
Contain	To keep the fire within established boundaries of constructed fire lines under prevailing conditions.
Control Line	All constructed or natural barriers and treated fire edges used to control a fire
Controlled	The completion of control line around a fire, any spot fires there from, and any interior islands to be saved; burned out any unburned area adjacent to the fire side of the control lines; and cool down all hot spots that are immediate threats to the control line, until the lines can reasonably be expected to hold under the foreseeable conditions.
Escape	A fire which has exceeded or is expected to exceed initial attack capabilities or prescription**.**
Flame Length (FL)	The distance between the flame tip and the midpoint of the flame depth, at the base of the flame (generally the ground surface) is called the “flame length”. The flame length is an indicator of fire intensity.
Fuel	Combustible material
Fuel Break	A natural or manmade change in fuel characteristics which affects fire behavior so that fires burning into them can be more readily controlled.
Fuel Moisture	The quantity of moisture in fuel expressed as a percentage of the weight when thoroughly dried at 212°F.

Mop Up	Extinguishing or removing burning material, especially near containment lines after an area has burned to make it safe, or to reduce residual smoke.
Offshore Flow	Wind blowing from land to water
Prescribed Burn	A management ignited wildland fire that burns under specified conditions where the fire is confined to a predetermined area and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.
Smoke Management	Guidelines used to maximize smoke dispersal away from smoke-sensitive areas.
Smoke Plume	The gases, smoke, and debris that rise slowly from a fire while being carried along the ground because the buoyant forces are exceeded by those of the ambient surface wind.
Smoldering	A fire burning without flame and barely spreading.
Spot Fire	A smaller fire that has started outside the perimeter of the main fire from sparks and brands thrown in the air by the main fire.
Suppression	All the work of extinguishing or confining a fire beginning with its discovery.
Terra Torch	A ground firing device which utilizes a gelled gasoline and diesel fuel mixture to produce high volume and heat intensity to rapidly consume heavy brush.
Type 1 Engine	A category of fire engine classified by a minimum pump rating of 1000+ gpm water flow at a rated pressure of 150 psi**,** with a master stream of 500 gpm, a 400+ gallon tank capacity range, holding 1,200 ft of 2.5” hose, 400 ft of 1.5” hose, 48 ft ladder, and has a minimum crew of 4.
Type 3 Engine	A category of fire engine classified by a minimum pump rating of 150 gpm water flow at a rated pressure of 250 psi, a 500+ gallon tank capacity range, holding 500 ft of 1.5” hose, 500 ft of 1” hose and has a minimum crew of 3.
Type 6 Engine	A category of fire engine classified by a minimum pump rating of 30 gpm water flow at a rated pressure of 100 psi, a 150 gallon tank capacity range, holding 300 ft of 1.5” hose, 300 ft of 1” hose and has a minimum crew of 2.

Type 2 Helicopter	A classification of helicopter with an allowable payload of 2,500 pounds, a maximum gross of 6,000 to 12,500 pounds, which can hold 9-14 people and can carry up to 300 gallons of water or retardant.
Type 3 Helicopter	A classification of helicopter with an allowable payload of 1,200 pounds, a maximum gross of up to 6,000 pounds, which can hold 4-8 people and can carry up to 100 gallons of water or retardant.

1 SUMMARY

On October 19, 2006, a prescribed burn was conducted on the former Fort Ord at Munitions Response Site (MRS)-16 located just north of the impact area. (Maps 1 and 2) The burn was performed to remove vegetation to provide a safe environment to conduct munitions and explosives of concern (MEC) removal, for habitat management and fire fuel reduction. The burn was performed as part of an Interim Action (IA) to protect the public from the threat posed by the MEC known to exist on the site. This after-action report (AAR) summarizes and evaluates this prescribed burn and provides lessons learned for future burns.

1.1 PURPOSE

As the lead agency at the former Fort Ord, the Army concluded in early 2002 that an IA is appropriate to protect the public from three high-risk MRSs at the former Fort Ord: Ranges 43-48, Range 30A and MRS-16. While ongoing comprehensive study of MEC clean up is conducted a quick action was needed in these three sites because they are accessible and in close proximity to the public (Map 3), susceptible to trespassing, and contain highly dangerous MEC on or near the surface that are obscured by dense vegetation. A prescribed burn was conducted in Ranges 43-48 in October of 2003. MRS-16 was determined to be the next priority because of its location outside the Impact Area, close proximity to homes and schools in the Ord Military Community and MEC present on it.

The alternatives identified for MRS-16 consisted of a vegetation clearance, a MEC remedial action, and detonations of MEC. A vegetation clearance was needed at MRS-16 because the site was covered by dense maritime chaparral that concealed the MEC on the site's ground, which made it too hazardous to complete the MEC remedial action. Several vegetation clearance alternatives were evaluated, and a prescribed burn was selected because it was determined to be the safest method for personnel, in addition to being the best clearance method for rejuvenating the habitat [Ref 1].

2 SITE CONDITIONS AND BACKGROUND

2.1 LOCATION OF FORMER FORT ORD

The former Fort Ord occupies approximately 28,000 acres adjacent to Monterey Bay and the cities of Marina, Seaside, Sand City, Del Rey Oaks, and Monterey. State Highway 1 crosses the western section of Fort Ord, separating the beachfront from most of the installation. Laguna Seca Recreational Area and the Toro Regional Park border former Fort Ord to the south and southeast, respectively, as well as several small communities such as Toro Park Estates and San Benancio.

2.2 HISTORY OF FORMER FORT ORD

Fort Ord became a training installation in 1917 and was used to train Army Infantry, Cavalry, and Field Artillery divisions for WWI and II, Korea, Vietnam, and Desert Storm. In 1991, the site was included on the Base Realignment and Closure (BRAC) list and closed in 1994. Since the BRAC listing and closure of Fort Ord, investigation and removal actions have been performed and documented to address explosive hazards and to prepare for the transfer and reuse of Fort Ord property.

2.3 REGULATORY STATUS

In 1990, the former Fort Ord was listed on the National Priorities List (NPL) of Hazardous Waste Sites based on the identified soil and groundwater contamination. In 1993, the Army issued the Archive Search Report (ASR) [Ref. 2], which identified several MRSs as potentially containing MEC based on past Army training activities. Subsequent ASRs and supplements [Ref. 3] added MRSs to this list.

In 1994, the Army issued a TCRA memorandum [Ref. 4] to address MRSs outside the Impact Area. In 1996, the Army issued the Phase 1 Engineering Evaluation/Cost Analysis (EE/CA) Action Memorandum [Ref. 5], which addressed 13 MRSs. In 1999, the Army issued the Phase 2 EE/CA Action Memorandum [Ref. 6], which addressed all MRSs at the former Fort Ord using a plug-in process approach.

An Ordnance and Explosives Remedial Investigation and Feasibility Study (OE RI/FS), consistent with Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), was initiated in November 1998 [Ref. 7] to address long-term cleanup needs regarding MEC at the former Fort Ord. The OE RI/FS will reevaluate all previous investigations and removal actions, including the surface removal of MEC under this Action Memorandum.

The Army has determined that an Interim Action (IA) is appropriate to protect human health from the imminent threat posed by MEC at three IA sites (Ranges 43-48, Range 30A and MRS-16) while an ongoing comprehensive study of MEC cleanup needs at former Fort Ord is conducted under the base-wide OE RI/FS. IA remedial activities were evaluated in three parts: vegetation clearance, OE remedial action and OE detonation, as described in the IA OE RI/FS (Harding Environmental Science and Engineering [ESE], 2002).

The Army's Proposed Plan (Army, 2002) identified prescribed burning as the preferred alternative to clear vegetation, subsurface MEC removal as the preferred MEC remedial action alternative, and detonation with engineering controls as the preferred MEC detonation alternative for the three IA sites. The public comment period for the Proposed Plan ended May 13, 2002. The final selection of vegetation clearance method, MEC remedial action and MEC detonation method to be used at the IA sites was made in the IA Record of Decision (ROD). The IA ROD was completed in September 2002.

2.4 SITE DESCRIPTION

2.4.1 Site Location

MRS-16 consists of approximately 79-acres located just north of the Impact Area. MRS-16 is bordered by Parker Flats Road to the north, Watkins Gate Road to the east and Eucalyptus Road to the south. (Maps 1 and 2) MRS-16 is surrounded by 45 ft asphalt roads on the north, south and east sides.

2.4.2 Site Characteristics

The reuse of the MRS-16 is designated as habitat reserve. The terrain in the area consists of a central ridge running east-west across the site with a gentle slope and valley areas on the north and south sides of the ridge with elevations ranging from 408 to 490 ft. The area was covered by maritime chaparral vegetation and approximately 1,000 coast live oaks around the perimeter of

the site. After being burned, it is now mostly barren with a few areas of unburned vegetation. Sections of unburned vegetation exist in the northwestern, southwestern, and southeastern corners of the subject area. There is a vernal pool just northeast of the burn site so no fire foam or retardant was used within 300 ft of the vernal pool's location.

3 PRESCRIBED BURN

3.1 BURN STRATEGY

For a safe execution of a prescribed burn and to meet desired objectives, a prescribed burn team was established. The burn team consisted of personnel from the Presidio of Monterey Fire Department (POMFD), meteorologists from the Naval Postgraduate School (NPS), and contracted fire behavioral analyst/burn boss. The burn team coordinated closely with local and state air district personnel throughout the development and execution of the MRS-16 burn event.

The prescribed burn was coordinated using the following guidelines:

- Overall fire hazard mitigation strategy,
- Monterey County Fire Hazard Mitigation Plan
- Former Fort Ord Installation-Wide Multispecies Habitat Management Plan

3.2 BURN PRESCRIPTION

The prescribed burn's smoke management prescription was established with the intention to minimize smoke impacts and provide ideal burning conditions to reduce escape potential and provide a minimum 80% consumption of the fuel bed. The prescription elements were modeled using a fire behavior modeling program to determine potential fire behavior from the prescription's environmental variables. Presidio of Monterey Fire Department coordinated with Monterey Bay Unified Air Pollution Control District (MBUAPCD) and the NPS project meteorologist to refine and establish the burn criteria.

The prescription was configured with the base parameters utilizing historical meteorological conditions and terrain features found at the former Fort Ord uninhabited areas. The prescription was found to be ideal for this burn since minimal smoke impacts occurred and no escapes were declared.

3.3 SITE PREPARATION

Fuel breaks and containment lines were established with respect to flame lengths, topography, unique synoptic weather conditions and tactical suppression capabilities. (Map 2) The primary fuel break was established by cutting a 150 ft wide buffer of vegetation around the burn project. (Map 4) Surrounding roads were inspected to ensure all roads were drivable by fire apparatus in the event they needed to be utilized to engage in aggressive fire attacks and defensive actions in the event of a spot fire or an escape.

Three 5,000 gallon helicopter dip tanks and two 5,000 gallon fold-a-tanks were set up in strategic locations around the burn location. The helibase was established at Range 37 south of Eucalyptus Road. (Map 2)

Vegetation removal of brush around perimeter of MRS-16

150 ft Primary Containment Line

3.4 MOBILIZATION

3.4.1 Burn Resources

On October 17, 2006 the decision was made to mobilize resources for a possible burn on October 19th. The burn resources arrived at the former Fort Ord on the October 18th.

POMFD provided five fire engines, four command vehicles, a terra torch, and a water tender. The California Department of Forestry (CDF) provided three fire engines as contingency resources on scene.

In addition to the POMFD fire equipment and personnel, additional ground and aerial resources were contracted. Among the contracted fire resources were two Type 6 engines and six crew members, two Type 2 helicopters, two Type 3 helicopters, four pilots, four helibase crew members and one helibase manager. Table 1 lists the equipment mobilized.

Table 1—Burn Equipment Mobilized

Equipment Type	Qty
Helicopter – Type 2	2
Helicopter Type 3	2
Fire Engine Type 6	2
Helitorch	2
Helicopter Dip Tank	3
Type 3 Engines	3
Type 1 Engines (Crash and Rescue)	2
Portable Water Tank	2
Terra Torch w/ truck	1
Command Vehicles	4
Water Tender (2000 gal each)	2
Water Tender – POMFD (1,800 gal)	1

3.4.2 Site Security

Presidio of Monterey Police Department (POMPD) provided site security for the burn site and surrounding containment areas. POMPD secured major roads surrounding the site, provided continuous stationary and roving patrols and closely monitored site access as specified in the MRS-16 Prescribed Burn Plan Appendix C Site Security Plan.

3.4.3 Safety Briefing

Considering the potential hazards and risks associated with wildland fire conducted on ordnance ranges special precautions were taken to ensure that the all fire and other essential personnel were informed and prepared. Periodic internal safety briefings were held at the POMFD for the fire crews and daily morning safety briefings were held at the staging area the morning of the burn and the morning of the post-burn mop-up day

Throughout the burn season several site familiarization trips were conducted so the fire personal could familiarize themselves with the area, topography, vegetation and firefighting strategy. When all crews were mobilized, a technical planning brief was conducted at POMFD station for all ground and aerial operation personnel to discuss the burn day strategies. USACE UXO Safety Officer gave a UXO briefing to all personnel. A final site inspection was conducted with the Helibase Manager and the aerial operation personnel to ensure that the helibase location and dip tanks were acceptable.

3.5 BURN DAY OPERATIONS

Fire crews assembled at the staging area at 6:00 a.m. the morning of the burn, anticipating beginning burn operations at 7:00 a.m. Prior to ignition, real time meteorological data was collected and analyzed to ensure ignition within the burn prescription. MBUAPCD and NPS meteorologists were on site to identify a burn window within the smoke management prescription parameters.

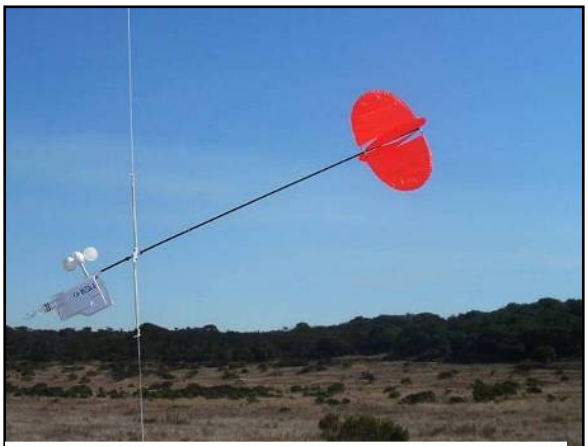
The tethersonde was set up in the Machine Gun Flats area off Hennekin's Ranch Road. The tethersonde was launched before dawn and the first real time meteorological data was collected just prior to sunrise at 7:19 a.m. PDT. Real time data being collected from the surface and upper level indicated that the upper level winds were too high.

Although at ground level winds were light, the tethersonde confirmed there was a low level jet only about 60 meters (200 ft) above the burn area. The low level jet is a layer of strong easterly winds just above the surface that often occurs over Fort Ord on clear fall mornings as air flows from the Salinas Valley toward the coast. It was a key concern for smoke management because it can prevent the smoke from achieving an acceptable height. Instead of the smoke column rising intact vertically, strong winds in the shallow jet layer would have sheared the column in a horizontal direction, thus holding the smoke close to the surface where it could cause significant smoke impacts in downwind communities.

At 9:45 a.m. PDT (per the Burn Boss' log), the meteorologists from NPS and the Air District notified the IC that the persistent low level jet was weakening to the point where conditions would be acceptable to perform a test burn at 10:00 a.m. It was critical to hold off burning until the morning jet had weakened to the point that the smoke column could rise to a height that would minimize off-site ground-level smoke impacts.

Tethersonde test inflation - October 18, 2006

BELOW: Pre-dawn Launch
October 19, 2006



Wind Speed Anemometer collects real time meteorological data.

3.5.1 Test Burn

At 10:00 a.m., once all prescription criteria were met and verified by NPS and MBUAPCD meteorologists. The Chief, Fire and Emergency Services for the Presidio of Monterey authorized ignition of a test burn to be conducted on the east side of the site. After a few minutes of smoke behavior observation it was determined, due to the easterly wind conditions, to extinguish the test burn and begin ignition from the western boundary.

Test burn along eastern boundary of MRS-16

Smoke behavior observation indicates an easterly flow. Ignition changed to western side of the site.

3.5.1 Ground Ignition

Ground Ignition was initiated from the western side of the site at 10:30 a.m. Two teams of ground crews (Teams "A" and "B") used drip torches and hand projected ignition devices to ignite from the perimeter. Team "A" started ignition from the center of the western boundary and continued in a clockwise direction around the perimeter of the site. Team "B" also started ignition in the center of the western boundary but continued in a counter-clockwise direction around the perimeter of the site.

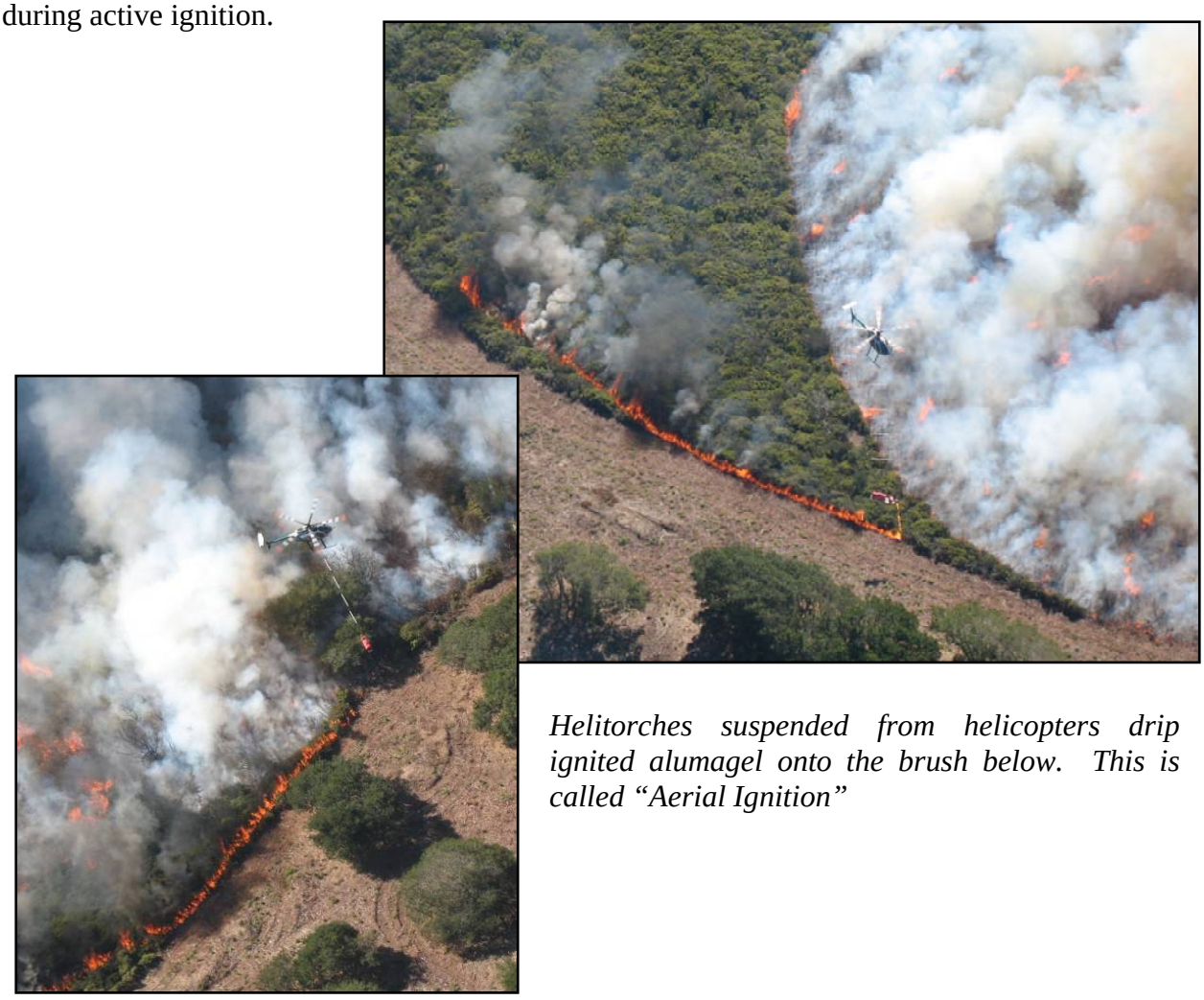
RIGHT: Ground crews using drip torches and hand fired ignition devices to create a buffer around the burn site.

LEFT: Ground crews beginning ground firing on SE corner.

3.5.2 Aerial Ignition

Aerial ignition began in conjunction with ground ignition. The aerial ignition pattern was anchored and progressed from the containment line into the burn area. Aerial ignition allowed the firing operation to maintain a well-developed smoke convection column. This allows the column to draw the heat and smoke upward for excellent smoke dispersal and more complete combustion of the vegetation.

One Type 3 helicopter, with a helitorch ignition device, was used to ignite the vegetation. A helitorch is a 82-liter drum filled with gelled gasoline with an ignition device which is suspended with cables from the bottom of a helicopter. The helitorch is used to provide rapid and complete combustion during the burning operations. The other Type 3 helicopter was used for observation during active ignition.



Helitorches suspended from helicopters drip ignited alumagel onto the brush below. This is called "Aerial Ignition"

At approximately 3:00 p.m. on the burn day, one Type 2 suppression helicopter ruptured a hydraulic line. The helicopter was out of operation for the remainder of the day but was repaired for the following day mop up activities.

3.5.3 Surveillance

A total of four helicopters were used to manage the burn operations. One ship was used for ignition a second ship was used for observation for the burn boss and MBUAPCD personnel for smoke management and as a back up for the ignition ship and suppression. Two Type 2 helicopters were used for suppression. All helicopters had suppression capabilities. The Incident Commander supervised the prescribed burn operations from the Incident Command Post (ICP) and the Burn Boss supervised the prescribed burn operations from both the ground (ICP, helibase) and the air.

3.5.4 Spot Fire

At approximately 10:45 a.m. a spot fire, south of Eucalyptus Road, was reported to the Burn Boss. Suppression was immediately initiated by the POMFD engines, which were positioned nearby. The strategic planning and quick response by firefighting crews led to the extinguishment of the spot fire, causing no disruption to burn operations.

An investigation to determine the cause and point of origin was conducted by the Presidio of Monterey Fire Department. The conclusion is that surface wind gusts transported hot firebrands, which were created from the dry wood chips, from the masticated fuel break onto the vegetation across Eucalyptus Road. The spot fire consumed 0.23 of an acre. (Map 6)

SPOT FIRE: Wind gusts transported hot fire brands across Eucalyptus Road and started a spot fire just south of the road. The spot fire burned approximately a ¼ acre.

3.5.5 Holding, Contingency and Mop-Up Operations

Upon satisfactory completion of the burn of MRS-16, ignition ceased and mop-up operations began. Mop up operations commenced at 1:30 p.m. The equipment used during mop up operations included two Type 2 helicopters with 300 gallon buckets, two Type 3 helicopters with 100 gallon buckets, ten fire engines, three water tenders, and three dip tanks. Suppression activities continued until sundown. After dark the burn area was put into patrol status and an engine from POMFD remained on site throughout the night to monitor the site.

The following morning mop up operations recommenced using all equipment on site the previous day. Aerial suppression ceased at 12:00 noon and the helicopters were released from the site. Ground mop up operations continued through out the remainder of the day.

A 300 ft fire retardant and foam restriction was placed around a vernal pool to the northeast of MRS-16 to protect any potential habitat of the California Tiger Salamander. No fire retardant or fire foam was to be used within that 300 ft unless in the event of an escape. (Map 4) During suppression activities one helicopter dip tank was reserved with plain water exclusively for the use of the entire eastern boundary of MRS-16 including the 300 ft buffer. No retardant was used on the MRS-16 burn and the fire foam that was used was utilized for spot fires primarily on the northwest and southwest sections of the fuel break (Map 6)

3.6 BURN RESULTS

The prescribed burn met its major objectives of executing a successful burn without an escape, without incident or injury to personnel and with an overall consumption of 80-90% of the target vegetation. Actual consumption was 68.56 acres of the 78.95 acres resulting in a total consumption of 86.8%. See map 6 for burn consumption.

4 RESOURCE MANAGEMENT GOALS & OBJECTIVES

Provided in Section 3 of the MRS-16 Prescribed Burn Plan was a list of goals and objectives to be met in order for the MRS-16 burn to be considered successful. Listed below are the goals and objectives from the MRS-16 Prescribed Burn Plan and the commentary of the POMFD Chief, Fire and Emergency Services (Incident Commander) and the Burn Boss.

- **GOAL 1:** Complete prescribed burn operations with no injuries to fire personnel or the surrounding communities.

  OBJECTIVES:

  (1) Ensure fire personnel receive adequate safety briefs as well as personal protection equipment (PPE).

  (2) Provide adequate onsite resources to contain the prescribed burn.

  (3) Provide adequate site security to ensure that there is no unintentional entry by unauthorized personnel into the safety exclusion zone around the burn unit.

IC/Burn Boss Commentary: Goal 1 and its objectives were met successfully.

- **GOAL 2:** Hold the burn within the established primary containment lines located around the MRS-16 perimeter.

  OBJECTIVES:

  (1) Suppress spot fires immediately that may be caused by unexpected wind changes and/or incidental UXO detonations.

  (2) Ensure adequate onsite resources for immediate aerial suppression.

  (3) Treat perimeter of burn by masticating then black lining 150 ft primary containment line on southern, eastern and northern boundaries. The western boundary will be masticated 150 ft with no black lining.

IC/Burn Boss Commentary: Goal 2 and objectives 1 and 2 were met successfully. Objective 3 was not met. Due to the late start of the mastication it was too late in the season and too dry conditions to safely perform any black lining. We will aim for earlier mastication next year. There was one small spot fire across Eucalyptus Road which consumed almost ¼ of an acre. It was spotted immediately and fire crews extinguished it within minutes.

- **GOAL 3:** Minimize smoke impacts.

  OBJECTIVES:

  (1) Follow burn prescription to avoid direct smoke plume contact with smoke-sensitive areas (SSAs).

IC/Burn Boss Commentary: Goal 3 and its objective were met successfully.

- **GOAL 4:** Clear vegetation to facilitate a safe MEC remedial action for MRS-16.

  OBJECTIVE:

  (1) Reduce vegetation (ground cover) by 90% to allow an unobscured view of the ground for MEC remedial action workers.

IC/Burn Boss Commentary: Goal 4 and its objective were met successfully. The objective of reducing vegetation was met by consuming 86% of the vegetation by fire and the remaining was reduced by the 150 ft mastication of the primary containment line.

- **GOAL 5:** Minimize damage to natural resources and to rare, threatened, and endangered species.

  OBJECTIVES:

  (1) Avoid areas containing plant and wildlife species identified by the Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord (HMP) and maritime chaparral during placement of all access roads, staging areas, and other associated facilities.

  (2) Use existing roads whenever possible and minimize use of vehicles off roads to the greatest extent practicable.

  (3) Minimize impacts to listed species by conducting prescribed burns between July 1st – December 31st.

  (4) To minimize potential impacts to California tiger salamanders, fire retardant will not be used within 300 ft of the adjacent vernal pool, unless required to prevent or suppress a breach.

IC/Burn Boss Commentary: Goal 5 and its objectives were met successfully. Existing dirt roads and asphalt roads were used for access and staging areas. The burn was conducted on October 19th which falls within the designated preferred time frame. No retardant was used at all on the MRS-16 burn. Fire foam was used during mop up operations not on the entire eastern boundary and not within 300 ft of the adjacent vernal pool. Locations of foam usage are identified on Map 5.

5 METEOROLOGICAL REVIEW

5.1 BURN PRESCRIPTION

The burn prescription called for conditions with light winds and good vertical mixing to allow for necessary smoke dispersion. The specific prescription for the MRS-16 is as follows;

- Surface winds less than 8 mph with a direction from West through North to Southeast
- Transport levels winds less than 15 mph with a direction from West through North to Southeast
- Mixing height of 1500 ft within 2 hours of ignition
- Temperature between 60 and 80 F
- Relative humidity between 40 and 80%
- Clear weather

5.2 BURN DAY WEATHER OBSERVATIONS

Based on the observed conditions for October 19, 2006 all aspects of the prescription were met, except slightly high surface winds (just above 8 mph) and relative humidity below 40%.

The large scale weather pattern is depicted in figure 1 and shows high pressure over Nevada with a relative pressure minimum along the coast. This pattern of low level pressure set up a period of offshore flow at and above the surface as suggested by the 850 mb level wind chart.

Offshore flow over the Fort Ord region is favorable for producing clear, warm weather and tends to transport smoke out over the ocean as opposed to inland. The basic weather pattern was reasonably well forecast but operational weather models 2-3 days prior to the event. Critical details of the weather pattern that must be present in order to meet the prescription, are that the air above the surface stay sufficiently cool to allow a 1,500 ft mixing depth to develop with daytime warming and that the wind shear in the lowest layers be minimal (transport level winds not much stronger than surface winds) to allow a more vertical smoke column.

Figure 1 – Atmospheric Pressure Analysis

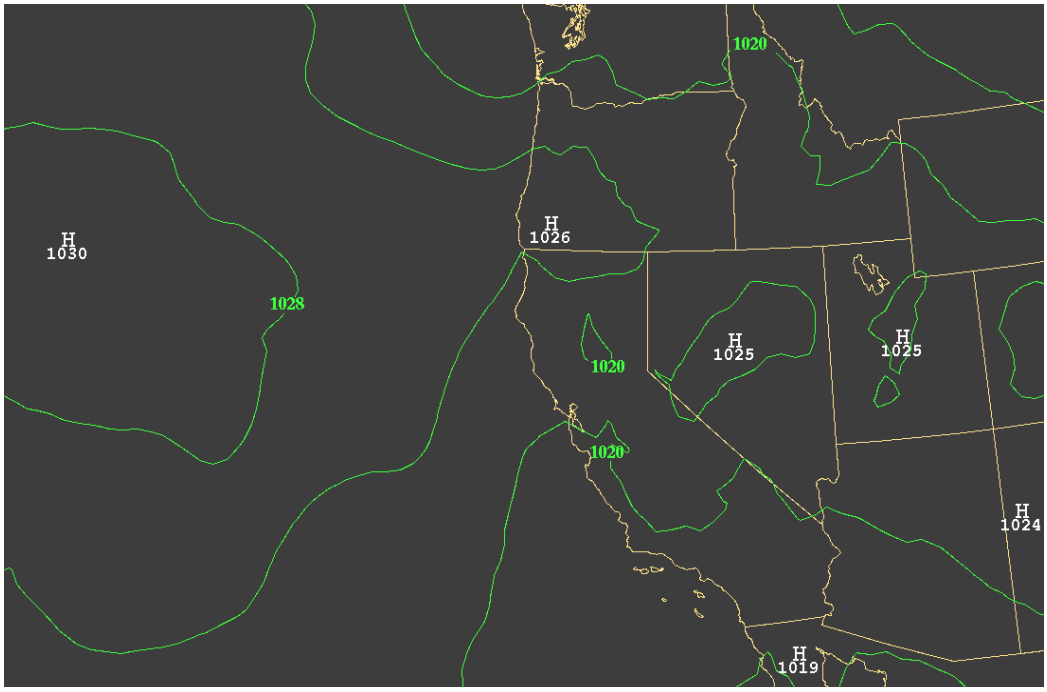


Figure 1a) Sea-level pressure analysis over the West Coast from the NCEP ETA model analysis. Shows high pressure to Northeast of Ft Ord.

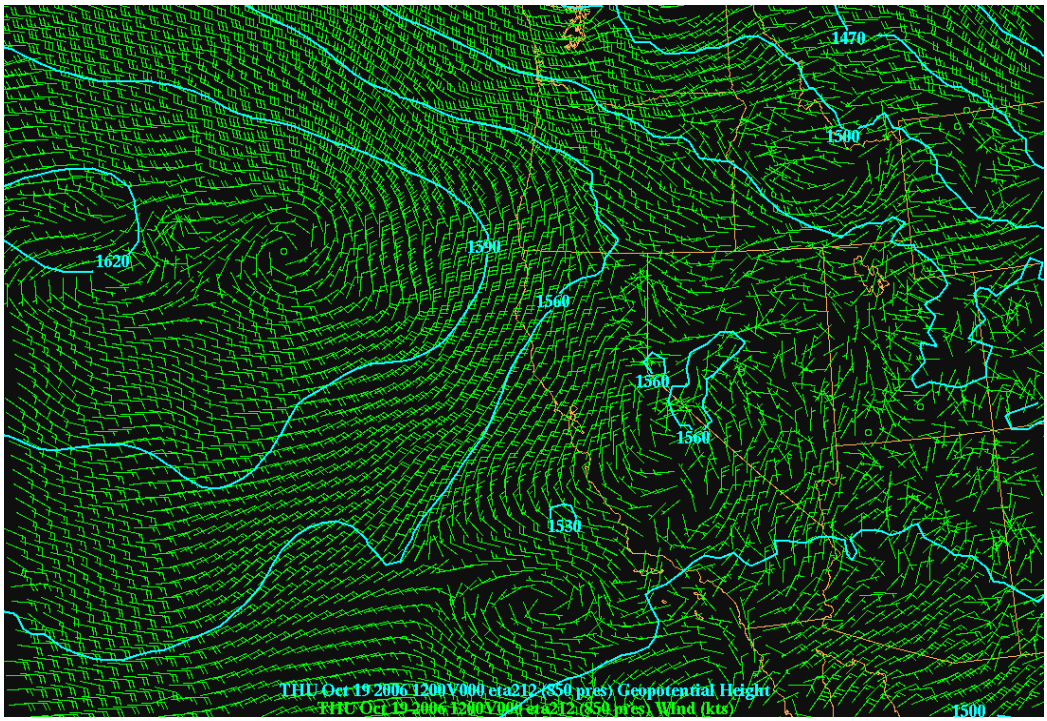


Figure 1b) 850 mb heights and winds from ETA model showing northeasterly offshore flow.

The surface conditions observed at the Fort Ord 2 RAWS site (Table 2), closest the actual burn site, show that surface aspects of the prescription were present. The air temperature and relative humidity were within the desired ranges throughout the day and particularly during the 9 a.m. to 1 p.m. period when the burn was done. Surface winds were between 5-10 mph, slightly above prescription, from the northeast (86-35 degrees). After about 1:30pm PDT, the winds abruptly shifted around to the west and increased in speed with the onset of the sea breeze at the site. Fortunately the burn was already completed by this time and so this wind shift impacted only during the smolder phase of the fire.

TABLE 2
Meteorological Conditions at Fort Ord RAWS 2
(Closest RAWS to actual burn site)

Time	Wind Speed m/s (mph)	Wind Direction	Temperature C (F)	Relative Humidity %
8:26am PDT	2.5 (5.6)	120	14.6 (58)	38
9:26am PDT	1.8 (4.0)	86	18.3 (65)	30
10:26am PDT	3.1 (6.9)	46	20.6 (69)	29
11:26am PDT	4.1 (9.2)	41	19.4 (67)	31
12:26pm PDT	3.3 (7.4)	35	21.1 (70)	25
1:26pm PDT	3.3 (7.4)	350	23.9 (75)	26
2:26pm PDT	4.2 (9.4)	299	21.0 (70)	31
3:26pm PDT	3.2 (7.2)	296	19.5 (67)	42
3:56pm PDT	3.7 (8.3)	273	18.6 (66)	51

The weak surface winds are also evident in the local mesoscale analysis at 10:00 a.m. PDT shown in Fig. 2a. Winds are generally less than 6 mph over the entire region and mostly from the northeast even at the shoreline. However, the 12 p.m. PDT analysis shown in Fig. 2b indicates the sea breeze initiation at the shoreline, which was picked up by the Range 7 observing station.

The vertical aspects of the prescription were also met as shown by the Fort Ord wind profiler plot in Fig. 3. The mixing height started to rise at 10 a.m. PDT and reached a height of 1600 ft by 1 p.m. PDT. Shortly after peaking it dropped again as the sea breeze started to lower surface temperatures. Transport level winds in the (1000-2000 ft layer) were from the Northeast and averaged around 10 mph during the 9 a.m. to 1 p.m. time period. This was well within prescription. Since the wind profiler misses the very lowest layers, NPS ran a tethersonde starting at dawn to help gauge the low level shear and its subsequent mix out. Fig. 4 shows these low level profiles around 8-9 a.m. (Fig. 4a) and then again at ignition time (Fig. 4b). The ignition was timed to this mix out of the low level shear to ensure better smoke plume rise at the initiation of the burn. This worked very well and should be considered a critical component for future burns.

Finally, the CALPUFF model forecasts were used to aid in planning for desired plume behavior and to assess potential smoke impact areas. Fig. 5 shows the CALPUFF predictions generated the evening before and valid 1(Fig. 5a) and 3 (Fig. 5b) hours after ignition. The dispersion model shows a broad plume that is being advected out to the south-southwest. The broad nature of the CALPUFF plume indicates excellent mixing both vertically and horizontally, which is desired to reduce overall concentrations at a particular location. The forecast plume verified rather well as

seen by comparing them to the 250m resolution MODIS satellite images for 12 p.m. (Fig. 6a) and 2 p.m. (Fig. 6b) PDT. The satellite image shows that the plume was transported more southwesterly than forecast and was generally narrower than the dispersion model suggested. However, the general characteristics were appropriately captured and the dispersion model seems to be a useful tool in assessing the plume behavior.

Figure 2 – Surface Wind Analysis

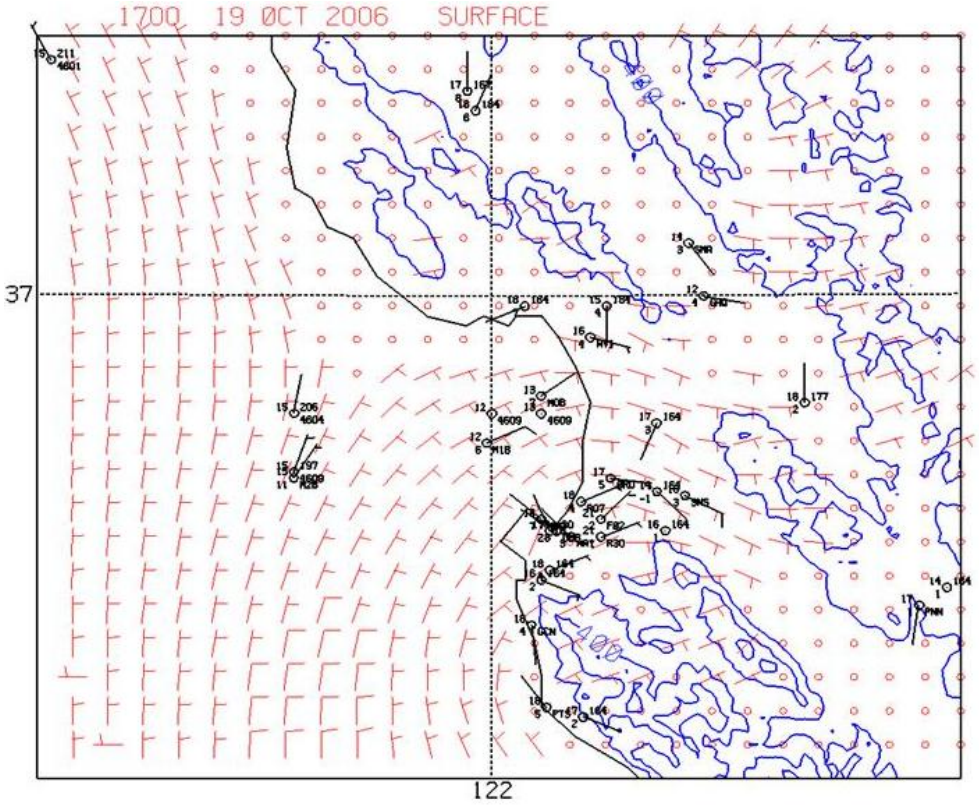


Figure 2 – Surface wind analysis at a) 10 a.m. (image above) and b) 12 p.m. PDT (image below). Observations are also shown.

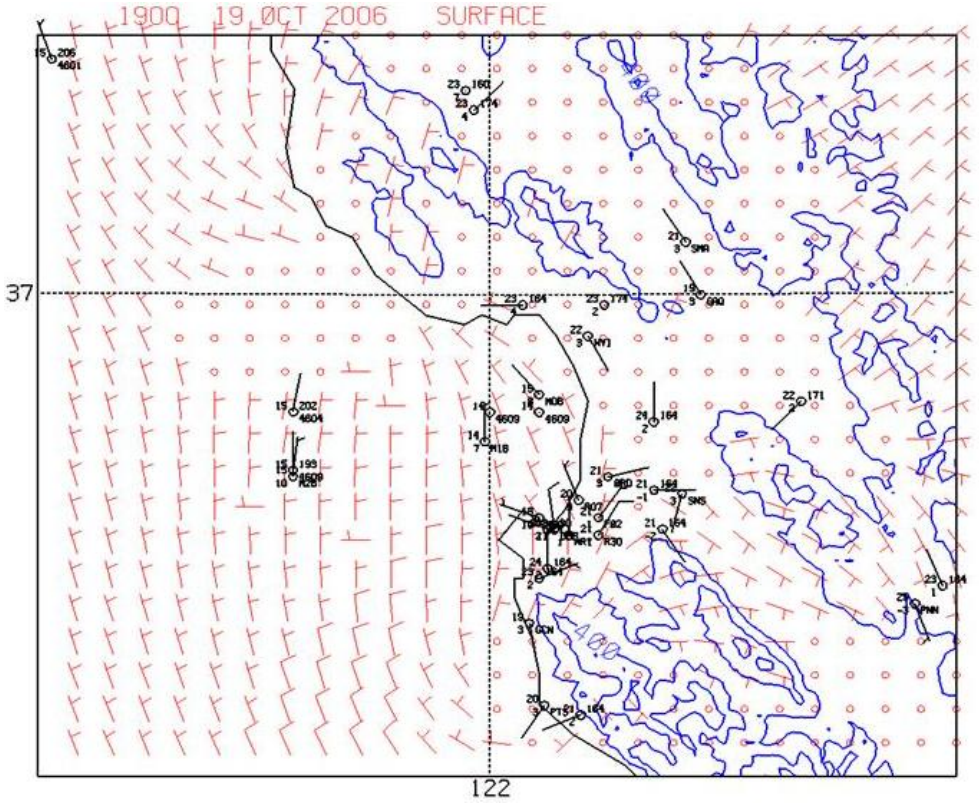


Figure 3 – Wind Profiler

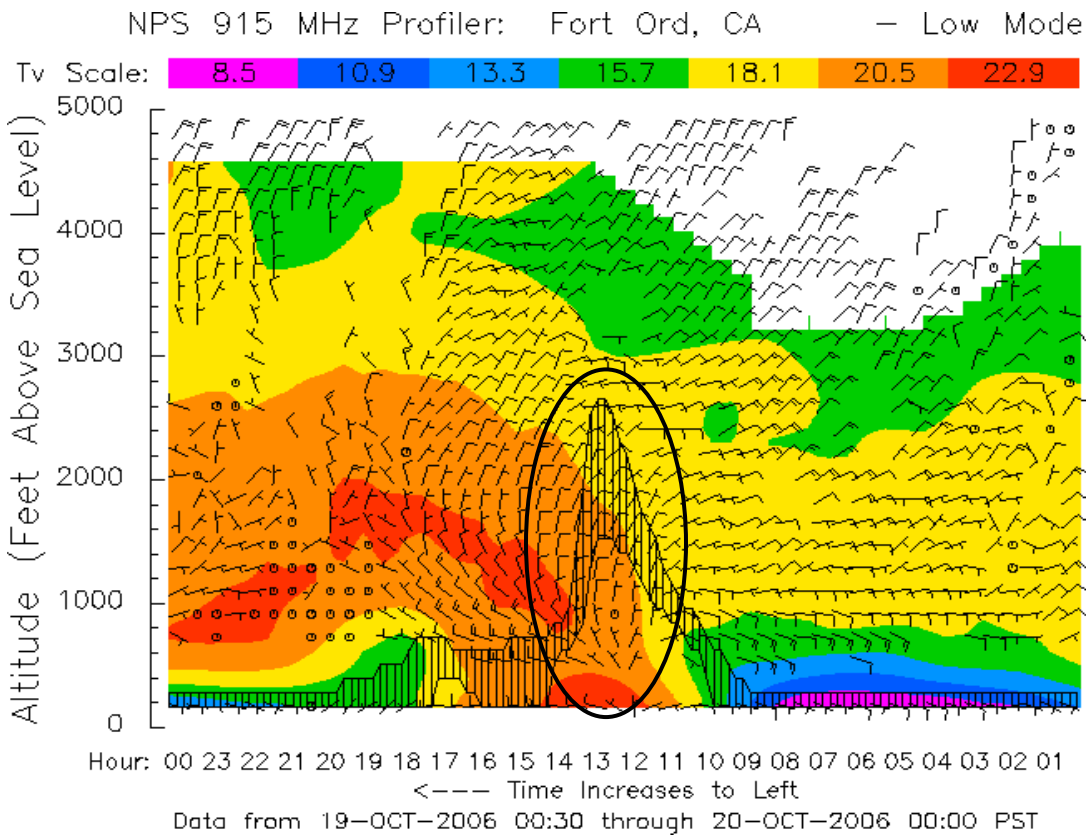


Figure 3 – Shown above is the vertical profile of winds and virtual temperature from Fort Ord wind profiler for October 19, 2006. The vertical hatched line shows the actual mixing height achieved on October 19, 2006. The peak mixing height is circled above.

Figure 4 – Tethersonde Wind Profiles

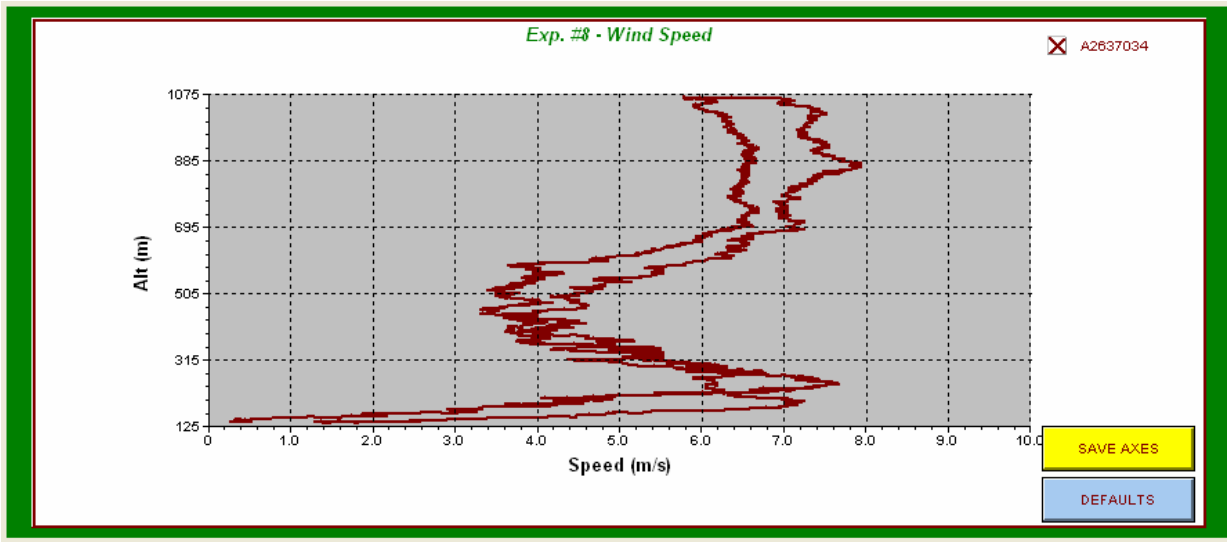


Figure 4 – Tethersonde wind speed profiles from a) 8-9 a.m. (image above) and b) 10 a.m. (image below) showing the low-level wind shear and its erosion after vertical mixing is active.

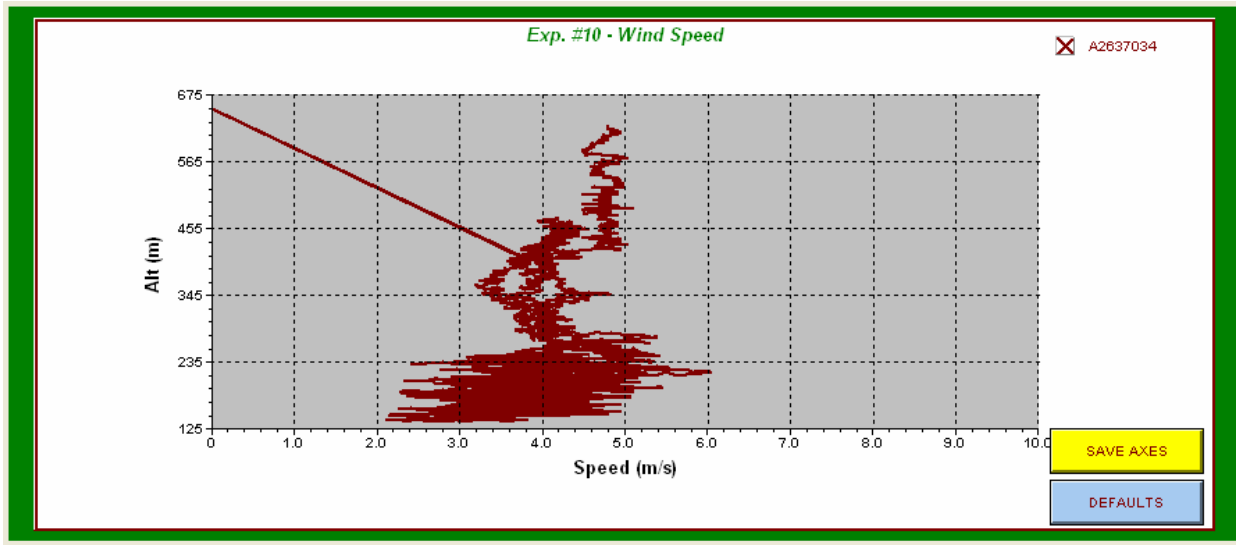


Figure 5 – CALPUFF

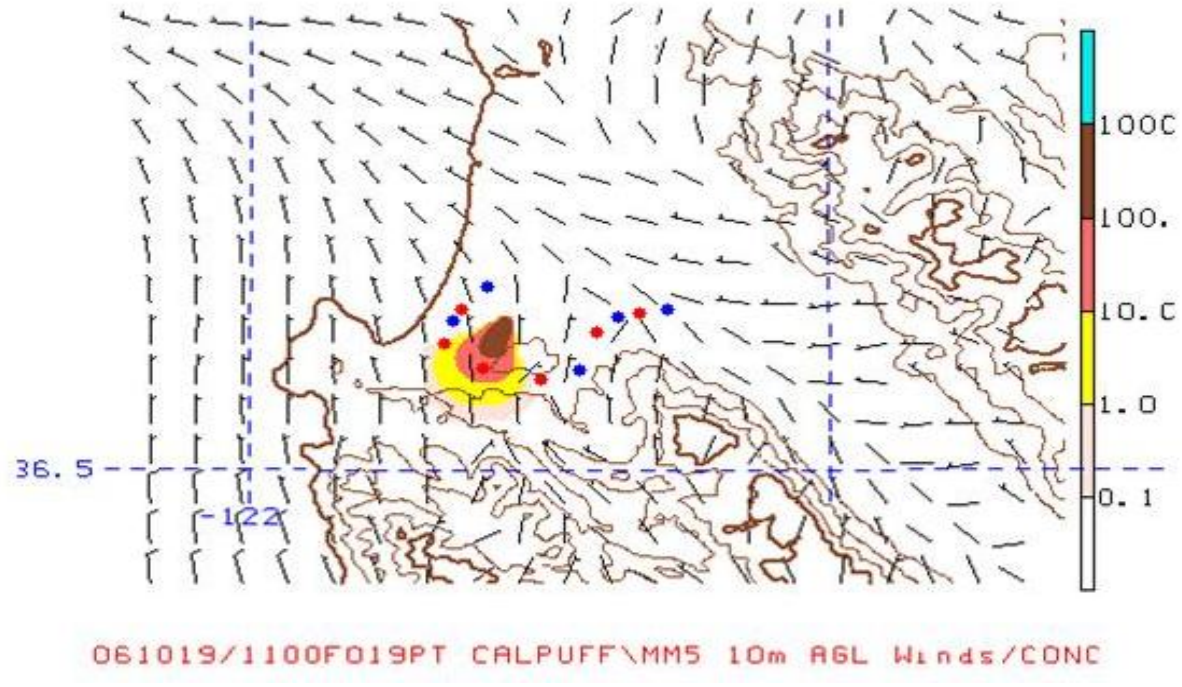


Figure 5 – CALPUFF dispersion model forecasts valid at a) 12 p.m. and b) 2 p.m. PDT of the smoke plume using NPS MM5 model forecast from October 19 0000UTC.

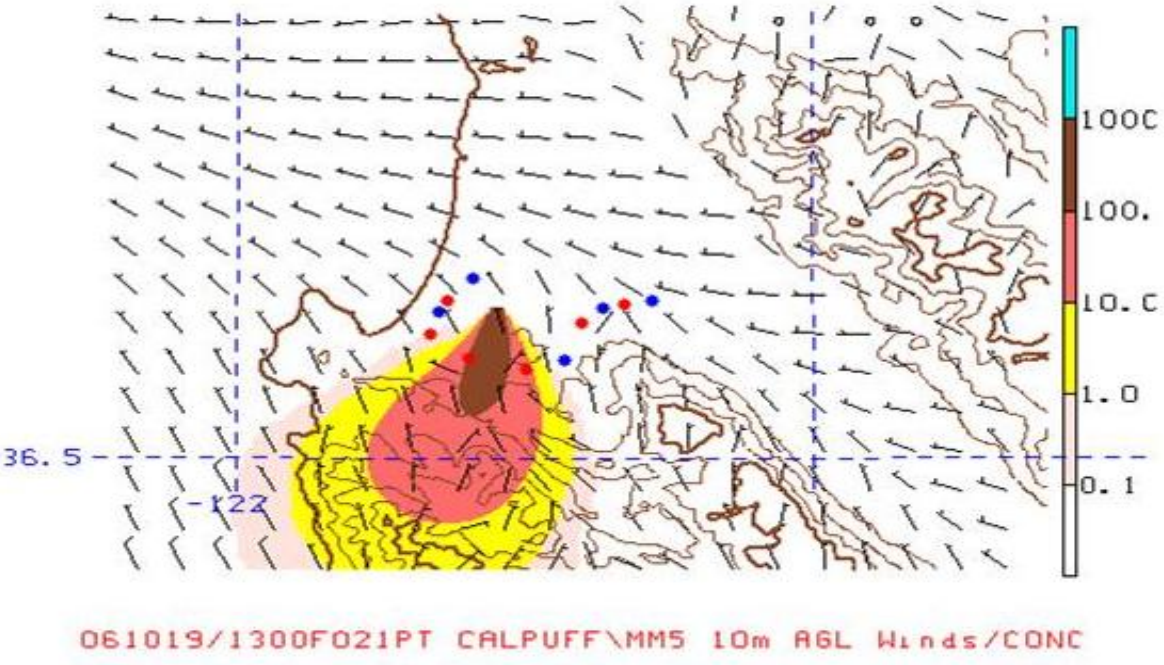


Figure 6 – Satellite Images

Figure 6 – MODIS 250m satellite image for a) 1925UTC (12:25 p.m. PDT) and b) 2105UTC (2:05 p.m. PDT) for October 19. The MRS-16 source is identified by the red box east of Monterey. Smoke is shown in white and there are no clouds present. NOTE: The smaller smoke plume on the right is a result of an agricultural burn northeast of Salinas.

6 CONCLUSION

The lessons learned from the 2003 prescribed burn gave insight from which this prescribed burn was planned and conducted. With the prescribed burn program continuing in 2007, some recommendations and changes to existing plans will need to be instituted prior to future burns taking place within the impact area. These changes and recommendations will be based on the complexity of the upcoming burns: burn unit size, vegetation density, terrain, smoke management, escape potential and the close proximity to civilian boundaries.

Continuous fire weather forecasting and weather pattern discussions with NPS burn project meteorologist, MBUAPCD, California Air Resources Board (CARB), and National Weather Service (NWS) to draw a concurrence or non-concurrence of the forecasting models proved to be a valuable asset in the mobilization and go/no go decision. The on site weather stations, real time weather readings were instrumental in the success of the burn.

MBUAPCD had several mobile smoke spotters traveling around various locations to report on smoke behavior and any possible smoke impacts. The air district's spotters reported good smoke behavior overall with only one minor smoke touch down in the San Benancio area. MBUAPCD received no complaint calls where smoke impacts reported could be verified as being the result of the MRS-16 prescribed burn.

Based on all the factors present, prior to and during the day of the MRS -16 burn, the conclusion formed by the Presidio of Monterey Fire Department is that the decision to burn on October 19, 2006 was proper and the prescribed burn was executed as planned.

7 REFERENCES

[1] 40 CFR Part 300, EPA National Oil and Hazardous Substance Pollution Contingency Plan.

[2] Archives Search Report, U.S. Army Corps of Engineers, St. Louis District, December 1993.

[3] Archives Search Report (Supplement No. 1), Fort Ord California, Monterey County, California, U.S. Army Corps of Engineers, Huntsville Division, 1994.

[4] Fort Ord Ordnance and Explosive Waste Time-Critical Removal Action Memorandum, Former Fort Ord, Monterey County, California, Final, September 1994.

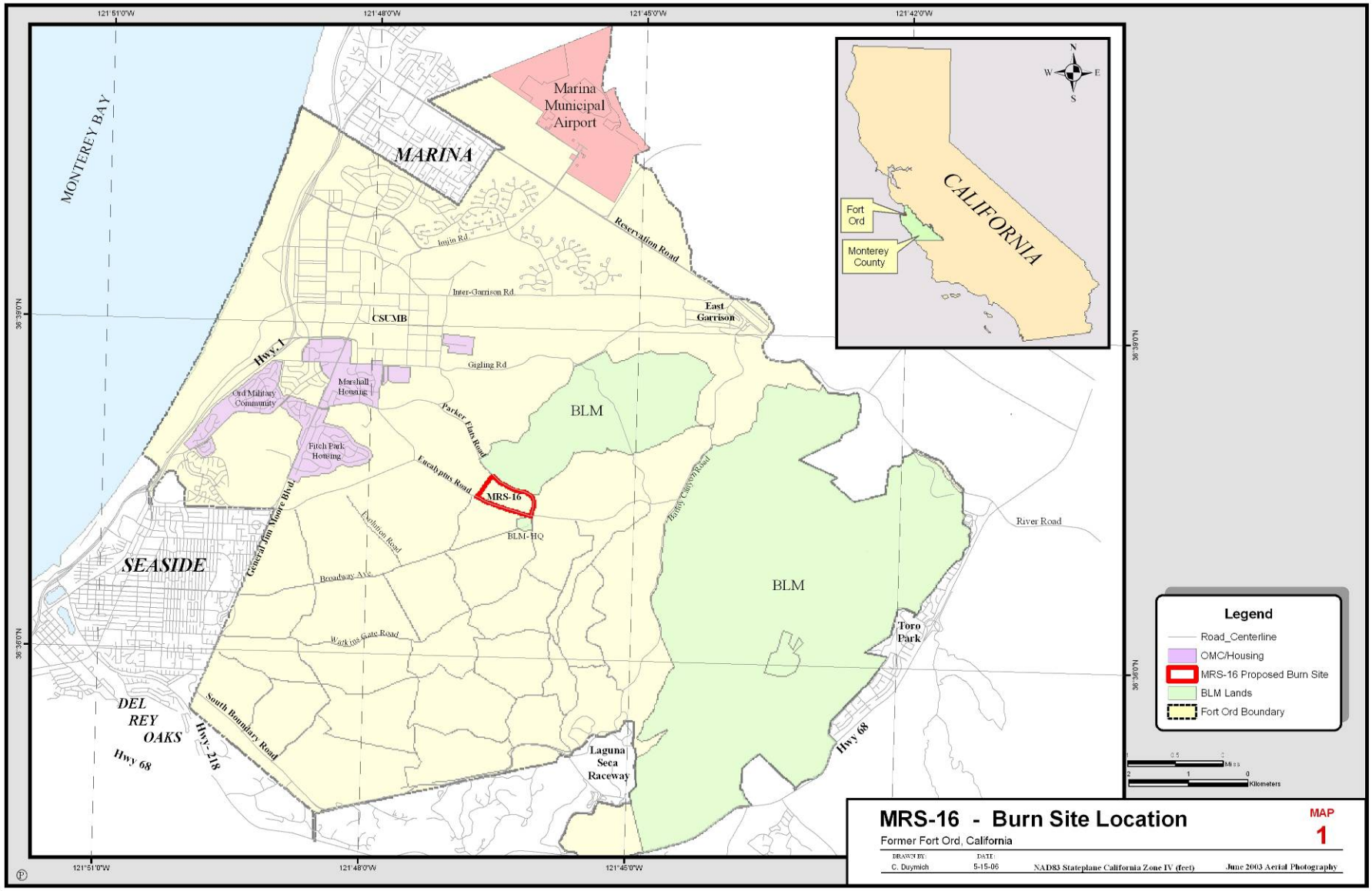
[5] Action Memorandum Engineering Evaluation/Cost Analysis–Phase 1, Former Fort Ord, Monterey County, California, Army, 1997.

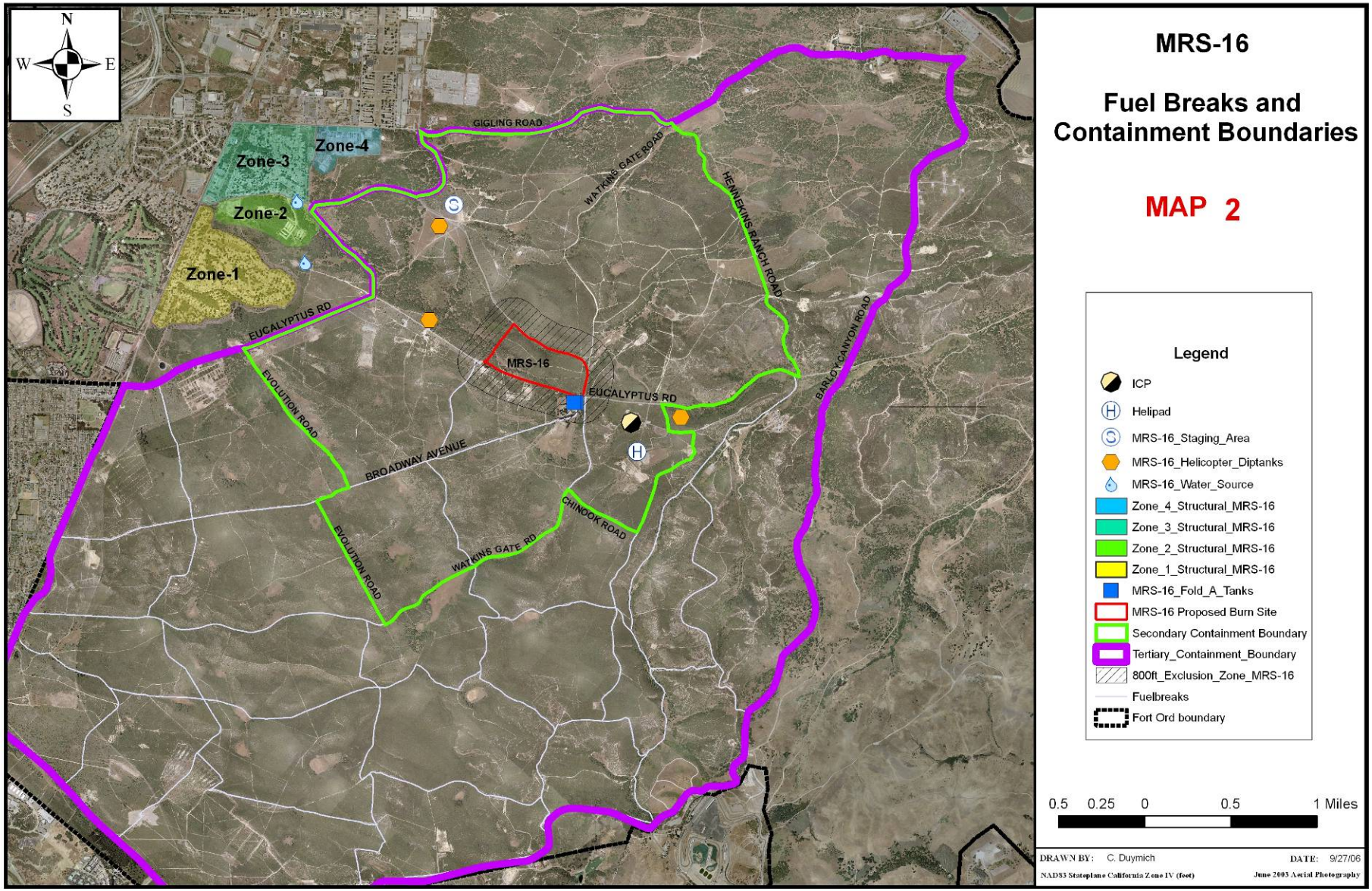
[6] Action Memorandum Engineering Evaluation/Cost Analysis–Phase 2, Former Fort Ord, Monterey County, California, Army, 1998.

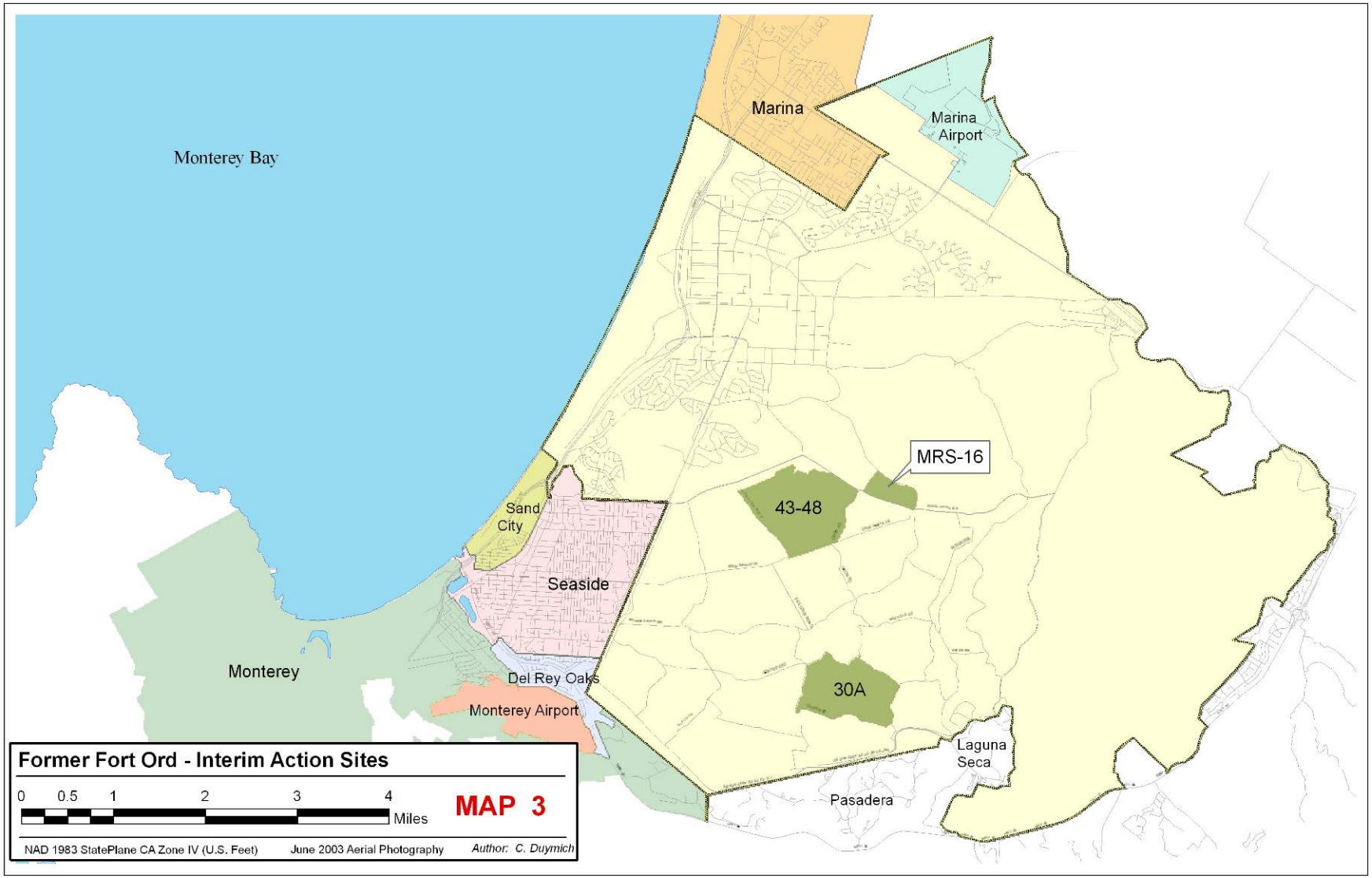
[7] Preliminary Final Ordnance and Explosives, Remedial Investigation/Feasibility Study Work Plan, Former Fort Ord, Monterey County, California, May 2000.

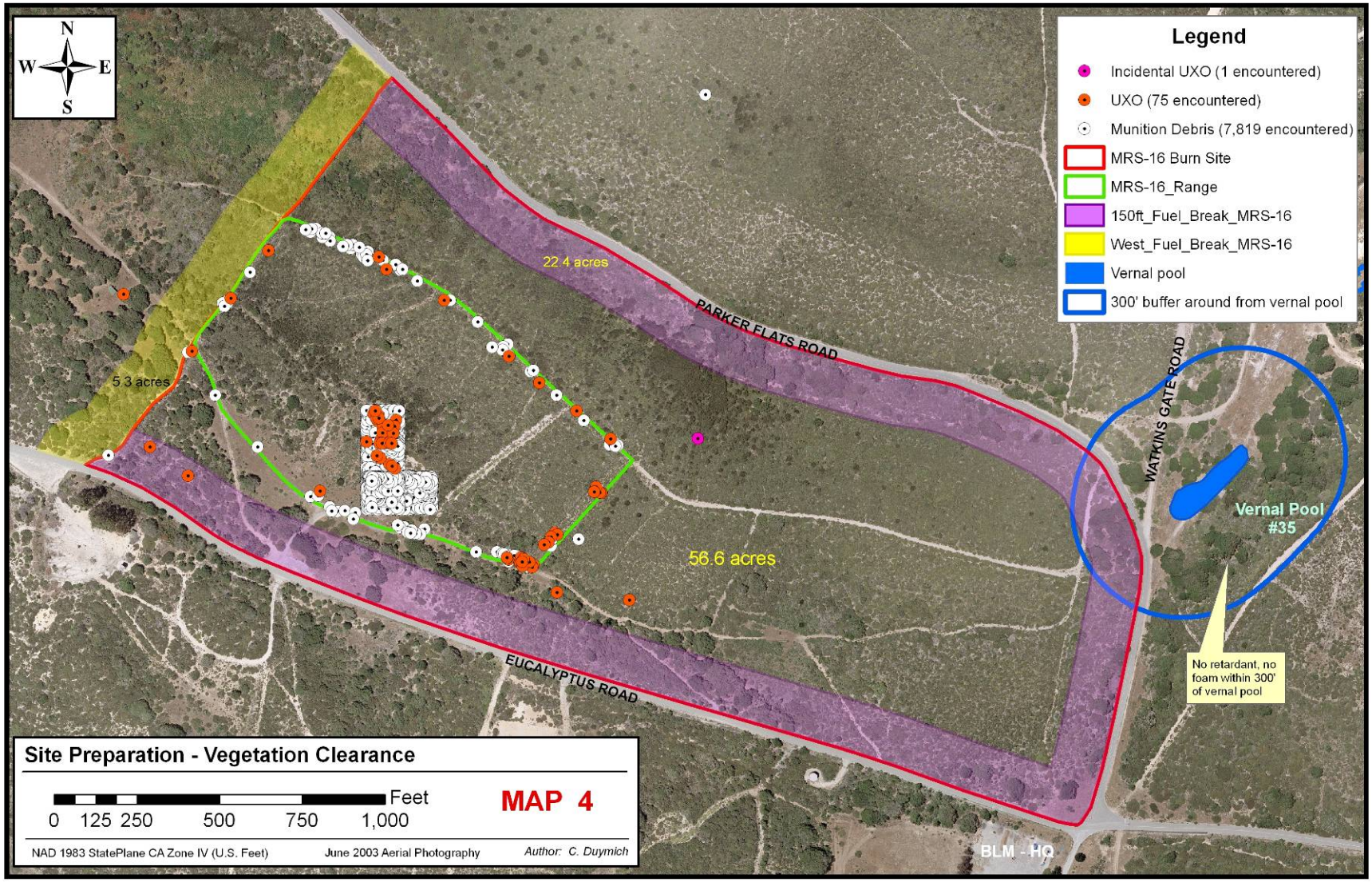
Appendix A

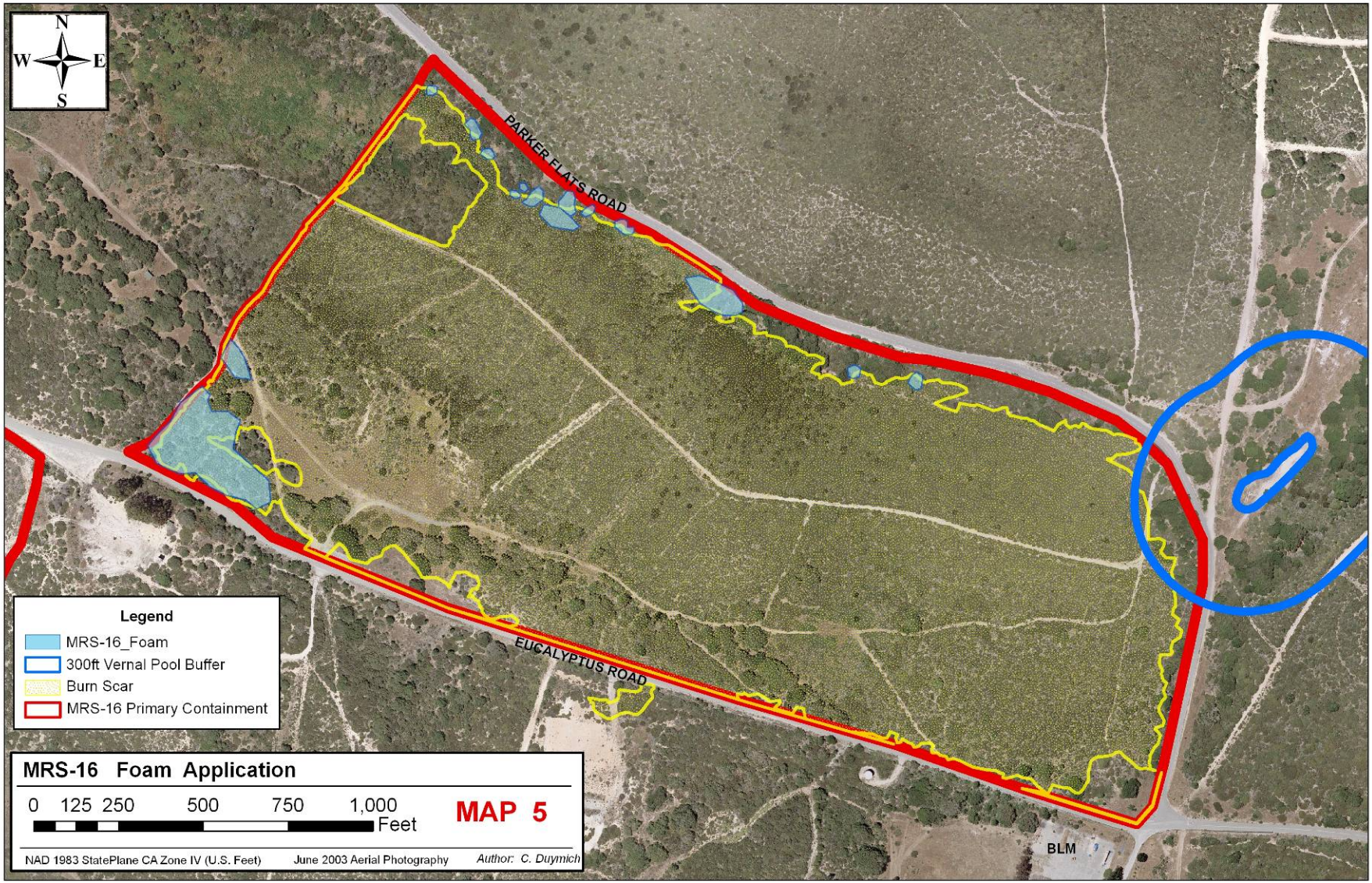
MAPS

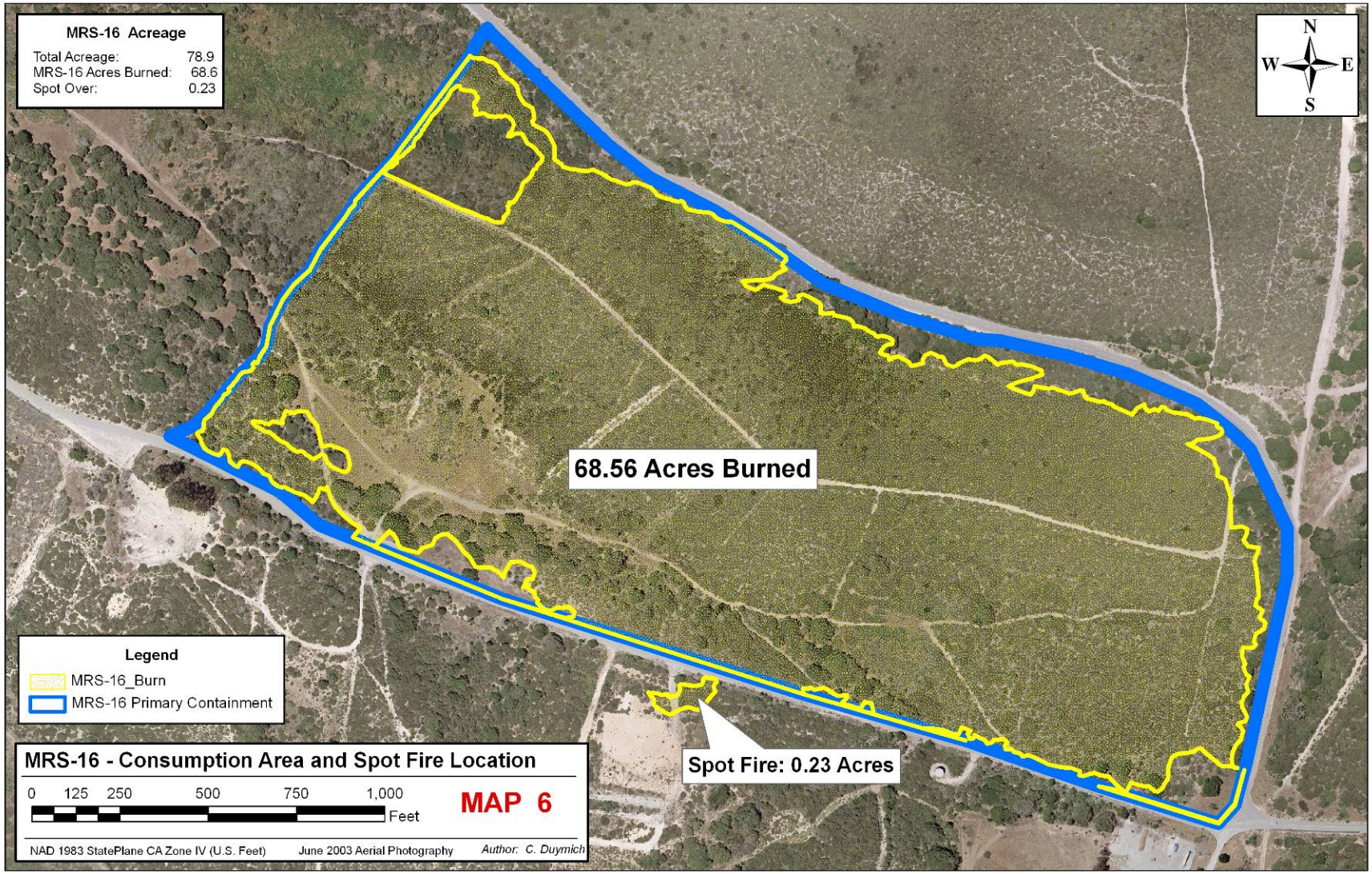

MONTEREY BAY
MARINA
Marina Municipal Airport
SEASIDE
DEL REY OAKS
CSUMB
East Garrison
Hwy 1
Hwy 68
Hwy 218
Reservation Road
Inter-Garrison Rd
Gigling Rd
Parker Flats Road
Eucalyptus Road
Broadway Ave
Watkins Gate Road
South Boundary Road
General Jim Moore Blvd
Barloy Canyon Road
River Road
Ord Military Community
Marshall Housing
Fitch Park Housing
BLM
BLM
MRS-16
BLM-HQ
Toro Park
Laguna Seca Raceway
CALIFORNIA
Fort Ord
Monterey County
Legend
Road_Centerline
OMC/Housing
MRS-16 Proposed Burn Site
BLM Lands
Fort Ord Boundary
MRS-16 - Burn Site Location
Former Fort Ord, California
MAP 1
DRAWN BY: C. Duymich
DATE: 5-15-06
NAD83 Stateplane California Zone IV (feet)
June 2003 Aerial Photography


N
W
E
S
Zone-4
Zone-3
Zone-2
Zone-1
GIGLING ROAD
WATKINS GATE ROAD
HENNEKINS RANCH ROAD
BARLOY CANYON ROAD
EUCALYPTUS RD
MRS-16
EUCALYPTUS RD
EVOLUTION ROAD
BROADWAY AVENUE
CHINOOK ROAD
EVOLUTION ROAD
WATKINS GATE RD
MRS-16
Fuel Breaks and Containment Boundaries
MAP 2
Legend
ICP
Helipad
MRS-16_Staging_Area
MRS-16_Helicopter_Diptanks
MRS-16_Water_Source
Zone_4_Structural_MRS-16
Zone_3_Structural_MRS-16
Zone_2_Structural_MRS-16
Zone_1_Structural_MRS-16
MRS-16_Fold_A_Tanks
MRS-16 Proposed Burn Site
Secondary Containment Boundary
Tertiary_Containment_Boundary
800ft_Exclusion_Zone_MRS-16
Fuelbreaks
Fort Ord boundary
0.5 0.25 0 0.5 1 Miles
DRAWN BY: C. Duymich
DATE: 9/27/06
NAD83 Stateplane California Zone IV (feet)
June 2003 Aerial Photography


Monterey Bay
Marina
Marina Airport
MRS-16
43-48
Sand City
Seaside
Monterey
Del Rey Oaks
Monterey Airport
30A
Laguna Seca
Pasadera
Former Fort Ord - Interim Action Sites
0 0.5 1 2 3 4
Miles
MAP 3
NAD 1983 StatePlane CA Zone IV (U.S. Feet)
June 2003 Aerial Photography
Author: C. Duymich


N
W
E
S
Legend
Incidental UXO (1 encountered)
UXO (75 encountered)
Munition Debris (7,819 encountered)
MRS-16 Burn Site
MRS-16_Range
150ft_Fuel_Break_MRS-16
West_Fuel_Break_MRS-16
Vernal pool
300' buffer around from vernal pool
22.4 acres
5.3 acres
56.6 acres
PARKER FLATS ROAD
WATKINS GATE ROAD
EUCALYPTUS ROAD
Vernal Pool #35
No retardant, no foam within 300' of vernal pool
BLM - HQ
Site Preparation - Vegetation Clearance
Feet
0 125 250 500 750 1,000
MAP 4
NAD 1983 StatePlane CA Zone IV (U.S. Feet)
June 2003 Aerial Photography
Author: C. Duymich

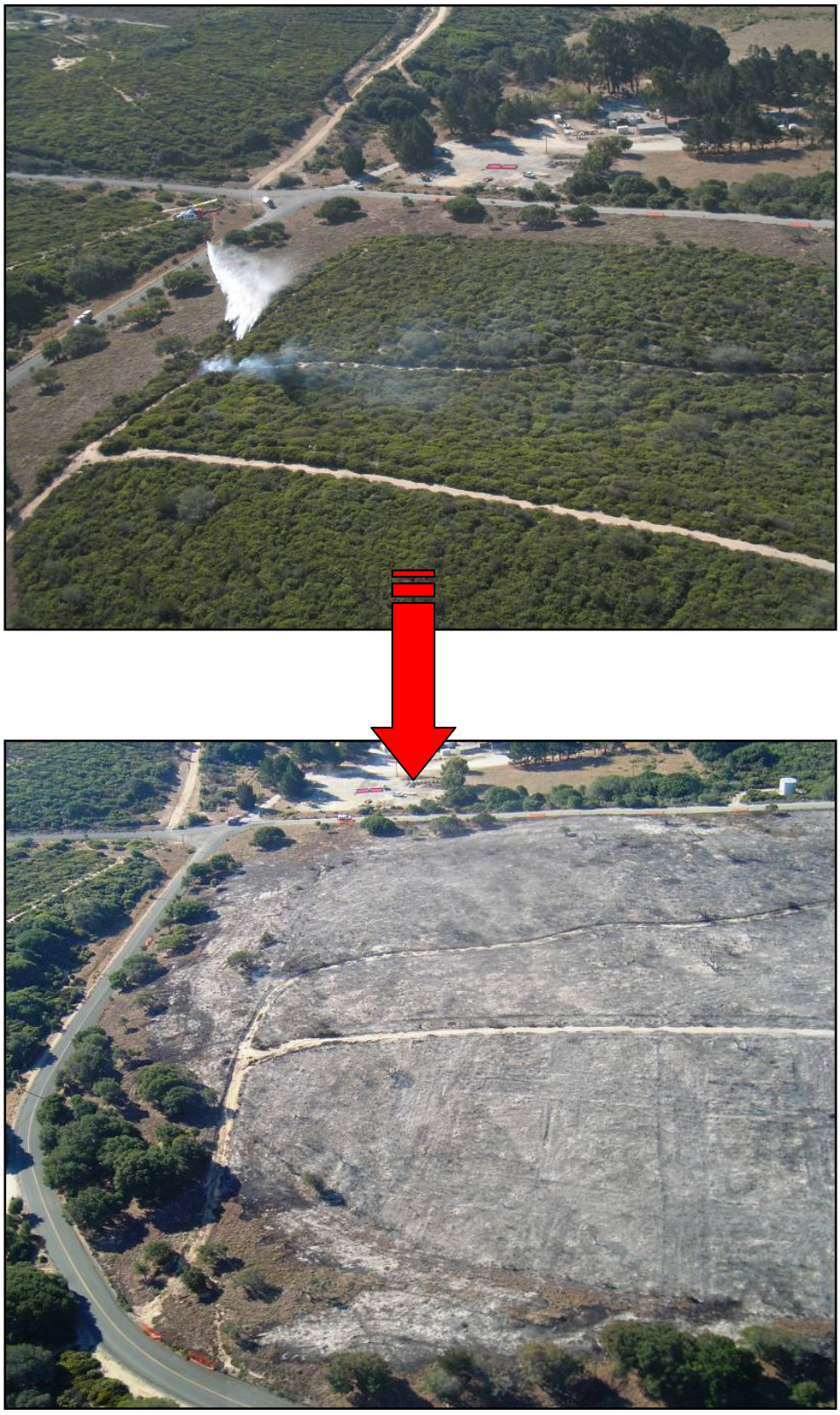

N
W
E
S
PARKER FLATS ROAD
EUCALYPTUS ROAD
BLM
Legend
MRS-16_Foam
300ft Vernal Pool Buffer
Burn Scar
MRS-16 Primary Containment
MRS-16 Foam Application
0 125 250 500 750 1,000
Feet
MAP 5
NAD 1983 StatePlane CA Zone IV (U.S. Feet)
June 2003 Aerial Photography
Author: C. Duymich


MRS-16 Acreage
Total Acreage: 78.9
MRS-16 Acres Burned: 68.6
Spot Over: 0.23
N
W
E
S
68.56 Acres Burned
Spot Fire: 0.23 Acres
Legend
MRS-16_Burn
MRS-16 Primary Containment
MRS-16 - Consumption Area and Spot Fire Location
0 125 250 500 750 1,000
Feet
MAP 6
NAD 1983 StatePlane CA Zone IV (U.S. Feet)
June 2003 Aerial Photography
Author: C. Duymich

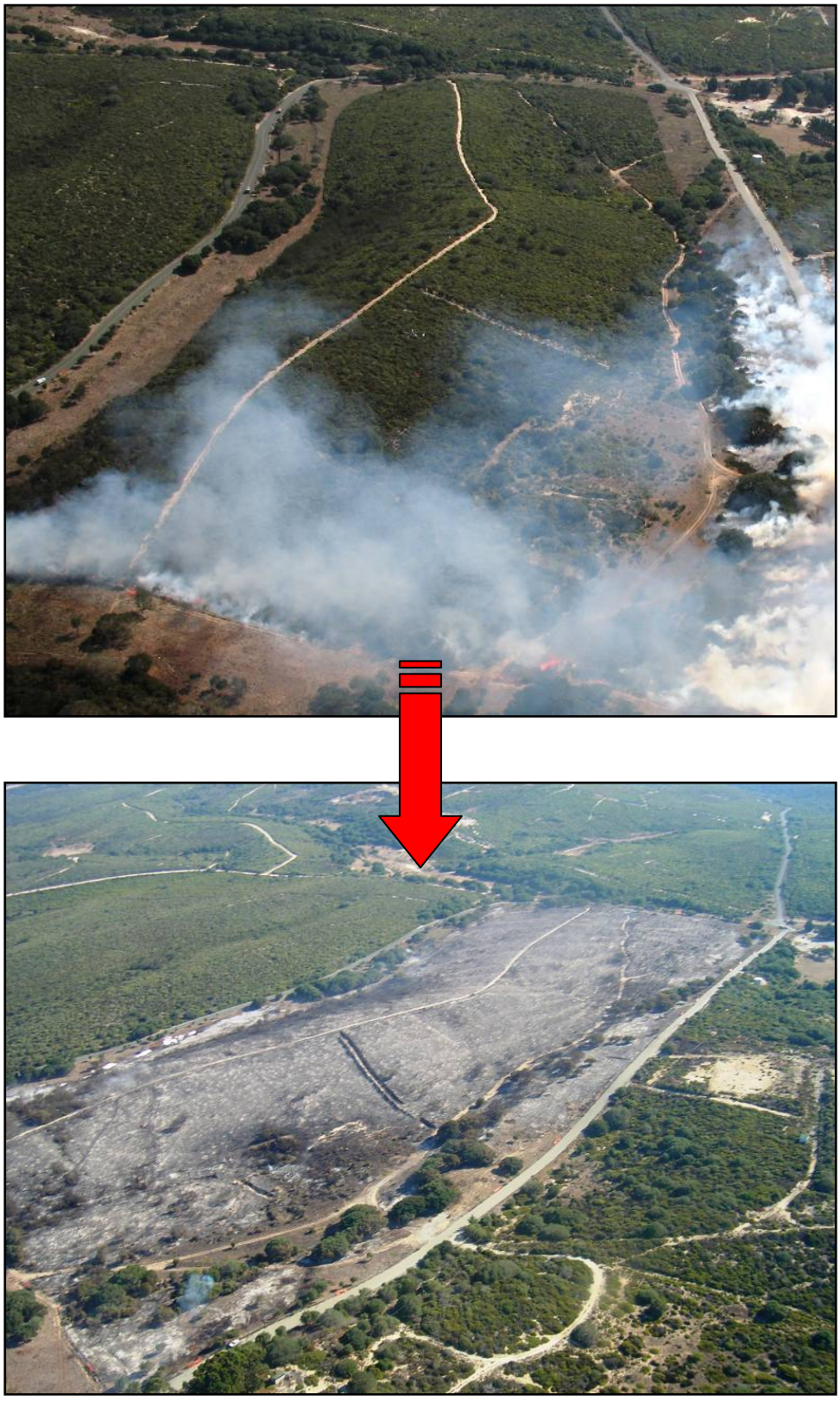
Appendix B

Site Photographs

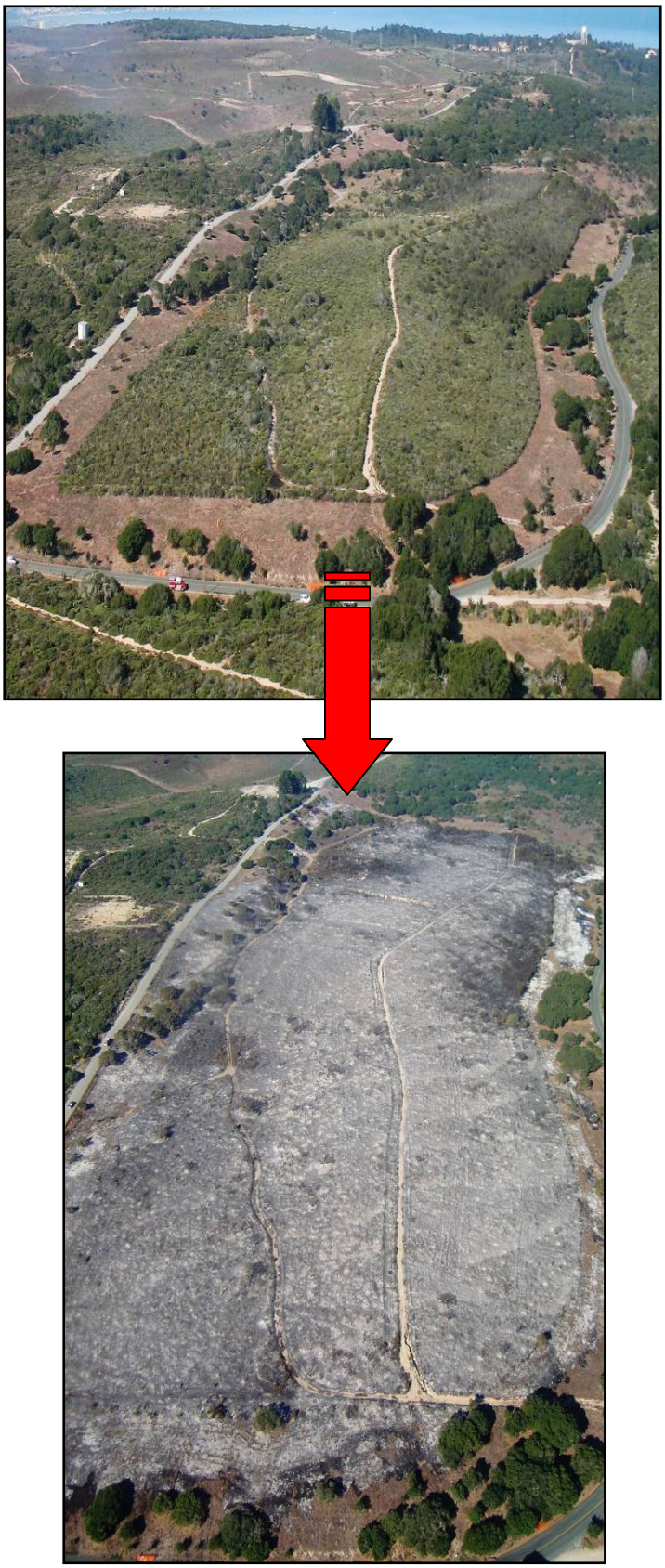
Before and After Images



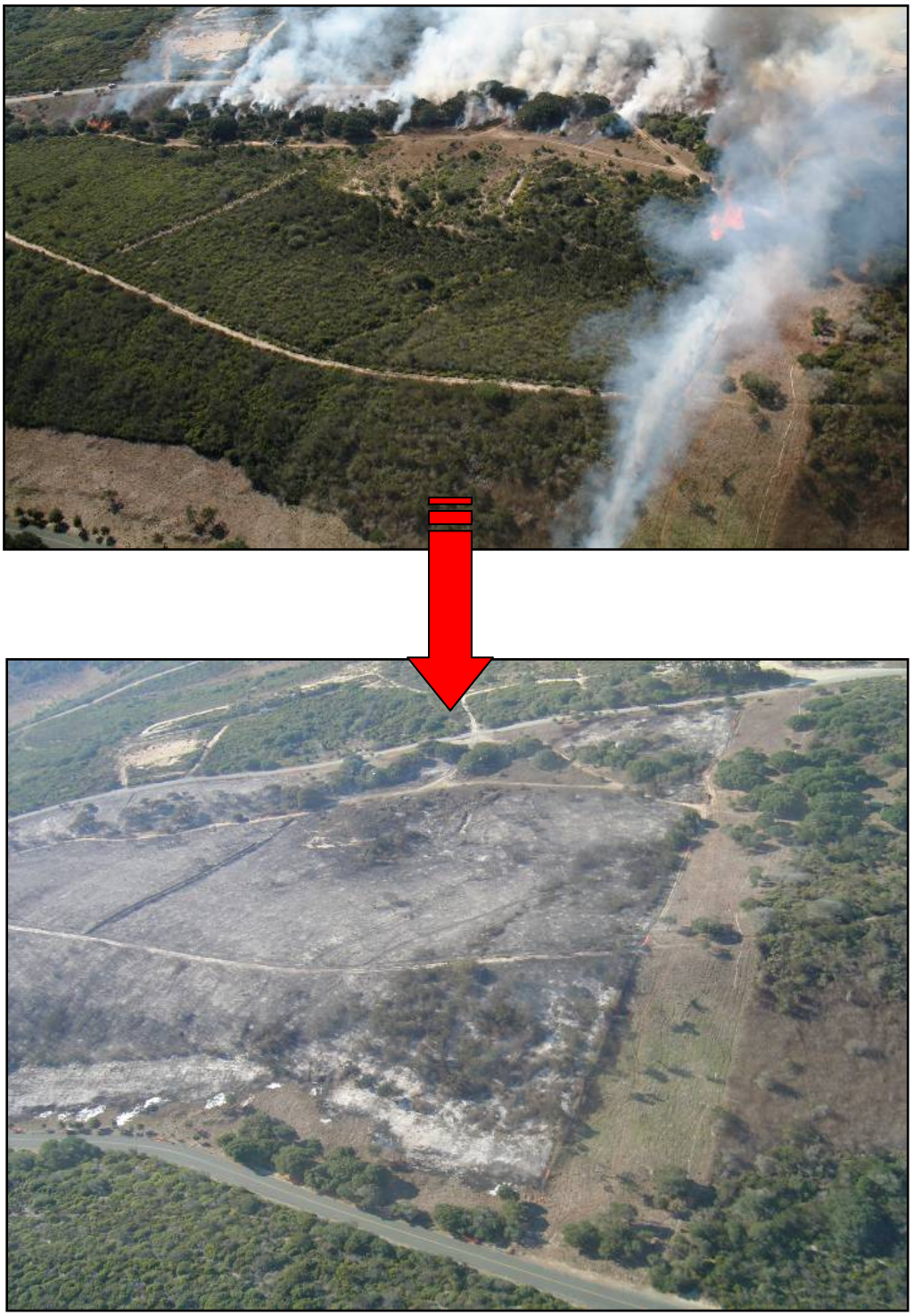
Before and After Photographs



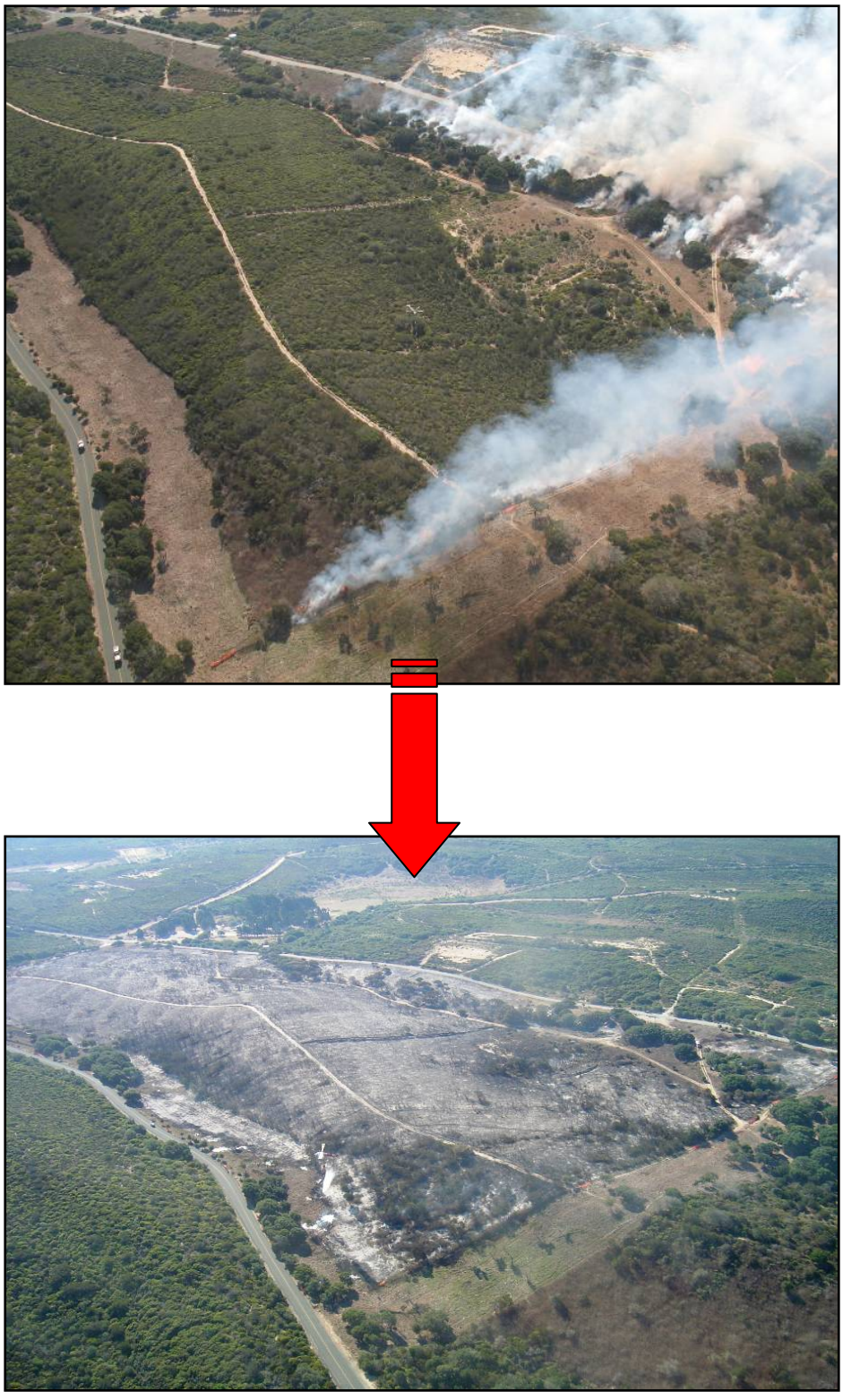
Before and After Photographs



Before and After Photographs



Before and After Photographs



Burn Photographs

Burn Photographs

Burn Photographs

Burn Photographs

Burn Photographs

Burn Photographs

Appendix C

Burn Plan Checklists

17 BURN DAY GO-NO-GO CHECKLIST

(To be filled out daily by burn boss and filed in project folder.)

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

17.1 BURNING OPERATIONS:

1. Are **ALL** fire prescription criteria met (Y)/N?
2. Is the fire weather forecast favorable (Y)/N?
3. Are **ALL** personnel required in the prescribed fire burn plan on site (Y)/N?
4. Have **ALL** personnel been briefed on safety hazards, escape routes and safety zones (Y)/N?
5. Is **ALL** of the required equipment in place and in working order (Y)/N?
6. Have **ALL** personnel been briefed on the prescribed fire burn plan requirements (Y)/N?
7. Are sufficient backup resources available for containment of escapes (Y)/N?
8. Can the burn be executed according to plan and will it meet management objectives (Y)/N?

17.2 HELICOPTER OPERATIONS:

9. Have **ALL** aviation safety requirements been met and the helicopter operation check list completed. (Y)/N?
10. Have aerial hazards been noted (Y)/N?
11. Have pilots been appraised of unavoidable flight hazards (Y)/N?
12. Have pilots been reminded of hazards (Y)/N?
13. Have over flights been avoided and personnel placed away from flight paths (Y)/N?

17.3 SMOKE MANAGEMENT:

14. Are **ALL** smoke management prescription specifications met (Y)/N?

IF ALL QUESTIONS ABOVE HAVE BEEN ANSWERED "YES" YOU MAY PROCEED WITH IGNITION.

FINAL

CERTIFIED BY: _____ **DATE:** 10/19/06
Incident Commander POM Fire Chief

Daily Positions:	**RX Burn Boss**	
	Ignition Specialist	
	Holding Specialist	_____
	Other	_____

18 TECHNICAL REVIEW

Checklist for Review of Prescribed Fire Burn Plans

Project Name: MRS-16

- ✓ **Plan is in compliance with the IA ROD, Habitat Management Plan and Biological Opinion for this project.**
- ✓ **Objectives, Desired Results & Tolerable Deviations clearly outlined.**
- ✓ **Prescription adequate to meet objectives and have a safe burn.**
- ✓ **Plan includes a prediction of expected fire behavior.**
- ✓ **Plan provides for requesting a spot weather forecast on moderate and high complexity burns.**
- ✓ **Plan requires a test burn.**
- ✓ **Problem areas or sensitive areas identified clearly.**
- ✓ **Plan includes organization needed and instructions for overhead.**
- ✓ **Maps adequate.**
- ✓ **Escape Contingency Plan adequate.**
- ✓ **Safety Plan adequate.**
- ✓ **Smoke sensitive areas identified & Smoke Management Plan adequate.**
- ✓ **Required documentation submitted to MBUAPCD for burn permit.**
- ✓ **RECOMMENDED FOR APPROVAL.**

INSTRUCTIONS: Technical Reviewer shall complete this checklist and attach it to the prescribed burn plan. Initial each box to indicate item found satisfactory. Enter N/A (not applicable) for those items reviewed and found not applicable.

Technical Review Completed by: [signature] **Date** 9/19/06

Prescribed Fire Qualification BBL

FINAL

HELITORCH OPERATIONS CHECKLIST

This Helitorch Operations Checklist shall be completed prior to each day's operation.

A. Organization

1. Helitack organization chart has been prepared and posted showing responsibilities for functions named. Contractor provide Helitorch ☑
2. All positions are filled by qualified personnel mgr ☑

B. Helibase Operations

1. Helibase Manager
   a. Has established separate radio frequencies as designated on Comm Plan ☑
   b. Communications tested and operational ☑
   c. Briefings to include all required helitack personnel, key firing personnel, and helitorch pilot. ☑
      1) Overhead responsibilities and authorities ☑
      2) Flight routes ☑
      3) Area Flight Hazards ☑
      4) Radio Frequencies ☑
      5) Personnel assignments ☑
      6) Emergency procedures ☑

NOTE: All personnel will be briefed on the adherence of alumagel and the hazards from coming into contact with it and gasoline.

C. Mixing Area

1. Separate from Helibase activities ☑
2. Traffic control ☑
3. Helitorch fuel supply available and properly located and grounded ☑
4. Fire Suppression equipment available ☑
5. Personnel assignments ☑
6. Emergency procedures reviewed ☑

FINAL

D. Landing Area

1. Located where safe approach and departure paths exist, and separate from other helibase activities take place ☑
2. Free from flight hazards ☑
3. Traffic control of ground vehicles, personnel, and aircraft ☑
4. Dust abatement ☑
5. Helicopter fuel truck security - parking area and driving route designated, located away from flight routes, landing areas and personnel. Static grounding measures required ☑
6. Helitorch loading procedures briefed ☑
7. Fire suppression equipment available ☑
8. Fire suppression person available ☑

F. Orientation flight completed ☑
G. Go/no-go check list completed ☑

CERTIFICATION - All items of the Helitorch operations Check list have been accomplished

Daryl L. Stockdale — 10/19/06 DLS
Helitorch Manager — Date

Burn Boss — 10/19/06
Burn Boss — Date

FINAL

This Plan was developed with the framework from the Federal Interagency Aerial Ignition Guide, May 1995

Ign Base
Lt 10 Francisco Gonzalez

Sup Base
Lt 12 Santiago

Appendix D

Lessons Learned

AAR RECOMMENDATIONS FROM OCTOBER 19, 2006 RANGE 16 BURN

Bob Nunes
Monterey Bay Unified Air Pollution Control District
10/31/2006

Although the Range 16 burn was "only" 58 acres, past Fort Ord burns have demonstrated that even smaller burns in the 20 to 50 acre range can cause significant impacts if conducted under unfavorable conditions for smoke management, which occur most of the time at Fort Ord. Even with a significant off-site burn occurring concurrently and adding to background, information available so far indicates that this was a low impact event from an air quality perspective. In terms of smoke management, this is the most successful Fort Ord burn I have witnessed over the past 10+ years of following these events.

Here are my comments and suggestions so far on the Range 16 burn:

1. Tethersonde – Retain this critical information source for future burns. Real-time observations and radio communications from this resource are critical to determining when conditions aloft (especially low-level wind shear) are amenable to maintaining the integrity of the bottom of the smoke column. At a minimum, monitor day of the burn starting early in the morning. If feasible, it would also be useful to run the system the morning before the target day as well in order to get a closer feeling for when critical diurnal pattern changes can be expected.

2. Rx Modification – Tweak the Smoke Management R_x (SMR_x) to include monitoring of the shear layer with the tethersonde to estimate when the wind shear layer immediately aloft will abate in relation to commencing ignition.

3. Onsite Meteorologist(s) – Use agency meteorologist(s) familiar with local conditions at Fort Ord to advise on critical elements of the SMR_x, as well to provide onsite input on the day of the burn, but not to make the actual Go/No Go decision

4. Shear Layer Timing – Refine the estimated rate of dissipation of the shear layer through post event review of the tethersonde and profiler data.

5. Test Fire – Clarify the general criteria for what constitutes a favorable test fire.

6. Communications for Full Ignition – Clarify the understanding of whether or not the report of favorable results from the test fire triggers automatic commencement to full ignition, or if the burn manager will be requesting another set of meteorological observations before proceeding.

7. Other Burns in Area – The District should curtail other burns in the region that could contribute to the smoke burden in the area. Large nearby burns especially should be curtailed on the day of and preferably the day before to eliminate carryover smoke, which elevates the PM background, and carryover burning continuing on the day of a Fort Ord burn.

8. Aerial Surveillance - Retain wide-view aerial surveillance of the plume with real-time communication of the observed smoke and fire behavior to the burn manager. The observed visual integrity of the plume base, time stamped digital images of the plume, as well as estimates of the plume height, and general trajectory of the plume using the navigational instruments are useful information for both real-time management of the plume and subsequent analysis of the event.

9. Peripheral Burns – Detached weak plumes from small fires (black-lining or detached smoldering areas?) occurring away from the main fire front appear to occasionally drift off on their own, where they escape entrainment into the main convective column from the burn. The resulting low level puffs of smoke can then cause sporadic offsite impacts. If feasible and safe, it might be preferable to minimize the lead distance from the fire front, or to increase active ignition to pull these peripheral plumes into the main column.

10. Fuel Breaks – Whenever feasible, retain the wide fuel break concept used in the Range 16 operation. These set-back, fuel deprived zones appear to have been essential for preventing the spot fires from developing into the type of escapes that have plagued prior Fort Ord burns and contributed to significant offsite smoke impacts. During escapes, full operational attention is given to fire suppression rather than smoke management. Further, the expanded fire produces excess emissions that are extended over a longer period of time, as well as developing an enlarged smolder field that increases and prolongs smolder phase smoke impacts.

11. Humidity/Fuel Moisture – Suggest reviewing the humidity and fuel moisture conditions that existed during the fire. This information could be useful for refining the SMRx as moisture levels during the Range 16 burn appear to have been in an optimum range that supported rapid ignition, but not so dry as to allow the few spot fires to develop into full escapes.

12. Site-Specific SMR_x – Retain the basic template of the Range 16 SMRx. These could be refined for lessons learned during the Range 16 event as well as the site-specific setting of each subsequent burn. For instance, for locations closer to the perimeter of the IMPACT AREA, some wind directions may be more critical to consider if there are nearby residents or heavy fuel accumulations immediately downwind of the burn site.

13. Rapid Ignition – Retain the objective to burn the fuels as quickly and completely as possible during the ignition phase. This shortens the duration of the event and having more complete consumption during the ignition phase deprives the extended smolder phase of available fuels.

14. CALPUFF/MM5 – Continue to run the CALPUFF simulations for future burns. As with the FORA burns, the CALPUFF smoke forecasts provided a useful advanced qualitative indicator of the areas where the plume was most likely to be moving over during the various stages of the burn.

15. Event Momentum - While waiting for the critical time to develop to commence ignition (or not commence ignition), it should be made sure that the momentum of the event not "take on a life of its own", as may have been the case in 2003. With ignition ships in the air, commanders on the ground, hundreds of thousands of dollars at stake and the whole world watching, the meteorologists need to just focus on critical changes in wind and temperature environment to which the plume will be introduced to best guarantee the success of the burn in terms of air quality.

16. Ember Fallout Pattern - It may be useful to reconstruct the winds and ember fall-out fields that existed at the time the resulting spot fires developed. Since MRS-16 was located in the middle of the former Army training lands, the off-site spot fires were extinguished and did not cause any significant problems. However, a similar fall-out field superimposed near the perimeter of the base near the urban interface or heavy vegetation could have a different result in terms of containment. The results of this review could be used to refine the wind prescription for burns near the perimeter of the base to avoid ember fall-out on sensitive or flammable areas to minimize the prospects of an escape.

17. Future Application - This event further confirms that there is no "bright line" separating the fire management and smoke management aspects of the operation into discrete components. The timing of the start of ignition, the ignition plan, the duration of ignition, the completeness of consumption on,

real-time communications on observed fire and smoke behavior through aerial surveillance, fuel moisture, escape prevention measures, etc. all relate to both aspects of this type of event. Although the District provided important input to both the conceptual and operational SMR_x for this burn, which included both of those elements, I think the next generation SMR_x will continue to focus on that interrelationship.

18. Profiler – For reference, I've included the October 19th daily charts from the NPS Fort Ord profiler (elevation ~ 170` msl) and accompanying surface station (although RAWS #2 is actually closer to Range 16, I don't have that summary at this time). A most important feature to note is the incredible persistence of the unwanted low level jet or shear layer within the first 1,000 ft of the profiler return (note the long series of two feathered wind barbs in green temperature fields at ~ 700` msl). Although winds were relatively light at the surface, the low level jet immediately aloft remained in the 15 knot range from about 5 am PST all the way to the time the test fire was conducted (~9 am PST on chart). This was the critical adverse feature that needed to be dissipating before full ignition could commence, otherwise the fumigation that occurred in 2003 would have been repeated. This data from the profiler was not available at the time decisions were to be made so that is why the tethersonde was deployed. The tethersonde filled this critical data gap and provided high resolution real-time data on the evolution of the feature directly at the site. At the tethersonde site (elev ~460 ft msl) the peak shear layer was only about 200` above ground level.

19. Historical Comparison – After a series of near-burn events in November 2002 and prior to the actual October 2003 fumigation, the District drew attention to the wind shear concern (see attached November 26, 2002 email). However, since the District was only peripherally involved at that time, those concerns did not seem to get followed through upon during the operational stage (R.I.P.). A key difference in 2006 is that the local District was centrally involved from the beginning and its suggestions, particularly those related to closely watching the shear layer, were taken seriously and more importantly, made part of the operational plan. I think that contributed to the far improved management of the smoke during the Range 16 burn. Allowing the shear layer to dissipate may have also helped prevent an escape since the wind carried embers could not fly as far.

From: BOB NUNES
To: "kentfield@worldnet.att.net".GWIA.MBUAPCD
Date: Tue, Nov 26, 2002 1:58 PM
Subject: Re: Ft. Ord Weather Prescription Variables

Hi Kent,

Thanks for the opportunity to comment on the revised Rx. The revisions look very close to what I recall from the phone call.

Here's a few minor suggestions:

1. Test Burn - You may want to place that text under the A.M. Rx since that will be the most immediate and important task, once the basic AM met criteria are met.

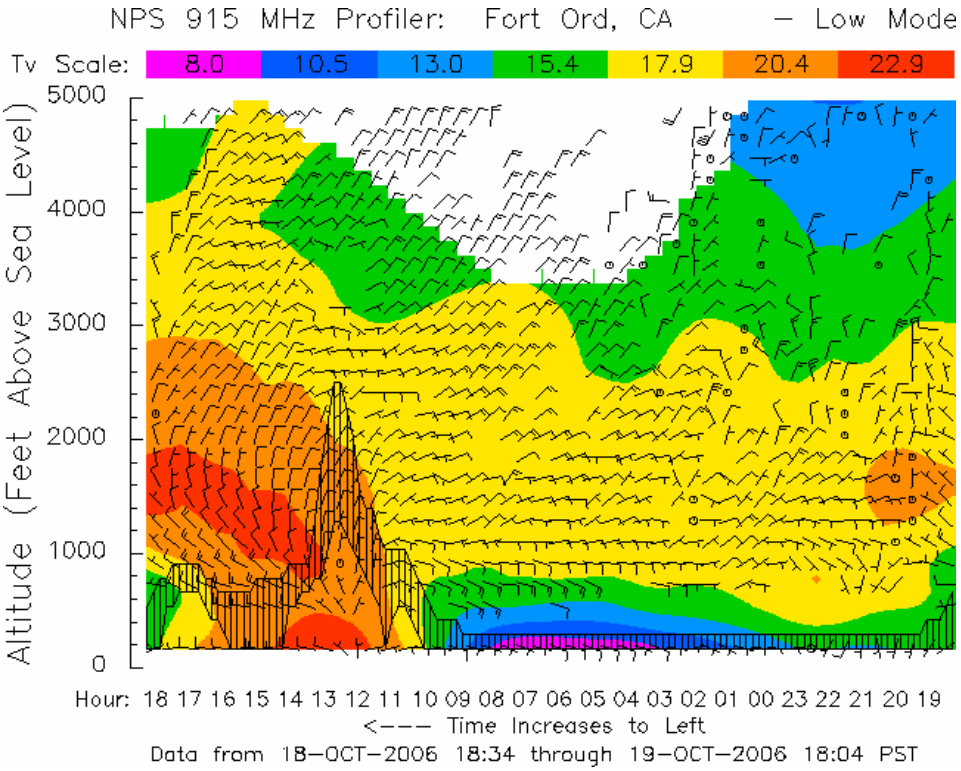
Just a thought on a recurring feature I've seen in the profiler data, during the test burn phase you might want to look for low level wind shear effects in the observed smoke behavior. In the profiler time/height cross-sections for both the recent November 19th and November 14th offshore cases (as well as some other offshore situations I've seen in the historical archive), there appeared to be a low-level morning jet at about 15 to 20 knots only a few hundred feet above the surface, despite very low wind speeds near ground level. This feature seems to develop during the pre-dawn hours and persist during the 7 to 10 AM time frame. It could be due to the additive effect of the nocturnal Salinas Valley land breeze, which tends to be in the offshore direction, combining with the general offshore flow in place during these offshore events. If present on the burn day, this low level wind shear could hinder the desired vertical development of the smoke column during the morning ignition phase, resulting in a plume that is closer to ground-level.

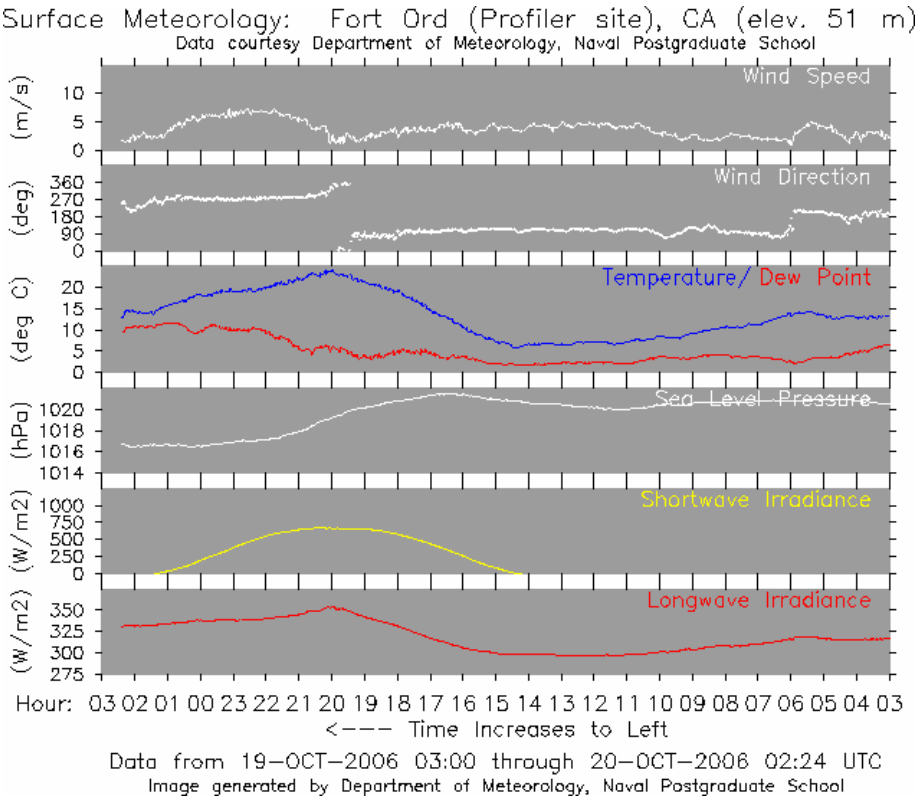
2. Start Time - For late Fall situations, the 7 to 8 AM start window may be on the early side due to the abbreviated solar cycle and later sunrise that occurs that time of year. You might want to allow for greater flexibility on the start time for those situations so the burn could be started slightly later, if necessary, especially if a delayed weak sea breeze is expected.

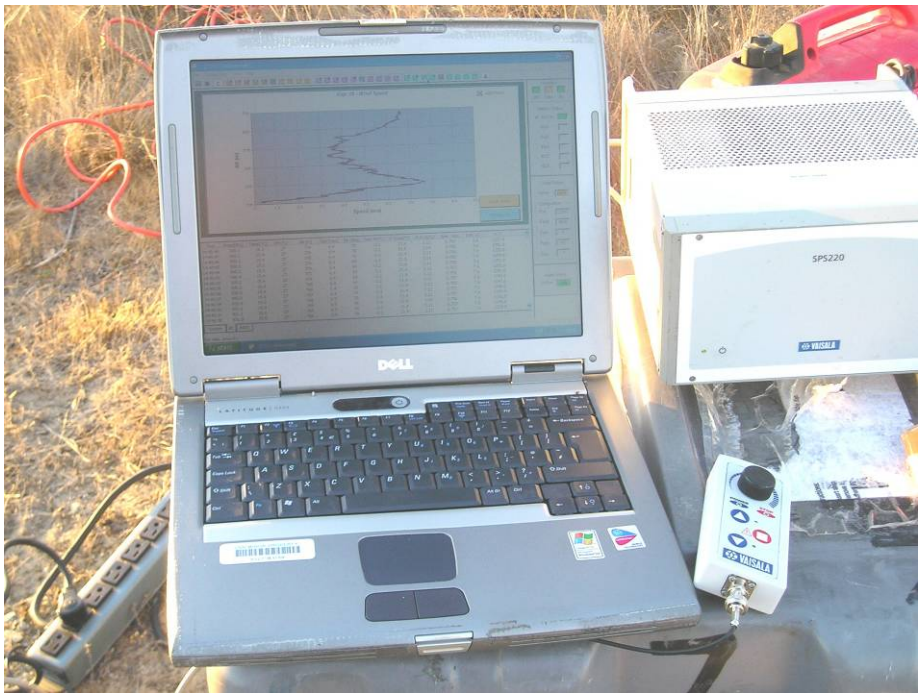
>>> "Kent Field" <kentfield@worldnet.att.net> 11/22/02 03:03PM >>>
Listed below is the Ft. Ord weather prescription. Please note that i have tried to reflect the changes suggested in this morning's meteorological phone call with ARB, MBUAQMD, EPA, DTSC, and Wendell Nuss. And if i have forgotten anyone i apologize.

Please comment.

Kent Field


NPS 915 MHz Profiler: Fort Ord, CA — Low Mode
Tv Scale: 8.0 10.5 13.0 15.4 17.9 20.4 22.9
Altitude (Feet Above Sea Level)
5000
4000
3000
2000
1000
0
Hour: 18 17 16 15 14 13 12 11 10 09 08 07 06 05 04 03 02 01 00 23 22 21 20 19
<--- Time Increases to Left
Data from 18-OCT-2006 18:34 through 19-OCT-2006 18:04 PST


Surface Meteorology: Fort Ord (Profiler site), CA (elev. 51 m)
Data courtesy Department of Meteorology, Naval Postgraduate School
Wind Speed (m/s)
Wind Direction (deg)
Temperature/ Dew Point (deg C)
Sea Level Pressure (hPa)
Shortwave Irradiance (W/m2)
Longwave Irradiance (W/m2)
Hour: 03 02 01 00 23 22 21 20 19 18 17 16 15 14 13 12 11 10 09 08 07 06 05 04 03
<--- Time Increases to Left
Data from 19-OCT-2006 03:00 through 20-OCT-2006 02:24 UTC
Image generated by Department of Meteorology, Naval Postgraduate School



Tethersonde Site - Upwind tethersonde and accompanying instrument package with the plume from the Range 16 burn rising in the background. Lower picture depicts system output with the sharp low level wind shear layer that existed prior to ignition actually displayed on the console. *Photos and set-up of tethersonde courtesy of NPS.*

Plume Comparison – Upper photo depicts the smoke plume from the Range 16 burn. Note how the integrity of the bottom of the plume is maintained aloft while it traveled above population areas. *Photo taken by Betsy Hibbits, MBUAPCD, looking over Seaside from Jack's Peak about 6.5 miles SW of Range 16.* In contrast, the lower photo depicts the plume from the October 24, 2003 burn. Note how the bottom of the plume has been frayed causing a curtain of smoke to descend to the surface upon the Seaside/Monterey urban corridor. The lower portion of this plume was ravaged as it penetrated the shallow wind shear layer that existed that morning during the ignition. *Photo taken by Mike Sheehan, MBUAPCD, about 6 miles N of the fire along Hwy 1*.

Response to Recommendations

AAR RECOMMENDATIONS FROM OCTOBER 19, 2006 RANGE 16 BURN

Bob Nunes, Monterey Bay Air Pollution Control District
10/31/2006

1. Tethersonde – Retain this critical information source for future burns. Real-time observations and radio communications from this resource are critical to determining when conditions aloft (especially low-level wind shear) are amenable to maintaining the integrity of the bottom of the smoke column. At a minimum, monitor day of the burn starting early in the morning. If feasible, it would also be useful to run the system the morning before the target day as well in order to get a closer feeling for when critical diurnal pattern changes can be expected.

Response: The above recommendation by MBUAPCD will be implemented as part of the 2007 burn planning and burn operations.

2. Rx Modification – The Smoke Management Prescription (SMR_x) will be adjusted to include monitoring of the shear layer with the tethersonde to estimate when the wind shear layer immediately aloft will abate in relation to commencing ignition.

Response: The above recommendation will be implemented as part of the 2007 burn planning and burn operations.

3. Onsite Meteorologist(s) – Use agency meteorologist(s) familiar with local conditions at Fort Ord to advise on critical elements of the SMR_x, as well to provide onsite input on the day of the burn, but not to make the actual Go/No Go decision.

Response: Meteorologist serve as a technical advisor to the Burn Boss and Incident Commander and the final decision for the GO/NO GO rest with them.

4. Shear Layer Timing – Refine the estimated rate of dissipation of the shear layer through post event review of the tethersonde and profiler data.

Response: Process in place and currently being implemented for data collection and review.

5. Test Fire – Clarify the general criteria for what constitutes a favorable test fire.

Response: If prescription elements are met, a test fire will be ignited to determine on-site fire behavior conditions as affected by current weather. If conditions are not satisfactory, the test fire will be suppressed and the burn will be rescheduled. If conditions are satisfactory the burn will continue as planned.

6. Communications for Full Ignition – Clarify the understanding of whether or not the report of favorable results from the test fire triggers automatic commencement to full ignition, or if the burn manager will be requesting another set of meteorological observations before proceeding.

Response: If the results are favorable the automatic commencement to full ignition will begin with continued monitoring of meteorological conditions.

7. Other Burns in Area – The District should curtail other burns in the region that could contribute to the smoke burden in the area. Large nearby burns especially should be curtailed on the day of and preferably the day before to eliminate carryover smoke, which elevates the PM background, and carryover burning continuing on the day of a Fort Ord burn.

Response: Concur with recommendation and that decision is left to the local air district to implement the recommendation into policy.

8. Aerial Surveillance - Retain wide-view aerial surveillance of the plume with real-time communication of the observed smoke and fire behavior to the burn manager. The observed visual integrity of the plume base, time stamped digital images of the plume, as well as estimates of the plume height, and general trajectory of the plume using the navigational instruments are useful information for both real-time management of the plume and subsequent analysis of the event.

Response: Aerial surveillance was conducted this year with personnel from the local air district on board and will continue for the 2007 burns as well.

9. Peripheral Burns – Detached weak plumes from small fires (black-lining or detached smoldering areas?) occurring away from the main fire front appear to occasionally drift off on their own, where they escape entrainment into the main convective column from the burn. The resulting low level puffs of smoke can then cause sporadic offsite impacts. If feasible and safe, it might be preferable to minimize the lead distance from the fire front, or to increase active ignition to pull these peripheral plumes into the main column.

Response: During the planning phase of the MRS-16 burn, it was requested to have fuel breaks established prior to the end of winter season to allow for safe black lining or reduction of masticated area. The fuel breaks were completed in early summer which prevented the black lining operations and made it necessary for a strategy switch to ground firing operations as a substitute effort to increase the buffer and reduce escape potent ional. The ground firing option, being of low heat and slow spread does risk small smoke impacts. Once the ground firing had been 50% completed aerial ignition was initiated and drew the heat and smoke into an effective plume. The plan for reducing these impacts in 2007 have already been established in our pre-planning stages.

10. Fuel Breaks – Whenever feasible, retain the wide fuel break concept used in the Range 16 operation. These set-back, fuel deprived zones appear to have been essential for preventing the spot fires from developing into the type of escapes that have plagued prior Fort Ord burns and contributed to significant offsite smoke impacts. During escapes, full operational attention is given to fire suppression rather than smoke management. Further, the expanded fire produces excess emissions that are extended over a longer period of time, as well as developing an enlarged smolder field that increases and prolongs smolder phase smoke impacts.

Response: The fuel breaks for 2007 have been increased to 200 ft and a request to have these established has been generated to BRAC environmental.

11. Humidity/Fuel Moisture – Suggest reviewing the humidity and fuel moisture conditions that existed during the fire. This information could be useful for refining the SMRx as moisture levels during the Range 16 burn appear to have been in an optimum range that supported rapid ignition, but not so dry as to allow the few spot fires to develop into full escapes.

Response: Analysis of data is on going and will be included in our 2007 prescription for smoke management.

12. Site-Specific SMR_x – Retain the basic template of the Range 16 SMRx. These could be refined for lessons learned during the Range 16 event as well as the site-specific setting of each subsequent burn. For instance, for locations closer to the perimeter of the IMPACT AREA, some wind directions may be more critical to consider if there are nearby residents or heavy fuel accumulations immediately downwind of the burn site.

Response: Template for Rx was generated for all burns and depending on the site features and escape potential each site will be given its own unique Rx with smoke management as a major issue.

13 Rapid Ignition – Retain the objective to burn the fuels as quickly and completely as possible during the ignition phase. This shortens the duration of the event and having more complete consumption during the ignition phase deprives the extended smolder phase of available fuels.

Response: Objective has been established and will remain in effect.

14. CALPUFF/MM5 – Continue to run the CALPUFF simulations for future burns. As with the FORA burns, the CALPUFF smoke forecasts provided a useful advanced qualitative indicator of the areas where the plume was most likely to be moving over during the various stages of the burn.

Response: Established and will remain in effect.

15. Event Momentum - While waiting for the critical time to develop to commence ignition (or not commence ignition); it should be made sure that the momentum of the event not "take on a life of its own", as may have been the case in 2003. With ignition ships in the air, commanders on the ground, hundreds of thousands of dollars at stake and the whole world watching, the meteorologists need to just focus on critical changes in wind and temperature environment to which the plume will be introduced to best guarantee the success of the burn in terms of air quality.

Response: Will include a separate individual for taking weather information and providing those updates to commanders on the ground.

16. Ember Fallout Pattern - It may be useful to reconstruct the winds and ember fall-out fields that existed at the time the resulting spot fires developed. Since MRS-16 was located in the middle of the former Army training lands, the off-site spot fires were extinguished and did not cause any significant problems. However, a similar fall-out field superimposed near the perimeter of the base near the urban interface or heavy vegetation could have a different result in terms of containment. The results of this review could be used to refine the wind prescription for burns near the perimeter of the base to avoid ember fall-out on sensitive or flammable areas to minimize the prospects of an escape.

Response: In progress and will be a deciding factor in the 2007 smoke management decision.

Lessons Learned from the MRS-16 Burn

October 19, 2006
Barry Callenberger
Burn Boss/Ignition Specialist

Over all the burn operations went well the ground ignition and the aerial ignitions went off without any problems. The following is a narrative of what went *right (in italics)* and what **could be done better (in bold print)** for the 2007 burn.

Overall the operation was very successful. POM fire did and excellent job of running the operations for the burn having the necessary support resources under POM command is the best command structure to accomplish the burning at Fort Ord.

Having all resources briefed for the burn the day prior to the burn was good it gave all the participants the time to ask questions and review the plan prior to the day of the burn. That allowed the burn day briefing to be short and focus on personnel safety.

Not having the original contracted helicopter company on site for the burn meant that the new companies had to be briefed and all the helibase locations revisited and the dip tanks relocated to meet the new pilots' specifications. This was a little disruptive but not an issue that potentially would have prevent the operation from continuing

Having the helibase manager made the air operations move along very well. It was a big asset to the overall operation. **I would recommend that he participate during the planning phase of the next years burns so that communications with the Monterey Airport can be established and all helibase locations and helicopter dip tank locations be acceptable to him. This would be helpful if there are any changes to helicopter companies and the air operations would be better prepared. With the burns only being permitted from July 1st to December 31st the availability of any single helicopter company will be difficult due to fire season commitments or training commitments.** *The helicopter companies used on this burn were excellent,* **The Type 2 helicopter had a chip light come on and was down after working mop up with a hydraulic leak and put it out of service for the second day. A report will be submitted by helibase manager on the incident.**

Two type 3 ignitions ships and two Type 2 suppression ships was the perfect number for this size burn they were manageable and provided back up support if one of the ships went out of service. Having the suppression ship airborne during burning operations was very good and allowed for quick suppression action on any spot fires.

Support from the California Department of Forestry and Fire Protection with 3 engines and a leader was excellent. This type of support is very important to the success of future burns. Using CDF as contingency resources for the burns is very good. Their support will continue to be very important in the future and I would encourage the Army to continue to keep them informed and a part of the planning operations.

We did have common communications with the helicopters and the helicopters could communicate with each other. **However, we did not have formal approval to use the frequencies that were used for air to ground communications. I would recommend that I or someone else contacts the BLM and or the communications department in Boise at NIFC to formalize an agreement to use the following on Fort Ord Burns. NIFC command frequency with repeater capabilities, a Tactical Frequency ie 168.000 or 168.200, and two air to ground Frequencies one being 170.000. I think that making sure that POM or DOD has approval is important to future burns. The frequencies that BLM had given us to use could not be programmed into the radios. The helicopters could not program the POM command or tactical frequencies into there radios they are too low a frequency for the helicopters. Any helicopter meeting the Forest Service specifications will have the capability to operate on the federal wildland radio frequencies and are commonly used on BLM, or FS fires or prescribed fires.**

The meteorology used for determining smoke dispersion and meeting the smoke prescription was the best ever. The conference calls to determine prescription needs and forecasting for burn days was very helpful and the website for weather predictions done by Wendell and the folks at NPS was the best. The air district and particularly Bob Nunes was a great team to work with on the burn as well as during the planning. I think that the planning and pre-burn weather work was the best we could have had and saved the Army a tremendous amount of money and time. **Only a few things to note that could have been improved on. One, a lot of emphasis was placed on smoke dispersion and not enough emphasis was placed on the fire environmental factors and prescription. For 2007, I would like to have an individual whose only duty is to provide surface weather information and to monitor the RAWS station's 10 hour fuel stick moistures. I can make this happen by providing a surface weather person. Fort Ord RAWS stations #2 had us out of prescription at 2:00, just after we completed the burning operations and had begun mop up. More attention needs to be paid to the surface weather factors that will affect the burning operations. An escaped fire will pose a bigger threat to the public than minor smoke impacts. An earlier start to the burning operations will be important.**

I think a lot was learned from this burn from the meteorology stand point that won't be difficult to improve on.

Ground suppression operations and ignition was excellent and the number and pieces of equipment was correct for this size an operation. The contract engines worked well with the POM fire department. The dip tanks were serviced by POM and Shaw which worked well. **The water tenders had some difficulty keeping up with filling the dip tanks for the helicopters and we learned that we will probably need a few larger dip tanks as we move into the impact area and that we may need to provide each dip tank with a water tender or get larger water tenders. As the burning moves away from paved roads and into the impact area water scuttles will take longer. Either an increase in helicopter turnarounds to the water source will increase of water tender scuttles will need to increase of a little of both. The helicopter dip tanks should be placed as close to paved roads as can be done. Shaw did bring on a second water tender on mop up day which helped but everyone using a lot of water kept them moving and they did get behind a bit.**

The Type 3 helicopters came with a hand held IR instrument which proved to be helpful during mop up operations. **I think that POM should invest in a hand held infrared instrument that can be made available to be flown on the burn. The cost would probably run about $10,000 but would be good insurance when experiencing spot fires. The instrument could be used to map hot spots during mop up or on the ground to be sure all spot fires are out.**

Response to Recommendations

Lessons Learned from the MRS-16 Burn

October 19, 2006

Barry Callenberger, Burn Boss/Ignition Specialist

Having Darryl Stockdale as the helibase manager made the air operations move along very well. Darryl was a big asset to the overall operation.

Recommendation:
I would recommend that he participate during the planning phase of the next years burn so that communications with the Monterey Airport can be established and all helibase locations and helicopter dip tank locations be evaluated by the helibase manager prior to mobilization day. This would be helpful if there are any changes to helicopter companies and the air operations would be better prepared. With the burns only being permitted from July 1st to December 31st the availability of any single helicopter company will be difficult due to fire season commitments or training commitments.

Response: Chief, Fire and Emergency Services concurs with recommendation and contract issues to have this implemented are being addressed through SHAW.

The meteorology used for determining smoke dispersion and meeting the smoke prescription was the best ever. The conference calls to determine prescription needs and forecasting for burn days was very helpful and the website for weather predictions done by Wendell and the folks at NPS were the best. The air district and particularly Bob Nunes was a great team to work with on the burn as well as during the planning. I think that the planning and preburn weather work was the best we could have had and saved the Army a tremendous amount of money and time.

Recommendation:
Only a few things to note that could have been improved on. One a lot of emphasis was placed on smoke dispersion and not enough emphasis were placed on the fire environmental factors and prescription. I would like to have an individual the next time whose only duty is to provide surface weather information and to monitor the RAWS station's 10 hour fuel stick moistures. I can make this happen by providing a surface weather person. When we were waiting for the upper air to come into prescription i.e. the up level jet to surface the surface environmental factors were moving to the hot side of the prescription. Had the acreage been larger or the ignition any later we probably would have gone out of prescription on the fire prescription. Going out of prescription on the surface weather parameters would have resulted in a shut down of burning operations or an escape. Fort Ord RAWS stations #2 had us out of prescription at 2:00, just after we completed the burning operations and had begun mop up. More attention needs to be paid to the surface weather factors that will affect the burning operations. An escaped fire will pose a bigger threat to the public than minor smoke impacts. An earlier start to the burning operations will be important.

Response: This aspect will be planned for and implemented for the 2007 burn.

Ground suppression operations and ignition was excellent and the number and pieces of equipment was correct for this size an operation. The High Sierra contract engines worked well with the POM fire department. The dip tanks were serviced by POM and Shaw which worked well.

Recommendation:

The water tenders had some difficulty keeping up with filling the dip tanks for the helicopters and we learned that we will probably need a few larger dip tanks as we move into the impact area and that we may need to provide each dip tank with a water tender or get larger water tenders. As the burning moves away from paved roads and into the impact area water scuttles will take longer. Either an increase in helicopter turnarounds to the water source will increase of water tender scuttles will need to increase of a little of both. The helicopter dip tanks should be placed as close to paved roads as can be done. Shaw did bring on a second water tender on mop up day which helped but everyone using a lot of water kept them moving and they did get behind a bit.

Response: Additional and larger capacity water trucks will be contracted for the 2007 burn.

The Type 3 helicopters came with a hand held IR instrument which proved to be helpful during mop up operations.

Recommendations:

I think that POM should invest in a hand held infrared instrument that can be made available to be flown on the burn. The cost would probably run about $10,000 but would be good insurance when experiencing spot fires. The instrument could be used to map hot spots during mop up or on the ground to be sure all spot fires are out.

Response: Purchase information is currently in progress and the purchase of will be completed prior to the 2007 burn.

Appendix E

Response to Comments