



## **ICA COMMISSION AGENDA**

December 4, 2013

ADOSH Director Bill Warren and Marshall Krotenberg, ADOSH Safety Compliance Supervisor, will be presenting at the December 4, 2013 Commission meeting.

### **FATALITY/ACCIDENT**

1. L3419-317242683  
Arizona State Forestry Division

ICA AGENDA

12/4/13

Arizona State Forestry Division  
1110 W. Washington St, Ste 100  
Phoenix, AZ 85007

Years in Business: 100  
Employed in establishment: 325  
Covered by inspection: 325  
Controlled by employer: 325

INSPECTION NO: L3419-317242683  
INSPECTION TYPE: FATALITY/ACCIDENT  
INSPECTION DATE: 07/01/2013  
SITE LOCATION: Weaver Mountains/Yarnell Hill Fire  
Yarnell, AZ 85362

TYPE OF INDUSTRY: Forestry/Wildland Fire

PREVIOUS HISTORY: No inspections in the past three years.

**Background:** On the evening of Friday, June 28, 2013, lightning ignited a small fire on a peak in the Weaver Mountains located west of the Arizona towns of Yarnell, Glen Ilah, and Peebles Valley. Initial attack efforts initiated by Arizona State Forestry Division (ASFD) on Saturday, June 29, 2013, were unable to suppress the eight acre fire in steep, rocky, chaparral fuels. By the evening of June 29, 2013, the fire had escaped initial attack and had grown to over 100 acres. That evening ASFD began ordering a Type 2 Incident Management Team (overhead), crews, and resources to begin an extended attack the following day. Due to extreme fire behavior and afternoon thunderstorm winds, firefighting efforts to control the fire on Sunday, June 30, 2013 were futile. On that day the fire burned over 8,00 acres of wildland, over 114 structures, and resulted in multiple instances of firefighters being unnecessarily and unreasonably exposed to the deadly hazards of wildland firefighting, the most catastrophic being the entrapment, burn-over, and deaths of 19 members of the Granite Mountain IHC.

**CITATION 1 – WILLFUL SERIOUS**

Item 1 – The employer did not furnish to each of his employees employment and a place of employment which were free from recognized hazards that were causing or likely to cause death or serious physical harm to their employees, in that the employer implemented suppression strategies that prioritized protection of non-defensible structures and pastureland over firefighter safety, and failed to prioritize strategies consistent with Arizona State Forestry Division – Standard Operational Guideline 701 Fire Suppression and Prescribed Fire Policy (2008). When the employer knew that suppression of extremely active chaparral fuels was ineffective and that wind would push active fire towards non-defensible structures, firefighters working downwind were not promptly removed from exposure to smoke inhalation, burns, and death: (23-403(A)).

- a) Yarnell Hill Fire, Yarnell, Arizona: On June 30, 2013, between 1230 and 1430, and after general public had been evacuated, thirty-one members of Structure Protection Group 2, charged with protecting non-defensible structures in the vicinity of the Double Bar A Ranch, were exposed to smoke inhalation, burns, and death by wind driven wildland fire.
- b) Yarnell Hill Fire, Yarnell, Arizona: On June 30, 2013, from and after 1530, one member of the Granite Mountain Interagency Hotshot Crew that continued to serve as a lookout was exposed to smoke inhalation, burns, and death by a rapidly progressing wind driven wildland fire.
- c) Yarnell Hill Fire, Yarnell, Arizona: On June 30, 2013, from and after 1530, approximately thirty firefighters continued indirect attack activities in Division Z (Zulu) and were exposed to smoke inhalation, burns, and death by a rapidly progressing wind driven wildland fire.
- d) Yarnell Hill Fire, Yarnell, Arizona: On June 30, 2013, from and after 1530, 19 members of the Granite Mountain Interagency Hotshot Crew continued in suppression activities, until 1642 when they were entrapped by a rapidly progressing wind driven wildland fire.

Prob. of Injury/ Illness or No. Cal. Days Uncorr.	Gravity- Based Penalty	Adjustment Factors				Formula Amount	Division Proposal
		<u>1) Size</u>	<u>2) Good Faith</u>	<u>3) History</u>	<u>4) Total</u>		
<b>HG</b>	<b>\$70,000.00</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>\$70,000.00</b>	<b>\$70,000.00</b>

Prob. of Injury/ Illness or No. Cal. Days Uncorr.	Gravity- Based Penalty	Adjustment Factors				Formula Amount	Division Proposal
		<u>1) Size</u>	<u>2) Good Faith</u>	<u>3) History</u>	<u>4) Total</u>		
<b>23-418.01</b>	<b>n/a</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>\$ 475,000.00</b>	<b>\$ 475,000.00</b>

A.R.S. Section 23-418.01: An Additional penalty of \$25,000 is assessed under A.R.S. section 23-418.01 for each employee that died.

## CITATION 2 – SERIOUS

Item 1 – The employer did not furnish to each of his employees employment and a place of employment which were free from recognized hazards that were causing or likely to cause death or serious physical harm to their employees, in that the employer failed to implement fire suppression plans consistent with A.R.S. Section 37-623 Suppression of wildfires and Arizona State Forestry Division – Standard Operational Guideline 701 Fire Suppression and Prescribed Fire Policy (2008) in a timely fashion during the life-threatening transition between initial attack and extended attack fire operations thereby reducing the risk of firefighter exposure to smoke inhalation, burns, and death: (23-403(A)).

- a) Yarnell Hill Fire, Yarnell, Arizona: On June 29, 2013, when the fire escaped initial attack, an incident complexity analysis was not conducted and reviewed by fire management to ensure that wildfires increasing in a complexity are quickly identified and a safe transition occurs to the appropriate level incident response.
- b) Yarnell Hill Fire, Yarnell, Arizona: On June 29, 2013, when the fire escaped initial attack, an Escaped Fire Situational Analysis (EFSA) or similar Wildland Fire Situation Analysis (WFSAs), Wildland Fire Decision Support System (WFDSS), or Operational Needs Assessment was not conducted by fire management to ensure a safe transition to extended attack.
- c) Yarnell Hill Fire, Yarnell, Arizona: On June 29, 2013, after the fire escaped initial attack and prior to transitioning to a more complex management team, an Incident Action Plan (IAP) containing objectives reflecting the overall incident strategy, specific tactical actions, and supporting information for the next operational period was not conducted by fire management to ensure a safe transition to extended attack.

Prob. of Injury/ Illness or No. Cal. Days Uncorr.	Gravity- Based Penalty	Adjustment Factors				Formula Amount	Division Proposal
		<u>1) Size</u>	<u>2) Good Faith</u>	<u>3) History</u>	<u>4) Total</u>		
<b>HG</b>	<b>\$7,000.00</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>\$ 7,000.00</b>	<b>\$ 7,000.00</b>

Item 2 – The employer did not furnish to each of his employees employment and a place of employment which were free from recognized hazards that were causing or likely to cause death or serious physical harm to their employees, in that pursuant to Arizona State Fire Division Standard Operating Guideline SOG-701, transition from initial attack to an extended attack operations is extremely dangerous and critical incident management personnel necessary to support the planning and implementation of fire suppression operations arrived late or were absent from their assigned positions during the life-threatening transition thereby increasing the risk of firefighter exposure to smoke inhalation, burns, and death: (23-403(A)).

- a) Yarnell Hill Fire, Yarnell, Arizona: On or about June 30, 2013, fire management positions of Safety Officer and Planning Section Chief were unfilled and therefore unable to participate during critical fire suppression planning, transition planning, and oversight of ongoing wildfire suppression operations.
- b) Yarnell Hill Fire, Yarnell, Arizona: On June 30, 2013, at approximately 1330, Division Z Supervisor departed from his assigned position which left Division Z without supervision during ongoing wildfire suppression operations.

Prob. of Injury/ Illness or No. Cal. Days Uncorr.	Gravity- Based Penalty	Adjustment Factors				Formula Amount	Division Proposal
<b>HG</b>	<b>\$7,000.00</b>	<u>1) Size</u> <b>0%</b>	<u>2) Good Faith</u> <b>0%</b>	<u>3) History</u> <b>0%</b>	<u>4) Total</u> <b>0%</b>	<b>\$ 7,000.00</b>	<b>\$ 7,000.00</b>

**TOTAL PROPOSED PENALTY                    \$559,000.00    \$559,000.00**





# Inspection Narrative

Inspection Nr.	317242683
Opt. Case Number	0618

Establishment Name	Arizona State Forestry Division		
Legal Entity		Type of Business	Forestry/Wildland Fire

Additional Citation Mailing Addresses

Organized Employee Groups

Authorized Employee Representatives

Employer Representatives Contacted

Name	Title	Function	Walk Around?
Scott Hunt	State Forester	I O C M	N
David Geyer	Fire Management Officer	I O C M	N
Elizabeth Nehring	Administrative Secretary	M	N
Jerry Payne	Deputy State Forester	M	N
Jim Downey	Phoenix Dist Forester	M	N
Brian Lauber	Planning Section Chief	M	N
Paul Musser	Agency Representative	M	N
Roy Hall	Incident Commander	M	N
Russell J Shumate	Asst Fire Mngt Officer	M	N
Byron Kimball	Fire Behavior Analyst	M	N
Glenn Joki	Incident Commander	M	N
Paul A Katz	Asst Attorney General	C	N
Brad Zettler	Air Support	M	N
Jake Guadiana	Crew Coordinator-Lewis	M	N
Justin Smith	Crew Coordinator-Perry	M	N
Will Brewer	Asst Fire Mngt Officer	M	N
Norval Tyler	AZ Dispatch Center Lead	M	N
Bill Astor	Safety Officer	M	N
Brock Heathcotte	Asst. Attorney General	C	N

Other Persons Contacted

Entry	07/01/13	13:30	First Closing Conference	12/03/13	09:30
Opening Conference	07/01/13	13:30	Second Closing Conference		
Walkaround	07/01/13	14:00	Exit	12/03/13	11:20
			Case Closed		

Penalty Reduction Factors					
Size	0	Good Faith	0	History	10

Followup Inspection?		Reason	
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## Coverage Information/Additional Comments

Inspection Number

317242683

**COVERAGE INFORMATION:**

(Provide a summary of the inspection, the establishment and nature of work)

On July 1, 2013, at approximately 1330 hours ADOSH Director Warren, ADOSH Supervisor Krotenberg, and ADOSH Compliance Officer Hanna visited the Yarnell Hill Incident Command Post, met with Safety Officer Gillispie, and Arizona State Forestry Division District Forester Jim Downey. Due to ongoing fire suppression operations inspection of the accident scene and operations was postponed. The Yavapai County Sheriff's Office maintained control of the incident scene which was inspected by ADOSH Supervisor Krotenberg on July 3, 2013.

On July 15, 2013, a formal opening conference was conducted with the Arizona State Forestry Division.

**FINDINGS**

(Mark the applicable boxes with an "X" and explain findings)

 Complaint Items: Referral:  
Received from: Accident Investigation Summary & Findings**Notification & Synopsis:**

On June 30, 2013 at 2130 Arizona State Forestry Division (ASFD) Deputy State Forester Jerry Payne telephoned the ADOSH Hotline and left a message regarding the workplace death of 19 firefighters from Granite Mountain Interagency Hotshot Crew (Granite Mountain IHC or GMIHC) who had been killed working the Yarnell Hill Fire when their position was overrun by flames (entrapment and burnover). Shortly thereafter, ADOSH Supervisor Marshall Krotenberg was notified by Hotline operators and telephoned Mr. Payne to obtain more information about what happened.

On the evening of Friday, June 28, 2013, lightning ignited a small fire on a peak in the Weaver Mountains located west of the Arizona towns of Yarnell, Glen Ilah, and Peoples Valley. Initial attack efforts initiated by ASFD on Saturday, June 29, 2013, were unable to suppress the eight acre fire in steep, rocky, chaparral fuels. By the evening of June 29, 2013, the fire had escaped initial attack and had grown to over 100 acres. That evening ASFD began ordering a Type 2 Incident Management Team (overhead), crews, and resources to begin an extended attack the following day. Due to extreme fire behavior and afternoon thunderstorm winds, firefighting efforts to control the fire on Sunday, June 30, 2013 were futile. On that day the fire burned over 8,000 acres of wildland, over 114 structures, and resulted in multiple instances of firefighters being unnecessarily and unreasonably exposed to the deadly hazards of wildland firefighting, the most catastrophic being the entrapment, burn-over, and deaths of 19 member of the Granite Mountain IHC.

**Investigation Details:****OPENING CONFERENCE:**

On July 15, 2013 an opening conference was conducted with ASFD. In attendance were Scott Hunt (State Forester), David Geyer (Fire Management Officer), Marshall Krotenberg (ADOSH Safety Compliance Supervisor and Lead Investigator), Bruce Hanna (ADOSH Compliance Officer) and Brett Steurer (ADOSH Compliance Officer). The opening conference was cordial.

**ASFD JURISDICTION, PERSONNEL AND OPERATIONAL STRUCTURE:**

The Yarnell Hill Fire burned predominately on Arizona State trust land and private land. As a result, the fire was managed by ASFD. The ASFD has the following powers and duties under A.R.S. Section 37-623:

*"The State Forester shall have authority to prevent and suppress any wildfires on state and private lands located outside incorporated municipalities and lands covered by cooperative fire agreements or on any lands in this state or other states, Mexico or Canada."*

*"The State Forester may enter into cooperative agreements with other state and federal agencies, departments and political subdivisions and any person for: prevention and suppression of wildfires; and, assistance with fire and nonfire national and state emergencies and multiagency logistical support in this state and other states."*

**ASFD wildfire management and personnel and operational structure:**

State Forester Scott Hunt;

Deputy State Forester Jerry Payne;

Fire Management Officer (FMO) David Geyer;

Three District Forester positions;

Two Assistant Fire Management Officers (AFMO) working for each District Forester;

There are twelve Crew Coordinators, one for each Department of Corrections Inmate Type 2 Hand Crew. The Crew Coordinators are supervised by the AFMO's.

ASFD manages the Arizona Dispatch Center located in Phoenix, Arizona.

ASFD employs 131 full time and seasonal employees. Depending upon need, the State Forester may request personnel and resources (equipment, aviation, services) from approximately 250 cooperating agencies located throughout Arizona and New Mexico.

ASFD deployed 21 state employees to the Yarnell Hill Fire. Another 66 cooperators sent resources and personnel to the fire. Approximately 20 private contractors also responded as did several Arizona Department of Corrections (AZDOC) Inmate Type 2 wildland firefighting hand crews (Arizona State Prison Complex - Lewis, Yuma, Florence and Globe). At the time of the incident, ASFD managed approximately 325 firefighters and various resources.

**DOCUMENTS REVIEWED:**

A large number of documents related to the fire were requested from State Forester Scott Hunt. In addition, reference documents were downloaded from internet sites maintained by the National Wildfire Coordinating Group (NWCG), NWCG Lessons Learned Center, National Interagency Fire Center (NIFC), and the Southwest Wildfire Coordinating Center (SWCC).

Documents provided by ASFD included: The Incident Response Pocket Guide, PMS 461, NFES 1077, January 2010; Wildland Fire Incident Management Field Guide, PMS 210, April 2013; Standards for Interagency Hotshot Crew Operations February 4, 2011; Interagency Standards for Fire and Fire Aviation Operations, NFES 2724, January 2013; Fireline Handbook, PMS 410-1, NFES 0065, March 2004; the Standard Operational Guidelines (SOG's) provided by ASFD along with A.R.S. Section 37-623 Suppression of wildfires; powers and duties of State Forester; entry on private lands are the standards used to suppress wildfires and provide for firefighter safety.

A second meeting was held on Tuesday July 30, 2013 at ADOSH with FMO David Geyer and Special Projects Coordinator Brian Lauber who served as Planning Section Chief Type 2 on the Yarnell Hill Fire. Lauber provided a compressed or redacted list of employers/resources (ASFD employees, Hotshot crews, Inmate hand crews, Municipal fire crews, Bureau

of Land Management, Forest Service) working on the fire as of the morning of June 30, 2013 through the entrapment of the Granite Mountain IHC.

## PERSONNEL INTERVIEWS:

### ASFD:

Interviews were conducted with ASFD management on August 14-16, 2013, August 21, 2013, August 23, 2013, October 15, 2013, October 18, 2013, and October 22, 2013. All management personnel were represented by State of Arizona Assistant Attorney General Paul A. Katz. The following personnel were interviewed and are listed in the order of the interview. All interviews were digitally recorded and the interviews were transcribed.

Jim Downey, District Forester, Central region including Phoenix;

Glenn Joki, Incident Management Type 2 Team, Incident Commander;

Brian Lauber, Planning Section Chief Type 2, Special Projects;

Russ Shumate, Incident Commander Type 3 and Type 4, Assistant Fire Management Officer;

Brad Zettler, Air Support;

Byron Kimball, Fire Behavior Analyst;

Paul Musser, Incident Commander Type 3, Operations Section Chief, Agency Representative;

Roy Hall, Incident Commander Type 2, Incident Management Team;

Scott Hunt, State Forester;

David Geyer, Fire Management Officer;

Justin Smith, Division Supervisor, Crew Coordinator-ASPC Perryville;

Will Brewer, Logistics and Communications, ASFD Engine Boss (Engine 151), Assistant Fire Management Officer, Central Phoenix Region,

Norval Tyler, Arizona Dispatch Center Lead;

Bill Astor, Safety Officer, Incident Management Team and Facilities Safety Officer.

The following individuals under the direction of the ASFD on the Yarnell Hill Fire were also interviewed either in person or over the telephone:

Todd Abel, Operations Section Chief, Captain for the Central Yavapai Fire District;

Gary Cordes, Structure Group 1 Supervisor (Yarnell), Battalion Chief/Training Officer for the Central Yavapai Fire District;

Patrick McCray, Captain for the Peoples Valley Fire Department;

Jake Moder, Structure Group 1 resource assigned to Yarnell, Captain for the Peoples Valley Fire Department;

Ron Smith, Structure Group 1 resource assigned to Yarnell, Captain for the Peoples Valley Fire Department;

Jim Koile, Fire Chief for the Yarnell Fire District;

Brad Haggard, Water Tender, Structure Group 1 resource, Captain for the Yarnell Fire District;

Sean Portillo, Water Tender, Structure Group 1 resource, Captain for the Yarnell Fire District;

Tyson Esquibel, Task Force Leader Trainee assigned to Structure Group 1 (Yarnell), Firefighter for the Peoria Fire Department;

Arizona Department of Corrections - AZDOC:

Sergeant Joe Barreras, assigned to Division Alpha, ASPC-Lewis Inmate hand crew;

Correctional Officer II Leo Vasquez, assigned to Division Alpha, ASPC-Lewis inmate hand crew;

Jake Guadiana, Crew Coordinator, assigned to Division Alpha, Arizona State Forestry Division, ASPC-Lewis inmate hand crew;

Sergeant Chad Blackwell, Structure Group 2 resource (Double Bar A Ranch, Model Creek Subdivision, Peeples Valley), ASPC-Yuma inmate hand crew;

Sergeant Parker, assigned to Incident Command Post initially, ASPC-Florence inmate hand crew;

Sergeant Paulson, Structure Group 2 resource (Double Bar A Ranch, Model Creek Subdivision, Peeples Valley), ASPC-Globe inmate hand crew.

City of Prescott Fire Department, Granite Mountain IHC:

Fire Chief Dan Fraijo, City of Prescott;

Darrell Willis, Structure Group 2 Supervisor assigned to Double Bar A Ranch, Model Creek Subdivision and Peeples Valley, Wildland Division Chief, City of Prescott;

Tony Sciacca, Safety Officer, Battalion Chief, City of Prescott;

Brendan McDonough, Division Alpha Lookout, Granite Mountain IHC, City of Prescott;

Tom Cooley, Temporary Captain, Granite Mountain IHC, Firefighter, City of Prescott.

United States Department of the Interior, Bureau of Land Management (BLM):

Rance Marquez, Division Zulu Supervisor, State Fuels Lead, Arizona State Office, Bureau of Land Management;

Dan Philbin, Division Supervisor from the Central West Zone assigned to Division Zulu and Structure Group 1, Assistant Fire Management Officer, Phoenix Office, Bureau of Land Management;

Paul Lenmark, Bravo 3, Air Tactical Group Support, Bureau of Land Management, Boise, Idaho;

Rusty Warbis, Bravo 3, Air Tactical Group Support, Bureau of Land Management, Boise, Idaho.

Arizona Department of Public Safety:

Ranger 58 Helicopter crew members Clifford Brunsting, DPS Helicopter Pilot; and Eric Tarr, DPS Medic/Officer.

Others:

Local Hikers Sonny Gilligan and Joy Collura from Congress, Arizona.

It should be noted that the United States Department of Agriculture - Forest Service (USDS-FS) denied ADOSH's requests to interview USDA-FS employees (Blue Ridge IHC and an Air Attack crew) who were working the Yarnell Hill Fire under cooperative agreement with ASFD. USDA-FS did provide redacted copies of written documents produced by members of the Blue Ridge Interagency Hotshot Crew describing their activities on June 30, 2013. The redactions included not only the names of Blue Ridge IHC personnel, but all names, as well as information USDA-FS stated was of a sensitive nature. As a result, the documents were useless in ADOSH's investigation.

In addition, ATGS Rory Collins failed to return multiple telephone messages requesting a return call and, accordingly, was not interviewed.

#### **INVESTIGATION CHRONOLOGY:**

July 1, 2013 - ADOSH Director Warren, ADOSH Compliance Supervisor Krotenberg, and ADOSH CSHO Hanna visit the Yarnell Hill Fire incident command post, make contact with incident staff, and offered assistance. Incident staff did not request any assistance.

July 2, 2013 - ASFD notified ADOSH that it would be permitted to participate as a member of the Serious Accident Investigation Team assembled on the behalf of ASFD. ADOSH Krotenberg contacts ASFD Deputy State Forester Jerry Payne to confirm meeting location and time.

July 2, 2013 - Krotenberg meets with ASFD Deputy State Forester Payne at the Phoenix Dispatch Center, is briefed on the incident, and Payne requested Krotenberg return the following morning to meet up with the Serious Accident Investigation Team (SAIT) as most members were in transit.

July 3, 2013 - ADOSH Krotenberg meets with SAIT at 0700 hours. Krotenberg and SAIT travel to Yarnell Hill Fire to inspect the fatality scene.

July 4, 2013 - ADOSH Krotenberg attends 0700 SAIT morning briefing. Shortly thereafter, Krotenberg was advised by ASFD Hunt and SAIT managers Karels and Dudley that the SAIT Team will be moving forward with its investigation without ADOSH participation.

July 10, 2013 - ADOSH opens an inspection with City of Prescott Fire Department. ADOSH requests documents from the City of Prescott.

July 10, 2013 - ADOSH Steurer and Hanna meet with Yavapai County Sheriff's Office (YCSO) Detective John McDormett to discuss obtaining investigative report, videos, 3-D imaging and photos of the deployment scene.

July 12, 2013 - ADOSH retains Wildland Fire Associates (WFA).

July 15, 2013 - ADOSH opens inspection with ASFD and requests documents.

July 16, 2013 - ADOSH/WFA investigation team meet in Phoenix followed by site visit.

July 18, 2013 - ADOSH opens inspection with Yarnell Fire District and visits Peoples Valley Fire Station. The Peoples Valley Fire Station is unmanned. ADOSH travels to Prescott and obtains previously requested documents from the City of Prescott. ADOSH visits Yavapai County Evidence Storage and inspects remaining evidence (19 body bags with personal items, radios, shelters, etc.). ADOSH receives three discs that contain photographs of the deployment scene.

July 23, 2013 - ADOSH Krotenberg begins calling next of kin and provides notification that ADOSH is investigating the deaths of the 19 firefighters.

July 24, 2013 - First set of documents requested from ASFD available for pick-up by ADOSH.

July 24, 2013 - ADOSH makes second request for additional documents to ASFD Hunt.

July 24, 2013 - ADOSH Hanna interviews Yarnell Fire Department Captain Brad Haggard and Captain Sam Portillo over the telephone.

July 25, 2013 - ADOSH Krotenberg completes calls to next of kin.

July 29, 2013 - ADOSH e-mails Arizona Department of Corrections (AZDOC) requesting information regarding staff that worked the Yarnell Hill Fire.

July 29, 2013 - ADOSH e-mails Blue Ridge Hotshot Superintendent Brian Frisby and Assistant Superintendent/Captain Rogers Trueheart Brown requesting information regarding staff that worked the Yarnell Hill Fire.

July 29, 2013 - ADOSH Hanna contacts Peebles Valley Fire Captain Patrick McCray and interviews Captain Jake Moder over the telephone.

July 30, 2013 - ADOSH Krotenberg, Hanna and Steurer meet with ASFD employees David Geyer and Brian Lauber at ADOSH.

July 30, 2013 - ADOSH Hanna contacts the Central Yavapai Fire District (CYFD) to schedule interviews with Todd Abel and Gary Cordes.

July 30, 2013 - ADOSH meets with FMO David Geyer and Special Projects Coordinator Brian Lauber who served as Planning Section Chief Type 2 on the Yarnell Hill Fire. Lauber states that he is in the process of obtaining additional documentation requested by ADOSH Team Lead Investigator Marshall Krotenberg. Lauber also states that he will provide a compressed or redacted list of employers/resources (ASFD employees, Hotshot crews, Inmate hand crews, Municipal fire crews, Bureau of Land Management, Forest Service) working on the fire as of the morning of June 30, 2013 through the entrapment of the Granite Mountain IHC.

July 31, 2013 - YCSO e-mails ADOSH that requested records were available for pick-up.

August 2, 2013 - ADOSH requests unit logs from ASFD for BLM employees working Yarnell Hill Fire.

August 5, 2013 - ADOSH Director Warren sends condolence letters to next of kin.

August 6, 2013 - ADOSH sends second e-mail request to Arizona Department of Corrections (AZDOC) requesting information regarding staff that worked the Yarnell Hill Fire.

August 6, 2013 - ADOSH Krotenberg e-mails BLM FMO Castillo requesting interview with BLM employee Marquez.

August 7, 2013 - ADOSH sends third e-mail request to (AZDOC) requesting information regarding staff that worked the Yarnell Hill Fire.

August 7, 2013 - AZDOC Smith e-mails ADOSH providing the names and contact information for AZDOC staff that worked the Yarnell Hill Fire.

August 9, 2013 - AZDOC Smith e-mails ADOSH authorizing ADOSH investigators to interview AZDOC staff.

August 11, 2013 - ADOSH receives e-mail from hikers Sonny Gilligan and Joy Collura that were at the fire on June 30, 2013.

August 12, 2013 - ADOSH Krotenberg sends e-mail response to hikers.

August 14-16, 2013 - ADOSH interviews ASFD staff.

August 19, 2013 - ADOSH conducts interviews with City of Prescott employees Dan Fraijo and Darrell Willis. The City of Prescott Attorney Jon Paladini is present for the interviews.

August 19, 2013 - ADOSH consultant Hicks is notified by USDA-FS Regional Acting Deputy Director Graham to provide ADOSH contact information to coordinate interviews with USDA-FS Aviation staff working Yarnell Fire.

- August 19, 2013 - ADOSH receives photos from a Yarnell resident.
- August 19, 2013 - ADOSH consultant Hicks is notified by USDA-FS French that a Touhy request would be required for authorization for interview USDA-FS personnel.
- August 20, 2013 - ADOSH Krotenberg e-mails BLM Castillo requesting status of interview with Marquez.
- August 20, 2013 - Krotenberg e-mails USDA-FS Graham requesting interviews with Aviation staff. Graham responds that the request was forwarded to USDA-FS Office of General Counsel (USDA-OGC).
- August 20, 2013 - ADOSH conducts interviews with City of Prescott employees Tony Sciacca and Brendan McDonough. Brendan McDonough has his personal attorney Emily Dolan present for his interview.
- August 21, 2013 - ADOSH e-mails request to USDA-FS for audio/video associated with retardant study conducted at Yarnell Hill Fire on June 30, 2013.
- August 22, 2013 - USDA-OGC Hattenbach e-mails ADOSH providing information to complete Touhy request for documents and interviews of USDA-FS employees.
- August 22, 2013 - ADOSH interviews CYFD Captain Todd Abel.
- August 26, 2013 - ADOSH Krotenberg e-mails T. Zachary Barnett in the federal OSHA Phoenix office requesting assistance in obtaining authorization to interview DOI-BLM and USDA-FS employees as well as copies of their unit logs.
- August 27, 2013 - US Department of Interior (DOI), Office of the Field Solicitor responds to ADOSH's
- August 28, 2013 - ADOSH Hanna interviews Peoria Firefighter Tyson Esquibel who was assigned to the Yarnell Hill Fire as a Task Force Leader Trainee for Structure Protection Group 1.
- August 29, 2013 - USDA-FS responds by letter to ADOSH that requested aerial audio/video recordings will be sent shortly.
- August 29, 2013 - ADOSH Krotenberg e-mails USDA-FS Hattenbach requesting update on request to interview FS personnel.
- August 29, 2013 - ADOSH Krotenberg e-mails DOI-BLM Castillo requesting update on progress towards interviews with BLM employees.
- August 30, 2013 - USDA-FS Hattenbach e-mails ADOSH Krotenberg with update regarding interviews of USDA-FS personnel. He advises that no interviews likely to occur until end of season. ADOSH must submit requests in writing.
- August 30, 2013 - United States Department of Interior (DOI), Office of the Solicitor, responds by letter to ADOSH 8-20-13 request for documents and interviews with DOI-BLM employees. DOI states ADOSH must submit a Touhy request for review by DOI.
- September 3, 2013 - ADOSH receives USDA-FS video of retardant study that occurred on Yarnell Hill Fire. Audio had been redacted.
- September 3, 2013 - ADOSH Krotenberg receives e-mail from federal OSHA Phoenix Office Barnett indicating that Federal OSHA efforts to assist ADOSH in obtaining access to Federal employees was not going well.
- September 4, 2013 - ADOSH Krotenberg e-mails Maughan Ranches requesting access to their property for follow-up visit to fire scene. Don Glasgow provides ADOSH Krotenberg approval during telephone conference.
- September 4, 2013 - ADOSH Hanna makes second request for additional documents to City of Prescott.
- September 4, 2013 - ADOSH e-mails five ex-Granite Mountain Hotshots requesting interviews.



- September 5, 2013 - ADOSH receives YCSO letter requesting guidance regarding disposition of evidence in their possession.
- September 5, 2013 - ADOSH Hanna interviews ASPC Lewis (Guadiana, Barreras and Vasquez), ASPC Yuma (Blackwell), ASPC Globe (Paulson) and ASPC Florence (Parker) over the telephone.
- September 6, 2013 - ADOSH submits Touhy Request to DOI Viscusi for interviews and unit logs for DOI-BLM employees that worked the Yarnell Hill Fire.
- September 6, 2013 - ADOSH e-mails request to City of Prescott requesting ex-Granite Mountain Hotshot/current City of Prescott employee clarification.
- September 11, 2013 - ADOSH e-mails National Oceanic and Atmospheric Administration (NOAA) Ocana requesting specific weather data.
- September 11, 2013 - ADOSH interviews CYFD Battalion Chief/Training Officer Gary Cordes.
- September 13, 2013 - USDA-FS responds by letter to ADOSH 9-5-13 request to obtain activity log for Blue Ridge IHC. USDA-FS is re-routing ADOSH request to USDA FOIA service center for review.
- September 13, 2013 - DOI Viscusi responds by letter to ADOSH granting access to interview Lenmark and Warbis.
- September 16, 2013 - ADOSH sends Touhy Request to USDA-FS Hattenbach regarding interviews with Forest Service employees that worked the Yarnell Hill Fire.
- September 16, 2013 - DOI, Office of the Field Solicitor grants request to interview Marquez and Philbin and for Marquez's notes subject to specified conditions.
- September 17, 2013 - City of Prescott provides partial submittal of documents pursuant to ADOSH second request for documents.
- September 18, 2013 - ADOSH Steurer and Hanna meet with Hikers Collura and Gilligan at Yarnell and hike the route taken by the Granite Mountain IHC on June 30, 2013.
- September 19, 2013 - ADOSH requests YCSO incident report.
- September 20, 2013 - ADOSH receives response from NOAA McCown regarding records request. Records are available. Cost would be about \$6,000.00.
- September 23, 2013 - ADOSH interviews DOI-BLM employees Rance Marquez and Dan Philbin.
- September 23, 2013 - YCSO provides requested reports.
- September 24, 2013 - ADOSH interviews DOI-BLM employees Lenmark and Warbis.
- September 24, 2013- ADOSH interviews Aerial Supervision Module One (Bravo 3) BLM employees Paul Lenmark and Rusty Warbis via telephone.
- September 26, 2013 - ADOSH Krotenberg e-mails ASFD Geyer a third request for additional information and to schedule follow-up interviews.
- September 27, 2013 - ADOSH submits request to DOI-BLM Viscusi for photographs from Lenmark/Warbis.
- September 29, 2013 - SAIT report published online.
- October 1, 2013 - Federal government employee's furloughed. Contacts for USDA-FS are unavailable.
- October 2, 2013 - ADOSH Krotenberg e-mails ASFD Geyer requesting time sheets for Shumate and SAIT documentation.

October 3, 2013 - Arizona Assistant Attorney General (AZAG) Katz notified ADOSH that SAIT investigation documents are available for ADOSH.

October 3, 2013 - ADOSH Hanna e-mails City of Prescott requesting follow-up interviews with Willis, McDonough, Sciacca, and first interview with Tom Cooley.

October 3, 2013 - City of Prescott e-mails ADOSH Hanna confirming interviews with Willis and Cooley. Interview with McDonough pending and Sciacca is out of the country until October 22, 2013.

October 4, 2013 - ADOSH receives copy of SAIT documents on portable hard drive from AZAG Katz.

October 7, 2013 - ADOSH receives partial package of documents requested from ASFD.

October 8, 2013 - City of Prescott confirms interview with McDonough.

October 10, 2013 - ADOSH conducts interviews with City of Prescott employees Tom Cooley, Darrell Willis and Brendan McDonough. The City of Prescott Attorney Jon Paladini is present for Cooley and Willis's interviews.

October 15, 2013 - ADOSH conducts a third interview with ASFD District Forester Jim Downey, second interview with Incident Commander Roy Hall, and first interview with Crew Coordinator Justin Smith.

October 18, 2013 - ADOSH conducts interview with ASFD Incident Management Team Safety Officer Bill Astor, Arizona Dispatch Center Lead Norval Tyler and second interview with Incident Commander Russ Shumate.

October 22, 2013 - ADOSH conducts interview with ASFD Assistant Fire Management Officer and Engine Boss Will Brewer. ADOSH conducts a follow-up interview with Crew Coordinator Justin Smith over the telephone concurrent with the Brewer interview.

October 23, 2013 - ADOSH telephone call with USDA-FS Hattenbach regarding interviews with Forest Service employees that worked the Yarnell Hill Fire. USDA-FS is still contemplating ADOSH interviews of FS employees.

October 29, 2013 - ADOSH Krotenberg interviews Sergeant Chad Blackwell from the Arizona Department of Corrections - Yuma Complex

October 30, 2013 - ADOSH receives response from the United States Department of Agriculture, Office of the General Counsel denying ADOSH's request to interview United States Forest Service employees (Blue Ridge IHC and ASM-2 Bravo 33 Thomas French and John Burfiend).

November 7, 2013 - ADOSH receives a CD from the United States Department of Agriculture containing 40 pages of responsive records regarding the Yarnell Hill Fire with respect to the "Activity Log" for the Blue Ridge IHC for June 30, 2013.

November 11, 2013 - ADOSH Krotenberg requests time cards and firefighter qualifications for ASFD fire management staff.

#### **WILDLAND FIRE ACRONYMS:**

A/G - Air to Ground

ADC - Arizona Dispatch Center

AFMO - Assistant Fire Management Officer

ASM - Aerial Supervision Module (is a two person crew functioning as the Lead and ATGS from the same aircraft)

ATGS - Air Tactical Group Supervisor (Air Attack)

BLM - Bureau of Land Management

BRIHC - Blue Ridge Interagency Hotshot Crew

C&G - Command and General Staff

DIVS - Division Supervisor (The Field Operations Section Chief designated two divisions on June 30, 2013; Division Alpha and Division Zulu)

DOC - Department of Corrections

FBAN - Fire Behavior Analyst

FMO - Fire Management Officer

GMIHC - Granite Mountain Interagency Hotshot Crew

HEQB - Heavy Equipment Boss (supervises and directs the dozer operator)

IA - Initial Attack

IAP - Incident Action Plan

IC - Incident Commander

ICP - Incident Command Post

ICS - Incident Command System

ICT1- Incident Commander Type 1

ICT2 - Incident Commander Type 2

ICT3 - Incident Commander Type 3

ICT4 - Incident Commander Type 4

IMT - Incident Management Team

IMT2 - Incident Management Team Type 2

LAT - Large Air Tanker

LCES - Lookouts, Communications, Escape Routes and Safety Zones

NWCG - National Wildfire Coordinating Group

OPS - Operations Section Chief (Field and Planning)

PSC - Planning Section Chief

SAIT - Serious Accident Investigation Team

SEAT - Single Engine Air Tanker

Slop over - a fire edge that crosses a control line or natural barrier intended to control the fire.

SOF - Safety Officer

SPGS1 - Structure Protection Group 1 Supervisor (Yarnell and Glen Ilah)

SPGS2 - Structure Protection Group 2 Supervisor (Double Bar A Ranch, Model Creek, and Peebles Valley)

TAC 1 - Tactical Channel 1

TAC 3 - Tactical Channel 3

Two-track road - a road with two visible ruts created by a vehicle such as a Jeep, tractor, ATV (All-Terrain Vehicle) or UTV

UTV - Utility Task Vehicle

WFDSS - Wildland Fire Decision Support System

WFSA - Wildland Fire Situational Analysis

VLAT - DC-10 Very Large Air Tanker

10 & 18 - The Ten Standard Firefighting Orders and the Eighteen (18) Situations That Shout Watch Out

**YARNELL HILL FIRE MANAGEMENT POSITIONS:**

Scott Hunt - State Forester

David Geyer - Fire Management Officer

Jim Downey - District Forester/Unit Manager/Line Officer

Russ Shumate - Assistant Fire Management Officer and Type 4 Incident Commander (ICT4)

Dean Fernandez - BLM Representative

Roy Hall - Type 2 Incident Commander (ICT2)

Glenn Joki - Type 2 Incident Commander (ICT2)

Todd Abel - Operations Section Chief I (OSC-Field)

Paul Musser -Operations Section Chief II (OSC -Planning)

Eric Marsh - Division Alpha Supervisor

Rance Marquez - Division Zulu Supervisor

Gary Cordes - Structure Protection Group 1 Supervisor

Darrell Willis - Structure Protection Group 2 Supervisor

Byron Kimball - Fire Behavior Analyst

GMIHC - Granite Mountain Interagency Hotshot Crew

Jesse Steed - Granite Mountain IHC Captain

Brendan McDonough - Granite Mountain IHC Lookout

BRIHC - Blue Ridge Interagency Hotshot Crew

Brian Frisby - Blue Ridge IHC Superintendent

Rogers Trueheart Brown - Blue Ridge IHC Assistant Superintendent/Captain

#### **GENERAL SUMMARY OF INVESTIGATION (ADDITIONAL DETAILS CONTAINED WITHIN CITATION NARRATIVES):**

On **June 28, 2013** at approximately **1700**, lightning started a wildland fire in the Weaver Mountains, Arizona, near the town of Yarnell, the fire was formerly named the Yarnell Hill Fire. The initial report was made to the Arizona Dispatch Center (ADC) at approximately **1740** by the volunteer fire department in Congress, Arizona.

Russ Shumate, an ASFD Assistant Fire Management Officer (AFMO) who is a qualified Incident Commander Type 4 and Type 3 (ICT4 and ICT3), traveled to Yarnell to be closer to the location of multiple new wildland fire starts that resulted from the lightning activity.

Land jurisdiction in the Yarnell area includes private, Arizona State Lands Department (for which Arizona State Forestry has fire suppression responsibilities) and U.S. Bureau of Land Management (BLM). Shumate met with Bruce Olson, the BLM Fuels Specialist to coordinate actions on fires on either jurisdiction.

The initial fire size-up was made by Bob Travis, the Air Tactical Group Supervisor (Air Attack) for the Doce Fire, who stated that the Yarnell Hill Fire was in a boulder field with no vehicle access. Due to the fire's perceived inaccessibility, Shumate, who had by this time (approximately **1940**) become the initial attack Incident Commander (ICT4), decided to take no action on the fire that evening due to safety concerns and a perceived low spread potential with low immediate risk for structures or people. Instead, Shumate planned for suppression activities for the following day and ordered two Arizona Department of Corrections (DOC) crews, a Type 6 engine and a Type 3 helicopter for June 29.

Shumate developed a full suppression strategy based upon the policy of the Arizona State Forestry Division. The tactic for the next day was to use a helicopter to transport people to and from the fire. This suppression strategy was concerned with mitigating risks of the predicted monsoonal lightning and rains, but did not initially appear to plan for potential extreme fire behavior. A spot weather forecast was received at **2207**.

#### **June 29, 2013**

On **June 29** Shumate returned to the fire early in the morning and began assigning resources to the Yarnell Hill Fire, which was the only lightning-caused fire still active from the storm on June 28. Sometime after **0700** and prior to **1100**, Dean Fernandez, a BLM representative, took a morning flight to update the situation of the fire and estimated the fire to be approximately eight acres. From this assessment, Shumate and Fernandez developed an initial attack plan to put six firefighters from the DOC Lewis Crew and one helitack crew member on the fire using the helicopter for transportation. Shumate also planned to remove the firefighters from the fire by **1530** due to perceived lightning risk from afternoon storms.

At **0651** Shumate requested that the Single Engine Air Tanker base at Wickenburg airport be opened so that two Single Engine Air Tankers (SEAT) could be used. The plan was to use fire retardant on the north and south sides of the fire, but leave the west and east flanks open. There was a two-track road on the east side of the fire.

At **1011** Shumate requested a helicopter to shuttle crews.

The SEATs arrived mid-morning and dropped fire retardant on the flanks, each SEAT making two retardant drops. Dan Eckstein, the ATGS planned to have the SEATS drop retardant to hold the fire perimeter.

At **1100** a BLM helicopter transported seven firefighters to the top of the ridge. One helitack crew member and six DOC Lewis Crew firefighters hiked in the rest of the way to construct handline, cold trail and hot spot.

At approximately **1225**, Shumate reported that the fire size was about two acres. Air Attack reported that the retardant had secured the south and west flanks. Air Attack also stated that a ridge flanked the fire to the north and that a two-track road secured the eastern flank. The Air Attack and SEATs returned to their base in Prescott, Arizona.

At **1442**, Shumate released the Air Attack and the SEATs due to the fire holding on all four sides and no other fire starts from the previous day showing smoke. The original plan by Shumate was to fly crews down off the fire by **1530**.

At **1500**, a weather alert for thunderstorms was issued by the National Weather Service. However, the storms far to the north dissipated prior to reaching the Yarnell Hill Fire.

At **1540**, Shumate released the BLM brush engine and a local Peebles Valley fire engine due to the lack of multiple fires.

During the afternoon, the temperature in Phoenix reached a high of 116 degrees.

At **1600**, weather conditions were hot and dry. Winds from the west-southwest increased which led to elevated fire activity.

At **1610**, Shumate requested two SEATs and Air Attack to return to the Yarnell Hill Fire. Arizona Dispatch Center (ADC) sent one SEAT but held the second aircraft so that it could be available for the Dean Peak fire.

About **1630**, afternoon winds increased and the Yarnell Hill Fire jumped the two-track road on the east side of the fire. Shumate told the ADC that containment was problematic, and at **1655** ordered a Type 1 Heavy Helitanker and later a Large Air Tanker (LAT).

At **1730**, a total of 13 firefighters were assigned to contain the eastern fire edge that crossed over the two-track road (slop over).

The Yarnell Hill Fire was estimated at six acres by ASFD Crew Coordinator Justin Smith who was assigned by Shumate as the Division Supervisor for the crew on the hill. At some point near this time Shumate learned that the Lewis Crew was out of chainsaw gas which seriously hindered their ability to be effective in chaparral.

At **1742**, additional air resources declined dispatch due to high winds and severe weather between their home base and the fire location. Shumate continued to use SEATs to drop retardant on the Yarnell Hill Fire.

At **1743**, dispatch offered a Very Large Air Tanker (VLAT) from Albuquerque in place of the heavy air tanker that could not respond due to weather. Based on discussion with Air Attack and Fernandez, Shumate declined the VLAT offer.

Between **1730** and **1924**, the fire behavior and complexity continued to escalate. ASFD began dispatching a Type 2 Incident Management Team. In addition, two structure group specialists were requested (one for north of the fire - Model Creek and Peebles Valley, and one for south of the fire - Yarnell and Glen Ilah). ASFD also requested three Interagency Hotshot Crews (IHCs). Three IHCs were assigned the Yarnell Hill Fire: Blue Ridge IHC, GMIHC (a local crew, ordered filled internally), and Arroyo Grande IHC (who ultimately missed this assignment).

At **1924**, the fire burned into chaparral to the north and northeast. Temperatures were above 100 F and relative humidity was at 12%. Sustained winds of 10 miles per hour were reported with gusts up to 20 miles per hour out of the south and southwest. Estimated flame lengths were reported between 10 to 20 feet and rate of spread was estimated at five to ten chains per hour. (one chain = 66 feet)

By **1938**, the Yarnell Hill Fire was an estimated 100 acres. The fire was approximately one mile from structures in Peebles Valley and 2.5 miles from the town of Yarnell.

At **2200**, the dispatch logs note that ASFD ordered additional resources including 14 engines, six water tenders, two Type 2 handcrews, two bulldozers, and numerous aircraft.

At approximately **2330** hours, Darrell Willis arrived at the Yarnell Hill Fire incident command post and met with Shumate. Shumate instructed Willis to scout the north side of the fire and determine risks to structures. Through the night and into the morning Willis scouted the area. At or about **0100** while scouting the Double Bar A Ranch, Willis notes in his unit log that the seven structures present there are all high risk, low probability of success.

At approximately **2340** hours, Structure Protection Group 1 Supervisor Gary Cordes arrived at the Yarnell Fire Station. He met with Shumate and was assigned by Shumate to implement a plan for the structure protection of Yarnell and Glen Ilah.

**June 30, 2013**

At **0100** hours, Cordes met with Shumate and BLM Representative Dean Fernandez. The fire was estimated to be between 120 and 300 acres by fire personnel on the hill. Cordes drove the area to size-up conditions and hiked to the fire. Cordes determines that structures were non-defensible. Cordes ordered resources for the next operational period.

At approximately **0100** hours, Willis noted that the fire was approximately 100 acres in size and actively burning on the east slope of the Weaver Mountains. He estimated flame lengths to be in excess of 20 feet.

At **0300**, Shumate, Cordes and Willis ordered additional resources based on the structure protection needs identified during scouting. Shumate assigned Willis the role of Structure Protection Group 2 Supervisor and given responsibility for protection of structures at the north side of the fire (i.e., Double Bar A Ranch, Model Creek, and Peoples Valley).

At **0330**, Willis and Shumate discussed the fire situation, very active fire behavior and probable outcomes for the strategy.

At approximately **0600** hours, additional crews and equipment began arriving at the fire scene. Structure Protection Group 2 resources ordered by Shumate and supervised by Willis included a total of thirty-one firefighters and two engines to protect structures at the Double Bar A Ranch. Personnel included BLM Engine 58 (crew of 6), Tonto National Forest Engine 3665 (crew of 3), Arizona Department of Corrections - Yuma (crew of 20), Willis, and Cory Moser, a Task Force Leader trainee (TFLD(t)). Planned activities included building a perimeter fire line, brush removal, and wetting down the structures.

Structure Protection Group 1 included four type 6 engines, 2 tenders, and one Taskforce Leader Trainee (TFLD(t) Tyson Esquibel. Approximately 12 to 20 firefighters were assigned to Esquibel in Glen Ilah. Based on the initial size-up by Structure Protection Group 1 Supervisor Cordes, Cordes determined that insufficient resources were available to perform structure protection.

At **0700** hours, Incident Commander Russ Shumate met with Operations Section Chief I Todd Abel, Operations Section Chief II Paul Musser, and Structure Protection Group 1 Supervisor Gary Cordes. During that meeting, Abel and Cordes decided that Division A would create an anchor point at the south heel of the fire and tie into a dozer line (Division Z) that would extend across the valley floor north of Yarnell and Glen Ilah. Shumate, Abel, Musser and Cordes believed if there were favorable winds they could burn-out from the dozer line to protect Yarnell and Glen Ilah from fire advancing from the north.

At **0700**, a briefing occurred between Shumate and incoming Incident Commander Type 2 (ICT2 - Roy Hall), Musser and Abel, Cordes, fire behavior analyst (FBAN - Byron Kimball), and deputies from the Yarnell County Sheriff's Office. The GMIHC Superintendent (Eric Marsh) was reportedly present and listened in on much of the discussion. Hall informed everyone that his first priority was to have an air operations plan developed so that air resources could operate safely over the fire. Hall's second priority was to hold a briefing with all assigned resource representatives prior to transfer of incident command.

Following the meeting Abel assigned Marsh as the Division Alpha Supervisor (DIVS A) transferring leadership of the GMIHC crew to the Granite Mountain IHC Captain (Jesse Steed). The GMIHC were assigned to Marsh with the task of establishing the anchor point at the heel of the fire, using direct and indirect attack.

At approximately **0800**, the GMIHC arrived at the ICP. Cordes escorted them through Yarnell and they stopped along Sesame Street. Cordes told them of the "bomb-proof" safety zone (the Boulder Springs Ranch), and Cordes reminded Marsh that the crew also had the previously burned black area as a safety zone. In addition, during their internal crew briefing, all GMIHC crew members were told the escape routes would be into the black and/or back to the crew carriers.

At **0854**, a VLAT was ordered by Shumate (SWCC had mentioned that competition for resources existed).

The Incident Command Post (ICP) was designated at the Model Creek School in Peoples Valley.

At **0930**, a briefing of assigned crews was held by Hall and Shumate at the ICP. Immediately after the briefing, Musser assigned several resources to Structure Protection Group 2 to protect structures. Sometime after the briefing, Musser directed Cordes to assess structures in the Yarnell area. Cordes confirmed that most but not all of the structures were indefensible with available resources.

The BRIHC was assigned by Abel to drive to the fire area and to meet up with Cordes on their way to the fire.

By **0930** hours, the dozer had created a line approximately three quarters of the way to the east side of Division A.

At approximately **0930**, Marsh was briefed over the radio by a helitack crew member (who had been on the fire overnight). Weather and fire behavior observations were relayed to Marsh along with an estimate of 500 acres for the fire size. Marsh was at the top of the ridge near a helispot.

Structure Protection Group 1 crews met at the Ranch Restaurant and were tasked with scouting Yarnell and Glen Ilah.

At **1000** hours GMIHC completed their hike to the south side of the fire along the eastern ridge of the Weaver Mountains. Their task was to establish an anchor point and connect to a dozer line in the valley below (about 1000 feet of steep elevation change). Fire behavior at the heel slowed as the fire, pushed by winds from the south, progresses northward towards Peoples Valley.

At **1022**, formal transfer of command (from Shumate to Hall) was announced via radio. The Incident Management Type 2 Short Team now in control of the fire did not have a Planning Section Chief and a Safety Officer (SOF), which are required under the ASFD Standard Operating Guidelines. Two SOF's had been ordered by Shumate through Deputy Incident Commander Glenn Joki at **2120** on **June 29, 2013** through the ADC but had not been filled.

Around **1030**, the BRIHC parked their crew carriers next to the GMIHC carriers. The BRIHC Superintendent (Brian Frisby) and Captain (Rogers Trueheart Brown) unloaded their utility task vehicle (UTV) and continued along Sesame Street. They encounter Cordes who requested a Heavy Equipment Boss (HEQB) to manage a dozer and clear out the two-track road on both sides as far as possible to provide access and to prepare for possible backfire. BRIHC assigned one of their squad leaders (Cory Ball), who is a qualified HEQB, to help.

Frisby and Brown scouted the fire edge while Ball took the dozer as far as an old abandoned grader to push a clear area around the old grader. Ball then headed in the direction of the saddle near GMIHC's anchor point and planned to then turn around and clear out the two-track road (an old fuel break) between Sesame Street and Shrine Road. During these operations, the remaining crew members of the BRIHC stayed with the crew carriers.

At **1030** hours, crews at the Double Bar A Ranch were still working on building the perimeter line. Fire activity had increased substantially. The fire head was reportedly half a mile wide with 40 to 50 foot high flames. Willis estimated that the fire front would reach the Double Bar A Ranch in approximately 60 to 90 minutes. Willis reported receiving a telephone call from the Southwest Wildfire Coordinating Center (SWCC) requesting photographs of the fire. Willis took several photos and sent them to Dana Carter at SWCC. Copies of the photos are included in this case file.

At **1045**, the Yarnell County Sheriff's Office issued evacuation notices to the residents of Model Creek and the Double Bar A Ranch.

At **1100**, the fire front was moving to the northeast along the eastern slope of the Weaver Mountains and headed directly towards Double Bar A Ranch. Cumulus clouds built up to the north and Musser contacted Marsh via radio to ascertain if Marsh could see the cloud formations. Marsh indicated that he could see the clouds and would keep an eye on the weather.

By this time, Frisby and Brown reached the old grader and were able to ascertain that the GMIHC were working on the east side of the ridge, slowly burning off of the two-track road. Over the radio, Frisby and Brown noted that the GMIHC was trying to get the fireline connected with the two-track road so the fire could not burn back up the ridge.

At or around **1100** based on the escalating fire danger, Hall informed the State Fire Management Officer (David Geyer) that the Yarnell Hill Fire needed a full Type 2 IMT.

At approximately **1100**, Structure Protection Group 2 Supervisor Willis called for the evacuation of the caretaker at the Double Bar A Ranch. Structure protection crews continued working at the Ranch.

Between **1130** and **1145**, the GMIHC conducted burnout operations, and Marsh and ATGS (Rory Collins) discussed tactical options. Collins directed two SEAT drops at **1136** and **1145** directly onto the burnout. Marsh indicated to air attack via radio that the drops were **not** what he wanted. As a result of the drops, GMIHC shifted tactics from building indirect line going direct along the fire edge. During this same period, a short squad of the GMIHC moved to the west side of the ridge and tied into the cold black and into steep rocky terrain.



At approximately **1150** hours, Frisby (BRIHC Superintendent) drove a utility vehicle up to the ridge and met with Marsh (Division A Supervisor). Operations Section Chief Todd Abel initially assigned the BRIHC to Division A; however, adjacent Division Z Supervisor Rance Marquez had yet to arrive to the fire, and a clear plan had not been developed. According to Frisby, tactics for Division Z were unclear and his crew was staged on Shrine Road waiting for instructions.

Frisby reported to Marsh that he attended a poor morning briefing and that radio communication problems were experienced by the dozer operator, the Operations Section Chief Todd Abel, and aviation resources. Marsh and Frisby decided that Division A would create an anchor by burning-out a section of brush located between the heel of the fire and the existing two-track road that led down into the valley. BRIHC would manage Division Z and work with the dozer to connect to the anchor point developed by Division A.

At approximately **1200** hours, Aerial Supervision Module B-3 arrived at the fire (Paul Lenmark and Rusty Warbis). While flying a test run in preparation for a very large air tanker (VLAT) retardant drop, B-3 noticed that the fire was burning in a horseshoe shape and that one end of the horseshoe appeared to be getting close to the Double Bar A Ranch entrance/exit road. B-3 radioed the ground crew and warned a firefighter associated with Engine 58 that their escape route may be compromised by the approaching fire.

At **1230**, radio communication frequency changed to TAC3 due to increased communication at the north side of the fire.

Between **1230** hours and **1300** hours, two VLAT retardant drops were made in a line in front of the approaching fire south of Double Bar A Ranch. Willis observed that the fire only slightly slowed by the retardant, quickly recovered, and continued to burn through the retardant line.

At approximately **1240** hours, Frisby transports GMIHC Lookout Brendan McDonough to the bottom of the valley. Before leaving, Frisby tells McDonough to contact them (Frisby and Brown) directly if he needs them for anything and they will return on the UTV for pickup. McDonough hiked to a small hill about 100 yards north of the two-track road. From that position he could observe the Granite Mountain crew working on the mountain side and their burn-out operation.

At approximately **1300** hours, Marquez arrived at the dozer line and spoke with Frisby in person and Marsh via Frisby's radio. Marquez was having trouble with his radio and could not contact Marsh with his own radio. There was confusion as to who had responsibility for Division Z and where the break between Division A and Division Z would be located. Air Attack overheard this conversation and radioed command instructions for Frisby, Marsh, and Marquez. However, Marsh disagreed and radioed back the original plan developed by him and Frisby. Marquez decided to leave and drove to the incident command post. He never returned to Division Z.

At approximately **1300** hours, the Yuma DOC crew working at Double Bar A Ranch packed-up and left while the remaining personnel lit backfires. The 11 remaining personnel monitored the burnout until it became clear that the escape route was about to be compromised.

At **1327**, the ASFD District Forester (Jim Downey) and Hall developed a complexity analysis. Based upon the analysis, Hall recommended ordering a full Type 2 IMT. However, Downey and Geyer changed the recommendation to a Type 1 IMT and placed the order through ADC at **1413** hours.

At **1402**, the FBAN (Kimball) received a weather update from the National Weather Service (NWS). Kimball was informed that thunderstorms were predicted to occur east of the fire and might produce wind gusts up to 30 to 45 miles per hour with winds out of the northeast. This information was relayed to Musser and Abel via tactical frequency 1 (TAC1).

Yavapai County Sheriff began pre-evacuation reverse 911 calls to residents of the Town of Yarnell.

At **1420**, the responding resources of Structure Protection Group 2 located north of the fire retreated due to the fire flanking the Double Bar A Ranch.

At approximately **1445** hours, Task Force Leader Trainee Tyson Esquibel met with Structure Protection Group 1 Supervisor Gary Cordes. Cordes instructed Esquibel to take several resources to the east end of Division Z's dozer line and construct a saw-line up a small hill located north of Yarnell. The saw-line would tie into the dozer line. Once completed, the plan was to burn-off the line later that evening or night to stop fire from moving south toward Yarnell and Glen Ilah.

At approximately **1445** hours, the Yavapai County Sheriff began evacuating the Town of Yarnell.

At **1447**, the second Aerial Supervision Module (ASM2 - Bravo 33) arrived to relieve ASM1 (Bravo 3). After a 10 minute briefing, Bravo 33 dealt with an arriving VLAT and supported structure protection north of the fire. However, conditions changed, turning priorities towards the Town of Yarnell.

At **1500**, the outflow boundary originating from thunderstorms to the northeast of the fire area begin to blow the fire eastward towards the incident command post and Highway 89A.

At approximately **1500**, the dozer was ordered to the north side of the fire where the ICP was being threatened by fire.

At approximately **1515** hours, Esquibel and his crew drove to the Shrine Road, parked their vehicles, and hiked about one quarter mile to the dozer line where they began building a saw line up a small hill directly north of Yarnell. BRIHC was working on Division Z's dozer line approximately one-quarter mile west of Esquibel's crew. Esquibel's crew consisted of Peeples Valley FD Engine 54 (2 crew members), Peeples Valley FD Water Tender 54 (2 crew members), and Sun City West Engine 103 (4 crew members). Sun City West Engine 131 (2 crew members) was serving as a lookout.

At **1526**, Kimball was informed of an update from the NWS. North to northeast winds of up to 40 and 50 miles per hour were now expected from the thunderstorm outflows which would push the fire south by southwest. This information was relayed to Musser and Abel via TAC1.

At **1530**, winds changed course by 90 degrees to the south-southwest. There was approximately three miles of an active fire head.

At approximately **1530** hours, Cordes placed an evacuation order for Yarnell and Glen Ilah.

At approximately **1540** hours, Cordes observed the fire one mile north of Yarnell and then a spot fire about one half mile south of the main fire. Cordes reported to his supervisor Operations Section Chief I Todd Abel that he could not transmit on the air to ground radio frequency. Abel relayed Cordes' message to aviation for them to drop retardant and water at will.

At approximately **1545** hours, Division A Supervisor Marsh had a radio conversation with Operations Section Chief I Abel regarding the weather and the position of Granite Mountain IHC. Marsh was located near the top of the Weaver Mountains and had a clear view of the thunderstorm, the fire, and the valley below. Marsh and Abel had been watching the storm for some time and discussed their concerns regarding the storm's effects. Marsh reportedly stated that Granite Mountain was safe and in the black (i.e., previously burned wildland). Marsh mentioned that the winds were "squirrely" at his position and that the retardant and dozer lines north of Yarnell were being compromised.

Shortly thereafter, Operations Section Chief II Musser radioed GMIHC and asked if they could spare resources to assist in Yarnell. Either Marsh or GMIHC Captain Steed responded that they were committed to the black and that Musser should contact BRIHC working in the valley (during his interview Musser stated that he wasn't sure who he was talking with).

At approximately **1550** hours, McDonough noticed that the fire head, which had been steadily progressing northwards, had switched directions, was approximately two miles wide, and burning southward towards his position. The fire had reached his trigger point to just to the north of his lookout position.

McDonough radioed his supervisor GMIHC Captain Steed and explained that the fire had reached his trigger point and he was leaving. Steed confirmed the message and could see the fire and McDonough in the valley below his position. McDonough hiked south while looking for a reasonable location to deploy his shelter should he become entrapped. He made his way to the old abandoned grader at the dozer line where brush had been cleared earlier that day. During his interview, he stated that he believed this area to be his best option as a safety zone. His other option was to hike up the steep mountain slope to previously burned wildland.

Frisby contacted Steed to determine Granite Mountain's progress. Steed stated to Frisby that they needed another hour to complete their work. Marsh overheard that conversation and requested that Frisby drive back up to the ridge for a face to face conversation. Frisby drove his utility vehicle west along the dozer line towards Division A and noticed very active fire and smoke pushing up the hill where McDonough had been stationed as a lookout.

While standing at the grader, McDonough keyed his radio to call BRIHC for pick-up; when simultaneously, Frisby drove up on a utility vehicle. Frisby picked up McDonough, turned around and they drove east down the dozer line past the

approaching fire front. Frisby radioed Steed that he had picked up McDonough and then he contacted his crew and instructed them to move to their vehicles and get ready to evacuate.

During the interview with McDonough, McDonough stated that he believes that had his escape been delayed for any number of reasons, he would have been faced with shelter deployment and burn-over.

At **1555**, fire was burning along the ridge north of Yarnell. Frisby dropped McDonough off at the GMIHC Superintendents truck. They then helped move the GMIHC crew carriers. At **1558** Air Attack (Collins) abruptly leaves the fire and goes to Deer Valley. He turned air tactical operations over to Bravo 33 who was very busy dealing with lead plane duties at the time. Bravo 33 received a very brief update as the Air Attack had departed the fire. Bravo 33 was unaware of either Division Breaks and on the ground fire fighter locations. Bravo 33 had been ordered as a lead plane thinking that the Air Attack function was covered.

At approximately **1600** hours, Cordes notified Abel that trigger points for Structure Protection Group 1 had been met indicating a one-hour evacuation time. Shortly thereafter, Abel was notified that Structure Protection Group 1 trigger point #2 had been reached - it was time to evacuate Yarnell. Abel radioed AZ Dispatch the evacuation notice. Cordes advised Structure Group 1 crews to move out of Yarnell and Glen Ilah. He estimated the fire front to be traveling approximately four miles per hour.

At **1601** hours, radio transmissions captured on video tape documented portions of a conversation between Marsh and Steed. Marsh reported that he "knew this was coming" and inquired about Steed's comfort level. Steed reported that "the fire had almost made it to the two-track road that they had hiked in on" earlier that morning.

Following this conversation, GMIHC and Marsh decided to move from their position. According to BRIHC unit logs, Eric [Marsh] says, *"I copy fire is progressed to the buggies, Also going to make our way through out escape route."* Brian [Frisby] asks, *"Are you in good black?"* Eric says, *"picking our way through the black to the rd in the bottom out towards the ranch."* Brian thinks he meant towards the two track. To confirm Brian says, *"the rd we came on w/ the ranger...affirm."*

Musser heard the radio transmission but didn't recall the exact words. Abel and Musser reportedly were not aware of the location of Marsh's reported predetermined route.

At **1604**, a GMIHC crew member sent a photo of the fire to family members with a text message about the fire.

At approximately **1610** hours, Esquibel, working at the east side of Division Z, noticed increasing fire behavior, and that the fire was moving south with large flame lengths. He noticed a horizontal vortex in that the wind at his location was calm, but the north side of the mountain was getting north winds.

At approximately **1620** hours, Esquibel met with the Sun City West E-103 Engine Boss and talked about the current conditions. Esquibel reportedly thought it was about time to evacuate his crews. At that point the fire had reached the trigger point at a ridge approximately one half mile north of their position.

At **1620** fire personnel near Yarnell heard thunder.

At approximately **1620** hours, fire activity at the east side of Division Z substantially increased. Wind gusts were reportedly 45 mph and visibility had reduced to approximately 150 yards. Crews working Division Z collected at their vehicles.

At **1624**, Doppler radar showed a fire plume at 31,500 feet that grew to 38,700 feet by 1633.

At **1630**, the thunderstorm outflow boundary moves across the southern end of fire boundary.

At **1630**, backfiring operations are completed on the Peoples Valley fire front. The wind changed direction and fire behavior decreased.

At approximately **1630** hours, Esquibel's crew, BRIHC, McDonough, and Peoples Valley Engines E-54 and T-64, assembled at their vehicles, accounted for all members, and began driving out to their safety zone at the Ranch Restaurant. The fire was at the perimeter of Glen Ilah although firefighters on the ground could not see the flaming front as the sky was dark and the atmosphere smoky. Crew members drove through extreme smoke, ash, and blowing embers to escape the fire.

Cordes reported that two engines working Shrine Road got "pinched." The crews had hiked in to work the dozer line at Division Z, and when they returned, their vehicles were missing. Cordes believed that a water tender operator had previously moved their vehicles to a safer location without the engine crew's knowledge.

At **1634**, the outflow boundary of the fire crested the southern ridge of the Weaver Mountains.

At **1637**, Bravo 33 flew a drop path for a VLAT north of Yarnell from west to east. This drop went over Marsh's location at the time. Marsh communicated with Bravo 33 informing him that was where the retardant was needed. Bravo 33 circled the south end of the fire above Yarnell to line up a final flight path for a tanker drop.

At **1639**, the aircraft crew was in the middle of a discussion with Abel on the air-to-ground frequency and the pilot was talking to the VLAT on the air-to-air frequency when an over-modulated and static-filled transmission came over the air-to-ground frequency. At this point, it had been determined that the GMIHC were in the front of the flaming front.

More broken communication was exchanged and due to poor reception, Bravo 33 could only understand fragments. The rapid advance of the fire toward Yarnell had generated a lot of radio traffic about structure protection. Bravo 33 assumed the broken and unclear transmission was one of the structure protection units calling to request a retardant drop. He said he did not suspect it was GMIHC since they had been in a safe area when he talked to them earlier.

By **1640**, the last firefighters, with the exception of the GMIHC, reached Highway 89 and confirmed on TAC1 with Cordes that they were safe. At around the same time, Cordes directed Bravo 33 to drop retardant at will to stop the fire from reaching the town.

At **1642**, the outflow boundary of the fire crested the Harper Canyon ridge just to the north of Yarnell for the second time.

Between **1640** and **1642**, the final communications occurred between GMIHC, Bravo 33, and Abel. The exchange affirmed that GMIHC needed air support. Abel released Bravo 33 from structure suppression to help GMIHC. Bravo 33 contacted Marsh to ascertain their location. Marsh informed Bravo 33 that their escape route had been cut off and that they were preparing a deployment site. They were burning out the brush around them. Bravo 33 asked if they were on the south side of the fire and Marsh affirmed that location. That was the last known communication with Marsh.

Soon after **1642**, the GMIHC deployed their fire shelters, they were entrapped, and the fire burned over them resulting in the death of 19 firefighters.

By **1700** hours, the fire front bypassed Yarnell but had burned completely through Glen Ilah and was approaching Highway 89A.

### Conclusions:

Please refer to the details of each citation worksheet.

For fatality investigations, was next of kin contact info available?

- No  
 Yes

If available, note date condolence letter sent:

Date: August 5, 2013

### OPENING CONFERENCE

- Presented credentials  
 Presented a copy of the ACT and ADOSH Poster  
 Explained reason for the inspection

Explained scope of the inspection

Are employees represented?

No

Yes    Name of org. or rep.:

If yes, did a representative participate in the inspection?

Yes

No - Reason:

Notes/comments regarding the opening conference:

**UNUSUAL CIRCUMSTANCES**  
(Describe as appropriate)

- None
- Denial of entry (see denial memo)
- Delays in conducting the inspection.
- Trade Secrets
- Other

Comments:

**RECORDKEEPING**

Is the employer completing the OSHA 300 log?

Yes

No

Copy of log(s) included in file.

Not applicable for this employer.

Reason:

**SAFETY AND HEALTH PROGRAM**

Does the employer have an overall safety and health program?

Yes

No

If yes, type of program:

Written

Verbal

Copy of program included in file.

Comments:

**EVALUATION OF SAFETY PROGRAMS**

(Check those programs that are in place and provide any relevant comments)

- Fall protection program/plan
- Fall protection training records
- Alternative fall protection methods
- Forklift Program
- Forklift training/certification records
- Scaffold safety program/training
- Lockout Tagout Program
- Punch press inspection
- Punch press injuries (reported in 30 days)
- Punch press maintenance and training records
- Crane inspections
- Crane training records
- Chain, wire rope, hook, sling inspections

Comments: All Arizona State Forestry Division safety programs and Standard Operational Guidelines (SOG's) are developed in compliance with NWCG Wildland Fire Incident Management Guide (2013), NWCG Interagency Standards for Fire and Fire Aviation (2013), and NWCG Incident Response Pocket Guide (2010).

**EVALUATION OF HEALTH PROGRAMS**

(Check those programs that are in place and provide any relevant comments)

- Emergency action plan
- Emergency response plan
- Confined space program
- Permit required confined space training
- Non-permit required confined space training
- Hearing conservation program
- Bloodborne Pathogens Program
- Bloodborne pathogens training
- Personal protective equipment hazard assessment
- Personal protective equipment training
- Hazard Communication Program
- Respiratory Protection Program

Comments:

**ADOSH SAMPLING**

Was employee exposure sampling conducted by ADOSH?

 Yes

No

If yes, explain type:

Sampling duration:

Screening

Full shift

Comments regarding ADOSH sampling:

**EMPLOYER'S MONITORING PROGRAM**

Is the employer conducting exposure sampling?

Yes

No

If yes, explain type:

Who conducted the sampling?:

What sampling method was used?:

What was the sampling frequency?:

Were overexposures documented by the employer?

Yes

No

Comments:

Were results obtained by ADOSH?

Yes

No

**RATING THE EMPLOYER'S SAFETY AND HEALTH PROGRAM**  
(0=Nonexistent, 1=Inadequate, 2=Average, 3=Above Average)

2 Written safety and health program

1 Communication to employees

2 Safety training program

2 Health training program

2 Training records

1 Accident investigation program

1 Preventive action taken

Comments:

**CLOSING CONFERENCE**

- No violations were observed
- Reviewed apparent violations
- Discussed employer rights/obligations
- Provided employer a copy of employer rights pamphlet
- Discussed/encouraged informal conference
- Offered abatement assistance
- Discussed consultation programs
- Discussed employee rights and prohibition against discrimination.

Were any unusual circumstances encountered such as, but not limited to, abatement problems, negative employer attitude, etc.?

- Yes
- No

Comments regarding the closing conference:

A closing conference was conducted on December 3, 2013 from 0930 to 1120 with State Forester Scott Hunt, Fire Management Officer David Geyer, Assistant Attorney General Paul A Katz, and Assistant Attorney General Brock Heathcotte. The closing was of a cordial nature. The apparent violations and potential penalties were addressed as well as employer responsibilities, employer rights, follow-up inspections, ADOSH Consultation, and employee discrimination under the OSHA Act.

CSHO Signature	<i>Bruce Rowen</i>	Date	12/3/13
Accompanied By	<i>Brock Heathcotte</i>		12/3/13

*Paul A Katz* 12/3/13





Worksheet

Wed Nov 27, 2013 12:15pm

		Inspection Number	317242683		
		Opt. Insp. Number	0618		
Establishment Name	Arizona State Forestry Division				
Type of Violation	SW Serious Willful	Citation Number	01	Item/Group	001
Number Exposed	81	No. Instances	4	REC	A Accident
Std. Alleged Vio.	23.0403(A)				

Abatement Period	MultiStep Abatements			Final Abatement	Action Type/Dates
	PPE Period	Plan	Report		
3					
Abatement Documentation Required			Y	Date Verified	

Substance Codes	
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AVD/Variable Information:

A.R.S. Section 23-403(A): The employer did not furnish to each of his employees employment and a place of employment which were free from recognized hazards that were causing or likely to cause death or serious physical harm to their employees, in that the employer implemented suppression strategies that prioritized protection of non-defensible structures and pastureland over firefighter safety, and failed to prioritize strategies consistent with Arizona State Forestry Division - Standard Operational Guideline 701 Fire Suppression and Prescribed Fire Policy (2008). When the employer knew that suppression of extremely active chaparral fuels was ineffective and that wind would push active fire towards non-defensible structures, firefighters working downwind were not promptly removed from exposure to smoke inhalation, burns, and death:

- a) Yarnell Hill Fire, Yarnell, Arizona: On June 30, 2013, between 1230 and 1430, and after the general public had been evacuated, thirty-one members of Structure Protection Group 2, charged with protecting non-defensible structures in the vicinity of the Double Bar A Ranch, were exposed to smoke inhalation, burns, and death by wind driven wildland fire.
- b) Yarnell Hill Fire, Yarnell, Arizona: On June 30, 2013, from and after 1530, one member of the Granite Mountain Interagency Hotshot Crew that continued to serve as a lookout was exposed to smoke inhalation, burns, and death by a rapidly progressing wind driven wildland fire.
- c) Yarnell Hill Fire, Yarnell, Arizona: On June 30, 2013, from and after 1530, approximately thirty firefighters continued indirect attack activities in Division Z (Zulu) and were exposed to smoke inhalation, burns, and death by a rapidly progressing wind driven wildland fire.
- d) Yarnell Hill Fire, Yarnell, Arizona: On June 30, 2013, from and after 1530, 19 members of the Granite Mountain Interagency Hotshot Crew continued in suppression activities, until 1642 when they were entrapped by a rapidly progressing wind driven wildland fire.

Penalty Calculations				Adjustment Factors			Proposed Adjusted Penalty
Severity	Probability	Gravity	GBP	Size	Good Faith	History	
H High	G Greater	10	70000.00	0	0	0	70000.00
Repeat Factor		0					

Employee Exposure:						
Occupation	Wildland Firefighters			Employer	ASFD	
Nr of Employees	31	Duration	8+ hours	Frequency	daily	

Employee Name	Structure Protection Group 2				
Address			Phone	( ) -	
Occupation	Wildland Firefighter	Employer	ASFD		
Nr. of Employees	1	Duration	3+ hours	Frequency	Daily
Employee Name	Brendan McDonough				
Address			Phone	( ) -	
Occupation	Wildland Firefighters	Employer	ASFD		
Nr. of Employees	30	Duration	8+ hours	Frequency	Daily
Employee Name	Division Z				
Address			Phone	( ) -	
Occupation	Wildland Firefighters	Employer	ASFD		
Nr. of Employees	19	Duration	6+ hours	Frequency	Daily
Employee Name	Granite Mountain IHC				
Address			Phone	( ) -	

Instance Description: A. Hazard B. Equipment C. Location D. Injury/Illness E. Measurements

**Date/time condition observed by CSHO:**

CSHO did not observe any of the cited instances. Details of exposure/violation were obtained through witness interviews, review of documents, and review of video and photographs taken by witnesses and other fire personnel working at the Yarnell Hill Fire.

**Instance description: Describe the hazardous condition. Include make, model/serial numbers and measurements where applicable.**

**Instance a:**

Hazard: Employees assigned to Structure Protection Group 2 were exposed to smoke inhalation, burns, and death by a rapidly progressing wind driven wildland fire. On the morning and early afternoon of June 30, 2013, fire management assigned thirty-one firefighters of Structure Protection Group 2 to provide point protection and structure protection at Double Bar A Ranch. Fire management previously identified structures at the Ranch as non-defensible. A tennis court designated as a safety zone was known to be too small for the approaching 40 foot long flames. Fire management observed air tanker retardant drops to be ineffective at suppressing fire progression. Despite fire management's knowledge of existing conditions, the impending hazard, failure to control or suppress active fire, and the known futility of attempting to protect non-defensible structures, management assigned employees to protect the Double Bar A Ranch, and permitted employees to remain at the Ranch conducting burnout operations until the last moments before escape. Although escape was successful, fire management's decision-making incorrectly prioritized the value of non-defensible structures ahead of firefighter safety which violated both State and Interagency wildland fire policy and procedures.

As the day progressed, fire management continued to fail to re-evaluate, re-prioritize or update suppression efforts based on existing and expected conditions which resulted in additional exposures described below.

**Instance b:**

Hazard: Granite Mountain Interagency Hotshot Crew lookout Brendan McDonough was exposed to smoke inhalation, burns, and death by a rapidly progressing wind driven wildland fire. McDonough, serving as lookout for the Granite Mountain IHC crew, stood on a small hill in the valley below his crew. He continued to serve as a lookout in the face of a rapidly progressing fire driven by the outflow boundary of an advancing thunderstorm with wind speed estimated to be between 10-20 mph with gusts up to 40 mph. McDonough's pre-established escape plan was to radio the Blue Ridge IHC for pick-up. At or around 1550, when fire began threatening his position, McDonough retreated to the predetermined pick-up location. Blue Ridge IHC Superintendent Brian Frisby was driving up the dozer line to meet with Eric Marsh when he saw McDonough at the pick-up spot. Due to increased fire activity, Frisby changed his plan to meet with Marsh and took on McDonough [on his ATV or in his truck], turned around, and he and McDonough escaped east down the dozer line towards the east side of

Division Z. Given the conditions, McDonough should have been evacuated on or about 1530. What should have been a planned retreat ended up being an emergency escape resulting from a fortuitous drive-by. It should also be noted that had McDonough's pick-up been delayed, McDonough would have faced shelter deployment and burnover. Had the Blue Ridge IHC vehicle experienced any problems, both McDonough and Frisby may have faced shelter deployment and burnover. Fire management's failure to re-evaluate, re-prioritize, and update fire suppression activities based on observed and expected fire behavior and fire weather resulted in a complete failure to protect employees working downwind of the fire from exposure to smoke, burns, and death.

**Instance c:**

**Hazard:** Approximately thirty employees assigned to Division Z were exposed to smoke inhalation, burns, and death by a rapidly progressing wind driven wildland fire. On the morning of June 30, 2013, fire management selected evacuation trigger points for citizens and employees assigned to Structure Protection Group 1 at Yarnell and Glen Ilah, as well as for employees working at Division Z. When expected thunderstorms approached the fire, and the rate of fire spread substantially increased, the previously established trigger points did not provide adequate time to avoid exposure to smoke and fire. By 1530 the weather conditions had dramatically changed and the employer choose to evacuate the incident command post but allowed Division Z to continue working downwind of a rapidly progressing wind driven fire past 1530. Division Z should have been evacuated on or about 1530. What should have been a planned retreat became an emergency evacuation at 1630. Although all employees assigned to Division Z escaped without injury or death, failure to re-evaluate trigger points based on existing and expected fire behavior resulted in a near-miss emergency escape. In addition, fire management's failure to re-evaluate firefighter safety based on continuously observed extreme fire behavior and expected and observed thunderstorm activity resulted in a complete failure to protect employees working downwind of the fire from exposure to smoke, burns, and death.

**Instance d:**

**Hazard:** Granite Mountain IHC exposure to entrapment hazard by a rapidly approaching wildfire. On the morning of June 30, 2013, Granite Mountain IHC crew began their work at the heel of the fire atop the Weaver Mountains. Their task was to establish an anchor point and connect to a dozer line in the valley below (about 1000 feet of steep elevation change). By late afternoon, Granite Mountain IHC had stopped to rest near the top of the mountain and observed the fire and approaching thunderstorm. Expected thunderstorm activity increased and winds pushed the fire southward towards their position. By 1530 the weather conditions had dramatically changed, and the employer choose to evacuate the incident command post but allowed the Granite Mountain IHC to work downwind of a rapidly progressing wind driven fire past 1530. Granite Mountain IHC should have been evacuated on or about 1530. What should have been a planned retreat became entrapment at 1642 in which all nineteen members died of exposure to inhaled smoke and burns. Fire management's failure to re-evaluate firefighter safety based on continuously observed extreme fire behavior and expected and observed thunderstorm activity resulted in a complete failure to protect employees working downwind of the fire from exposure to smoke, burns, and death.

**Describe employee exposure to the condition, including the relationship to this cited employer.**

Over 300 firefighters were employed directly by or under cooperative agreements with the Arizona State Forestry Division (ASFD) and were exposed to smoke inhalation, burns, and death by rapidly progressing wildland fire, by implemented suppression strategies that prioritized protection of non-defensible homes and pastureland over firefighter safety.

**There is no specific OSHA standard that addresses this hazard and a general duty citation is therefore recommended based on the following information:**

**A: Recognition of the Hazard:**

**A.1 Employer Recognition:**

Evidence the Arizona State Forester recognized the hazard includes documents the ASFD provided ADOSH that it uses in wildland fire operations and safety in Arizona.

A.R.S. Section 37-623 Suppression of wildfires; powers and duties of state forester; entry on private lands.

Arizona State Forestry Division, Standard Operational Guideline 701, Fire Suppression and Prescribed Fire Policy (2008).

NWCG Wildland Fire Incident Management Field Guide (2013)

NWCG Interagency Standards for Fire and Fire Aviation Operations (2013)

NWCG Incident Response Pocket Guide (2010)

Relevant excerpts from the SOG-701 are described below. Relevant excerpts from the NWCG documents, which apply to both employer and industry hazard recognition is described in the following section titled "Industry Recognition."

**Arizona State Forestry Division, Standard Operational Guideline 701, Fire Suppression and Prescribed Fire Policy (2008)**

**Policy, Page 2**

1. Safety: Firefighter and public safety is the first priority. All fire management activities must reflect this commitment.
2. Fire Management: The full range of fire management activities will be used to hold wildfire losses on state lands to a level consistent with resource values at risk while providing adequate health and safety protection to the public and firefighters and with a minimum expenditure of state funds.
3. Response to Wildfire: Appropriate response to wildfires is based on environmental, social and legal considerations, and the likely consequences on firefighter and public safety and welfare, natural and cultural resources and the values to be protected, and the economic interests of the Land Trust and State Treasury.
4. Use of Wildfire: Wildfires will not be used to enhance natural resources. Wildfires will be controlled, contained, or confined at the least cost to the State, consistent with firefighter and public safety and welfare.
5. Protection Priorities: The protection of human life is the single, overriding suppression priority. Setting priorities among protecting human communities and community infrastructure, other property and improvements, and natural and cultural resources will be done based on the values to be protected, human health and safety, and the costs of protection. Once people have been committed to an incident, these human resources become the highest value to be protected.
7. Suppression: Wildfires are suppressed at minimum cost, considering firefighter and public safety, and all values to be protected, consistent with management objectives.
9. Standardization: The State will implement training and qualification requirements, operational procedures and methodologies, and public education programs for all fire management activities that are compatible with the federal wildland agencies.
10. Interagency Cooperation: Fire management planning, preparedness, prevention, suppression, fire use, restoration and rehabilitation, monitoring, research, and education will be conducted on an interagency basis with the involved of cooperators and partners. (emphasis added)

**Wildfire Suppression Strategies, paragraph 1, page 4**

*The primary criteria for choosing fire suppression strategies and tactics are to ensure the safety of the public and firefighting resources while minimizing suppression costs, resource loss, environmental damage, and the threat of wildland fire escaping onto non-state lands.*

There is no specific OSHA standard that addresses this hazard. However, this hazard is recognized by the employer, his industry, or both, in the following manner:

**A.2 Industry Recognition:**

The Arizona State Forester provided ADOSH with the following documents that it uses in wildland fire operations and safety in Arizona:

NWCG Wildland Fire Incident Management Field Guide (2013)

NWCG Interagency Standards for Fire and Fire Aviation Operations (2013)

NWCG Incident Response Pocket Guide (2010)

**Arizona State Forestry Division, Standard Operational Guideline 701, Fire Suppression and Prescribed Fire Policy (2008)**

**Policy, Page 3**

1. Safety: Firefighter and public safety is the first priority. All fire management activities must reflect this commitment.

2. **Fire Management:** *The full range of fire management activities will be used to hold wildfire losses on state lands to a level consistent with resource values at risk while providing adequate health and safety protection to the public and firefighters and with a minimum expenditure of state funds.*
3. **Response to Wildfire:** *Appropriate response to wildfires is based on environmental, social and legal considerations, and the likely consequences on firefighter and public safety and welfare, natural and cultural resources and the values to be protected, and the economic interests of the Land Trust and State Treasury.*
4. **Use of Wildfire:** *Wildfires will not be used to enhance natural resources. Wildfires will be controlled, contained, or confined at the least cost to the State, consistent with firefighter and public safety and welfare.*
5. **Protection Priorities:** *The protection of human life is the single, overriding suppression priority. Setting priorities among protecting human communities and community infrastructure, other property and improvements, and natural and cultural resources will be done based on the values to be protected, human health and safety, and the cost of protection. Once people have been committed to an incident, these human resources become the highest value to be protected.*
6. **Wildland Urban Interface:** *The operational roles of the State as partners in the wildland urban interface are wildland firefighting, hazard reduction, cooperative prevention and education, and technical assistance. Structural fire suppression is the responsibility of federal, tribal, or local governments. The State may assist with exterior structural fire protection activities under formal fire protection agreements that specify the mutual responsibilities of the partners.*
7. **Suppression:** *Wildfires are suppressed at minimum cost, considering firefighter and public safety, and all values to be protected, consistent with management objectives.*
8. **Prevention:** *The State will work with the federal wildland agencies and with local governments and partners and other affected groups and individuals to prevent unauthorized ignition of wildland fires.*
9. **Standardization:** *The State will implement training and qualification requirements, operational procedures and methodologies, and public education programs for all fire management activities that are compatible with the federal wildland agencies.*
10. **Interagency Cooperation:** *Fire management planning, preparedness, prevention, suppression, fire use, restoration and rehabilitation, monitoring, research, and education will be conducted on an interagency basis with the involvement of cooperators and partners. (emphasis added)*

## **National Wildfire Coordinating Group (NWCG) Wildland Fire Incident Management Field Guide (2013)**

### **Chapter 1, Firefighting Safety, Risk Management, Page 1**

*The wildland fire environment possesses inherent hazards that can result in harm to firefighters engaged in fire operations. Therefore, sound risk management is the foundation for all fire management activities. Risk management is defined as the process whereby management decisions are made and actions taken concerning the control of hazards and acceptance of remaining risk. The risks involved with any fire activity must be identified, assessed, and mitigated (or eliminated) when possible and practicable. The remaining risk must be considered acceptable to everyone involved and be weighed against the potential benefit during the management decision of continuing or discontinuing the activity. We practice risk management to minimize firefighters' exposure to inherent hazards in fire operations while still accomplishing management objectives.*

*The five-step risk management process is outlined in the IRPG.*

*Step 1 - Establish situational awareness.*

*Step 2 - Identify hazards and benefits and assess the risk.*

*Step 3 - Control, mitigate, or eliminate hazard.*

*Step 4 - Make go/no-go decision based on acceptability of remaining risk.*

*Step 5 - Evaluate effectiveness of hazard controls and continuously reevaluate.*

### **Wildland Fire Safety Principles, Page 3**

*Most of the common fire safety principles for wildland fire operations are found in the Incident Response Pocket Guide (IRPG) which should be carried by all operational firefighters on the fireline. The safety principles should be understood at all levels of command. They include but are not limited to:*

- \* Risk Management Process
- \* Look Up, Look Down, Look Around
- \* Standard Firefighting Orders
- \* Watch Out Situations
- \* Lookout(s), Communication(s), Escape(s), and Safety Zone(s) (LCES)
- \* Safety Zone Guidelines
- \* Downhill Line Construction Checklist
- \* Communication Responsibilities
- \* First Aid Guidelines

### **Safety Responsibilities of Wildland Fire Supervisors, General Responsibilities, Page 15**

*Supervision of other firefighters includes the following tasks:*

- \* *Maintain accountability of assigned personnel's exact location and general welfare at all times, especially during incident operations.*
- \* *Set a personal example of safe behavior and enforce safe practices.*
- \* *Assign fireline assignments only to people who are properly qualified and physically fit for the job.*
- \* *Evaluate firefighters' physical and mental condition.*
- \* *Analyze work situations to eliminate or avoid hazards. Discuss safety at the beginning of each shift or new work assignment.*
- \* *Become immediately involved whenever an injury occurs, and ensure that medical treatment is provided in a timely manner.*
- \* *Monitor work to be sure it is done safely and efficiently.*
- \* *Monitor and enforce work/rest guidelines.*
- \* *Provide leadership in applying corrective action aimed at eliminating accidents and instilling a safe work attitude.*
- \* *Protect employees from reprisal for reporting unsafe conditions.*

**REMEMBER: EACH INDIVIDUAL, AND ESPECIALLY SUPERVISORS, HAVE AND MUST RECOGNIZE THEIR SAFETY RESPONSIBILITIES.**

(emphasis added)

### **NWCG Interagency Standards for Fire and Fire Aviation Operations (2013)**

#### **Chapter 01, Federal Wildland Fire Management Policy Overview, Principles of Suppression Operations, Page 01-9**

*The primary means by which we implement command decisions and maintain unity of action is through the use of common principles of suppression operations. These principles guide our fundamental fire suppression practices, behaviors, and customs, and are mutually understood at every level of command. They include Risk Management, Standard Firefighting Orders and Watch Out Situations, LCES, and the Downhill Line Construction Checklist. These principles are fundamental to how we perform fire suppression operations and are intended to improve decision making and firefighter safety. They are not absolute rules. They require judgment in application.*

#### **Chapter 07, Safety and Risk Management, Policy, Page 07-1**

*Firefighting and public safety is our first priority. All Fire Management Plans and activities must reflect this commitment. The commitment to and accountability for safety is a joint responsibility of all firefighters, managers, and administrators. Every supervisor, employee, and volunteer is responsible for following safe work practices and procedures, as well as identifying and reporting unsafe conditions.*

#### **Chapter 07, Safety and Risk Management, Definitions, Page 07-2**

*Safety: A measure of the degree of freedom from risk or conditions that can cause death, physical harm, or equipment or property damage.*

*Hazard: A condition or situation that exists within the working environment capable of causing physical harm, injury, or damage.*

*Risk: The likelihood or possibility of hazardous consequences in terms of severity or probability.*

*Risk Management: The process whereby management decisions are made and actions taken concerning control of hazards and acceptance of remaining risk.*

**Chapter 07, Safety and Risk Management, Risk Management Process, Page 07-2**

*Fire operations risk management is outlined in the NWCG Incident Response Pocket Guide (IRPG). The five step process provides firefighters and fire managers a simple, universal, and consistent way to practice risk management by:*

- \* *Establishing situational awareness.*
- \* *Identifying hazards and assessing the risk.*
- \* *Controlling or eliminating hazards.*
- \* *Making decisions based on acceptability of remaining risk.*
- \* *Evaluating effectiveness of hazard controls and continuously re-evaluating the situation.*

**Chapter 07, Safety and Risk Management, Fireline Safety, Page 07-2**

***Incident Briefings***

*Fire managers must ensure that safety briefings are occurring throughout the fire organization, and that safety factors are addressed through the IC or their designee and communicated to all incident personnel at operational briefings. The identification and location of escape routes and safety zones must be stressed. A briefing checklist can be found in the Incident Response Pocket Guide (IRPG).*

***LCES - A System for Operational Safety***

*LCES will be used in all operational briefings and tactical operations as per the Incident Response Pocket Guide (IRPG).*

*L - Lookout(s)*

*C - Communication(s)*

*E - Escape Route(s)*

*S - Safety Zone(s)*

**NWCG Incident Response Pocket Guide (2010)**

**Risk Management, Page 1**

***Situation Awareness***

*Gather Information*

*Objective(s)*

*Communication*

*Who's in Charge*

*Previous Fire Behavior*

*Weather Forecast*

*Local Factors*

*Scout the Fire*

***Hazard Assessment***

*Estimate Potential Fire Behavior Hazards*

*Look Up/Down/Around Indicators*

*Identify Tactical Hazards*

*Watch Outs*

*What other safety hazards exist?*

*Consider severity vs. probability?*

***Hazard Control***

*Firefighting Orders - LCES*

*Anchor Point*

*Downhill Checklist (if applicable)*

*What other controls are necessary?*

***Decision Point***

*Are controls in place for identified hazards?*

*NO - Reassess situation YES - Next question*

*Are selected tactics based on expected fire behavior?*

*NO - Reassess situation YES - Next question*

*Have instructions been given and understood?*

*NO - Reassess situation YES - Initiate action*

**Evaluate**

- Human Factors:**      *Low experience level?*  
                              *Distracted from primary tasks?*  
                              *Fatigue or stress reaction?*  
                              *Hazardous attitude?*
- The Situation:**    *What is changing?*  
                              *Are strategy and tactics working?*

**Common Denominators of Fire Behavior on Tragedy Fires, Page 4**

*There are four major common denominators of fire behavior on fatal and near-fatal fires. Such fires often occur:*

- 1. On relatively small fires or deceptively quiet areas of large fires.*
- 2. In relatively light fuels, such as grass, herbs, and light brush.*
- 3. With unexpected shifts in wind direction or wind speed.*
- 4. When fire responds to topographic conditions and runs uphill.*

**Common Tactical Hazards, Page 5**

**Position**

- o Building fireline downhill.*
- o Building underslung or mid-slope fireline.*
- o Building indirect fireline, or unburned fuel remains between you and the fire.*
- o Attempting frontal assault on the fire, or you are delivered by aircraft to the top of the fire.*
- o Depending on escape routes that are uphill or difficult to travel.*

**Situation**

- o Poor communication due to a rapidly emerging small fire or an isolated area of a large fire.*
- o Suppression resources are fatigued or inadequate.*
- o Assignment or escape route depends on aircraft support.*
- o Nighttime operations.*
- o Wildland/urban interface operations.*

*When selected tactics put firefighters in these positions or situations, a higher level of risk is involved. Consider additional hazard controls that may be needed.*

**LCES, Page 6**

*LCES must be established and known to ALL firefighters BEFORE it is needed.*

**Lookout(s)**

- o Experienced, competent, trusted*
- o Enough lookouts at good vantage points*
- o Knowledge of crew locations*
- o Knowledge of escape and safety locations*
- o Knowledge of trigger points*
- o Map, Weather Kit, Watch, IAP*

**Communication(s)**

- o Radio frequencies confirmed*
- o Backup procedures and check-in times established*
- o Provide updates on any situation change*
- o Sound alarm early, not late*

**Escape Route(s)**

- o More than one escape route*
- o Avoid steep uphill escape routes*
- o Scouted for loose soils, rocks, vegetation*
- o Timed considering slowest person, fatigue, and temperature factors*
- o Marked for day or night*
- o Evaluate escape time vs. rate of spread*



- o Vehicles parked for escape

**Safety Zone(s)**

- o Survivable without a fire shelter
- o Back into clean burn
- o Natural features (rock areas, water, meadows)
- o Constructed sites (clearcuts, roads, helispots)
- o Scouted for size and hazards
- o Upslope?
- o Downwind? - More heat impact - Larger safety zone
- o Heavy Fuels?

*Escape time and safety zone size requirements will change as fire behavior changes.*

**Safety Zones, Page 7**

*A safety zone is an area where a firefighter can survive without a fire shelter. Considerations for effective safety zones:*

- o Take advantage of heat barriers such as lee side of ridges, large rocks, or solid structures.
- o When possible, burn out safety zones prior to arrival of fire front.
- o Avoid locations upslope or downwind from the fire; chimneys, saddles, or narrow canyons; and steep uphill escape routes.
- o Not intended for structure protection.

*Separation distance between the firefighter and the flames should be at least four times the maximum continuous flame height. Distance separation is the radius from the center of the safety zone to the nearest fuels.*

<b>Flame Height</b>	<b>Separation Distance (firefighters to flames)</b>	<b>Area in acres*</b>
10 ft	40 ft	1/10 acre
20 ft	80 ft	1/2 acre
50 ft	200 ft	3 acres
100 ft	400 ft	12 acres
200 ft	800 ft	46 acres

*\*Area in acres is calculated to allow for distance separation on all sides for a 3-person engine crew (1 acre is approximately the size of a football field, or 208 feet by 208 feet).*

*Calculations are based on radiant heat only and do not account for convective heat from wind and/or terrain influences. Since calculations assume no wind and no slope, safety zones downwind or upslope from the fire may require larger separation distances.*

**Wildland/Urban Interface Firefighting, Page 10**

*Structure protection is inherently dangerous because it involves indirect firefighting.*

*Do not commit to stay and protect a structure unless a safety zone for firefighters and equipment has been identified at the structure during sizeup and triage. Move to the nearest safety zone, let the fire front pass, and return as soon as conditions allow.*

**Fire Behavior Prediction**

- \* Base all actions on current and expected fire behavior - do this first!
- \* An estimate must be made of the approaching fire intensity to determine if there is an adequate safety zone and time available before the fire arrives.
- \* Due to the dynamic nature of fire behavior, intensity estimates are difficult to make with absolute certainty. It is imperative that firefighters consider the worst case and build contingency actions into their plan to compensate for the unexpected.

**Structure Sizeup, Page 11**

### **Site considerations**

- o Adequate safety zone based on fire behavior prediction.
- o Adequate lookout and communication capability.
- o Adequate defensible space based on surrounding wildland vegetation.
- o Avoid narrow canyon bottoms, mid-slope with fire below, and narrow ridges near chimneys and saddles.

### **Tactical challenges and hazards**

(Firefighters with a safety zone can safely defend structures with some challenges)

- o Narrow roads, unknown bridge limits, and septic tank locations.
- o Ornamental plants and combustible debris next to structure.
- o Wooden siding and/or wooden roof materials.
- o Open vents, eaves, decks, and other ember traps.
- o Fuel tanks and hazardous materials.
- o Power lines
- o Limited water sources.
- o Property owners remaining onsite.

### **Structure Triage, Page 12**

#### **Defensible - Prep and Hold**

- o Determining factor: Safety zone present.
- o Sizeup: Structure has some tactical challenges.
- o Tactics: Firefighters needed onsite to implement structure protection tactics during fire front contact.

#### **Defensible - Standalone**

- o Determining factor: Safety zone present.
- o Sizeup: Structure has very few tactical challenges.
- o Tactics: Firefighters may not need to be directly assigned to protect structure as it is not likely to ignite during initial fire front contact. However, no structure in the path of a wildfire is completely without need of protection. Patrol following the passage of the fire front will be needed to protect the structure.

### **Structure Triage, Page 13**

#### **Non-Defensible - Prep and Leave**

- o Determining factor: NO safety zone present.
- o Sizeup: Structure has some tactical challenges.
- o Tactics: Firefighters not able to commit to stay and protect structure. If time allows, rapid mitigation measures may be performed. Set trigger point for safe retreat. Remember, preincident preparation is the responsibility of the homeowner. Patrol following the passage of the fire front will be needed to protect the structure.

#### **Non-Defensible - Rescue Drive-by**

- o Determining factor: NO safety zone present.
- o Sizeup: Structure has significant tactical challenges.
- o Tactics: Firefighters not able to commit to stay and protect structure. If time allows, ensure people are not present in the threatened structure (especially children, elderly, and invalid). Set trigger point for safe retreat. Patrol following the passage of the fire front will be needed to protect the structure.

### **Structure Protection Tactics, Page 14**

#### **Rapid mitigation measures**

- o Remove small combustibles immediately next to structure.
- o Close windows and doors, including garage (leave unlocked).
- o Clean area around fuel tank and shut off tank.
- o Charge garden hoses.
- o Apply CAF, foam, or gel retardants if available.

#### **Equipment and water use**

- o Mark entrance to indicate a staffed location if it is not obvious.
- o Charge hose lines.
- o Long hose lays are not recommended.

- o Keep 100 gallons of water in reserve.*
- o Identify a backup water source.*
- o Identify power lines for aerial resources.*
- o Never rely on water for firefighter safety.*

**Patrol following the fire front**

- o Most structures do not burn until after the fire front has passed.*
- o Move to closest safety zone and let fire front go through.*
- o Return as soon as conditions allow safe access to structures.*
- o Secondary ignition is usually due to residual spot fires or creeping ground fire.*
- o Take suppression actions within your capability.*
- o Call for assistance if needed.*

(emphasis added)

**STANDARD FIREFIGHTING ORDERS**

- 1. Keep informed on fire weather conditions and forecasts.*
- 2. Know what your fire is doing at all times.*
- 3. Base all actions on current and expected behavior of the fire.*
- 4. Identify escape routes and safety zones, and make them known.*
- 5. Post lookouts when there is possible danger.*
- 6. Be alert. Keep calm. Think clearly. Act decisively.*
- 7. Maintain prompt communications with your forces, your supervisor, and adjoining forces.*
- 8. Give clear instructions and be sure they are understood.*
- 9. Maintain control of your forces at all times.*
- 10. Fight fire aggressively, having provided for safety first.*

**WATCH OUT SITUATIONS**

- 1. Fire not scouted and sized up.*
- 2. In country not seen in daylight.*
- 3. Safety zones and escape routes not identified.*
- 4. Unfamiliar with weather and local factors influencing fire behavior.*
- 5. Uninformed on strategy, tactics, and hazards.*
- 6. Instructions and assignments not clear.*
- 7. No communication link with crewmembers or supervisor.*
- 8. Constructing line without safe anchor point.*
- 9. Building fireline downhill with fire below.*
- 10. Attempting frontal assault on fire.*
- 11. Unburned fuel between you and fire.*
- 12. Cannot see main fire; not in contact with someone who can.*
- 13. On a hillside where rolling material can ignite fuel below.*
- 14. Weather becoming hotter and drier.*
- 15. Wind increases and/or changes direction.*
- 16. Getting frequent spot fires across line.*
- 17. Terrain and fuels make escape to safety zones difficult.*
- 18. Taking a nap near fireline.*

**A.3: Arizona Industry Common Practice, pursuant to A.R.S. Section 23-403(C):**

*Notwithstanding subsection A of this section, a condition or practice which is common within an industry is not deemed a recognized hazard unless a standard or regulation concerning the condition or practice has been developed pursuant to section 23-410 or 23-414.*

The condition or practice of implemented suppression strategies that prioritized protection of non-defensible structures and pastureland over firefighter safety exposing firefighters to smoke inhalation, burns, and death is a recognized hazard within the industry of wildland firefighting and it is not a common practice in the industry to prioritize protection of non-defensible structures or pastureland over safety of employees.

**B: Probability of death or serious physical harm:**

The probability of employee exposure to serious physical harm and death is directly related to fire behavior, weather, and distance employees work from fire and smoke. Should wind driven wildland fire or smoke overtake an employee the probability of serious physical harm or death is extremely high due to exposure to toxic gases and extreme high temperature.

**C: What feasible abatement methods are available to address this hazard?**

Feasible abatement includes:

ASFD could abate the hazard by following their guidelines as well as adopted interagency guidelines that prioritize the safety of wildland firefighters and by ensuring that these guidelines are followed by staff and cooperators assigned to fire management positions.

ASFD should ensure that firefighter safety is the highest priority when making risk based decisions regarding suppression strategies and tactics.

ASFD should re-evaluate fire conditions and re-prioritize suppression strategies and tactics promptly when conditions threaten firefighter safety.

**D: Appropriateness of the penalty amount:**

An employee exposure value of 10 was selected as more than 10 employees were exposed to wildland fire.

Frequency of exposure was estimated to be a value of 10 (16 hour workday and up to 14 consecutive days).

Proximity was estimated to be a value of 10 (at the point, high risk hazards).

Stress was estimated to be a value of 10 (high management stress, very poor conditions).

A severity factor of 10 was selected as employee exposure to smoke inhalation or burns would likely result in serious debilitating injuries or death.

**Describe whether the employer knew, or with the exercise of reasonable diligence, could have known of the presence of the hazardous condition and of employee exposure to the condition.**

Pursuant to Arizona Revised Statutes, A.R.S. Section 37-623, The Arizona State Forestry Division has jurisdictional responsibility for management of fires on State lands and private property outside of incorporated areas. The Yarnell Hill Fire initially started on State trust land yet mostly burned private lands outside of incorporated areas.

On the evening of Friday, June 28, 2013, a lightning strike ignited a small fire on the west side of the Weaver Mountains (State Trust Land) northwest of Yarnell, Arizona. Due to the location of the fire the Arizona State Forestry Division (ASFD) took control of the fire. ASFD District Forester Jim Downey was assigned as the person in charge of the entire fire suppression effort. ASFD employee Russ Shumate was the initial attack Incident Commander. On June 30, 2013, ASFD employee Roy Hall was the extended attack Incident Commander.

Between June 28, 2013 and July 1, 2013, ASFD personnel operating in the capacity of Fire Management Officer, District Forester, Incident Commanders (IC4 and IC2) and support staff managed Yarnell Hill Fire suppression operations. Incident Command positions as well as ground and aviation operations were managed and conducted by ASFD staff or by staff from other agencies working under cooperative agreements with ASFD.

Interviews of fire management and employees uniformly demonstrated knowledge of expected extreme fire behavior based on extended drought conditions, high fuel loading, excessive heat, and forecasted afternoon thunderstorms. Incident command reported this information to fire crews during morning briefings and throughout the day as new information became available. One week earlier some of the same management and employees worked the Doce Fire, near Prescott, Arizona, and experienced similar fire conditions.

On Sunday, June 30, 2013, extreme fire behavior combined with strong thunderstorms caused the fire to become a more active fire that burned relatively uninhibited by suppression resources. Wind direction changed multiple times and wind intensity picked-up substantially ahead of forecasted thunderstorms. The employer knew that suppression of extremely active chaparral fuels was ineffective, knew that the active fire was pushing towards non-defensible structures, and knew that employees were working downwind of a rapidly progressing wind driven wildland fire in furtherance of suppression strategies that were

implemented to protect structures (known to be non-defensible). Notwithstanding this knowledge, throughout the afternoon, and in disregard of its own requirement to prioritize firefighter safety, fire management failed to re-evaluate, re-prioritize and update suppression efforts and failed to promptly remove employees working downwind of the fire resulting in multiple incidences of employee exposure to smoke, burns, and death.

**Instance a:**  
June 30, 2013

Early in the morning, resources assigned to Structure Protection Group 2 by Incident Command personnel began to prepare for point protection of structures located north of the existing fire.

At mid-morning, 5-10 mph winds pushed the fire along the east ridge of the Weaver Mountains towards Peeples Valley. The southern-most collection of structures, Double Bar A Ranch, was directly in the fire's path. The approaching fire split into two separate heads with one head threatening Double Bar A Ranch and the other head threatening the assigned crew's escape route. Fire behavior was observed and described by Willis as extreme with flame lengths in excess of 40 feet. Conditions were so extreme that he took a number of photos and forwarded them to the Southwest Coordinating Group for evaluation.

Crews remained at the Ranch conducting burn-out operations while the fire closed in on their position. Fortunately, all personal escaped without incident.

ASFD incident management (Willis, Abel, Musser, Hall, and others): observed extreme fire behavior conditions; observed retardant fail to suppress the progressing fire; knew if the wind continued to blow northward, structures of Double Bar A Ranch, Model Creek, and Peeples Valley would burn; knew that the fire had recently transitioned to an extended attack potentially "life-threatening" condition; knew that structures of Double Bar A Ranch were non-defensible; knew that the safety zone (a tennis court) at the Double Bar A Ranch was too small for the approaching 40 foot flames; and, knew that active fire would overtake the crew. Despite this knowledge, fire management failed to re-evaluate, re-prioritize and update suppression efforts and they made risk management decisions and planned operations based on the value of structures to be protected ahead of firefighter safety even when conditions demonstrated that structure protection efforts would fail. These decisions needlessly exposed firefighters to impending hazards and associated life threatening exposure to smoke, burns, and death.

Structure Protection Group 2 Supervisor (Willis) confirmed that none of the suppression efforts employed at the fire made any difference on that day.

**Instance b:**

On or about 1955 on Saturday, June 29, 2013, fire management received the following weather spot forecast for Yarnell.

.DISCUSSION...STRONG HIGH PRESSURE OVER THE SOUTHWEST WILL MAINTAIN THE HEAT SPELL THROUGH THE WEEKEND. LIMITED MOISTURE WILL RESULT IN ISOLATED THUNDERSTORM ACTIVITY SUNDAY AFTERNOON AND EARLY EVENING. THESE STORMS WILL PRODUCE LIGHTNING AND GUSTY WINDS...BUT LITTLE OR NO MEASURABLE PRECIPITATION.

SUNDAY NIGHT WEATHER WILL BE VERY SIMILAR TO TONIGHT'S CONDITIONS.

On or about 0845 on June 30, 2013, fire management received the following weather spot forecast for Yarnell.

.DISCUSSION...STRONG HIGH PRESSURE OVER THE SOUTHWEST WILL MAINTAIN THE HEAT SPELL FOR THE NEXT SEVERAL DAYS. LIMITED MOISTURE WILL RESULT IN ISOLATED THUNDERSTORM ACTIVITY TODAY AND MONDAY. THESE STORMS WILL PRODUCE LIGHTNING AND STRONG AND GUSTY WINDS...BUT LITTLE OR NO MEASURABLE PRECIPITATION. TEMPERATURES WILL DECREASE SLIGHTLY AND MINIMUM RELATIVE HUMIDITY WILL SLOWLY INCREASE OVER THE NEXT FEW DAYS.

During the morning of June 30, 2013, winds from the south blew the fire north towards Double Bar A Ranch, Model Creek, and Peeples Valley. By 1200 thunderstorms could be seen building to the north.

At approximately 1500, the wind shifted from blowing north to east towards the incident command post and Highway 89A. The employer evacuated the incident command post shortly after the wind shifted.

At approximately 1530, the wind shifted to blowing south and what had been two fire flanks became a three mile long fire head. Wind speed was estimated to be between 10-20 mph with gust up to 40 mph.

A Granite Mountain IHC lookout (Brendan McDonough) observed the fire approaching from the north from his position on a small hill at the base of the Weaver Mountains. The advancing fire reached his trigger point and he retreated. He began exploring a location to deploy. As it turned out, he was able to escape when he was picked up by another employee using an off-road vehicle and driven to safety. Had he not been discovered, his only other option was to deploy in a small clearing that was too small to protect from the 30 to 40 foot flames. Fortunately, McDonough and the driver of the off-road vehicle were able to escape.

ASFD incident management (Marsh, Abel, Musser, Hall, and others) knew: that the fire had recently transitioned to an extended attack potentially "life-threatening" condition and observed extreme fire behavior conditions; knew of forecasted afternoon thunderstorms and strong winds; observed approaching thunderstorms; observed thunderstorm outflow winds push the fire rapidly south; knew that firefighters were positioned downwind of the rapidly progressing wind driven fire; and knew that suppression strategies continued to focus on protection of non-defensible structures and pastureland. Despite this knowledge, ASFD incident management failed to re-evaluate, re-prioritize and update suppression efforts and they made risk management decisions and planned operations based on values to be protected ahead of firefighter safety. The resulting failure to adequately plan for a timely retreat of firefighters when conditions changed unnecessarily exposed firefighters working in the path of the active fire to impending hazards and associated life threatening exposure to smoke, burns, and death.

**Instance c:**

At or around 0100 on Sunday, June 30, 2013, Structure Protection Specialist 1 Gary Cordes met with Incident Commander Russ Shumate and BLM Representative Dean Fernandez. The fire was estimated to be between 120 and 300 acres. Cordes drove the area to size-up conditions and hiked to the fire. Cordes determined that structures in Yarnell and Glen Ilah were non-defensible.

At or around 0700, Cordes met with Shumate, Abel, Musser, and Marsh. They discussed expected winds and the formulating plan. They decided that Marsh would be assigned responsibility for Division A and create an anchor point at the south heel of the fire and tie into Division Z's dozer line that would extend across the valley floor. They determined that with favorable winds they could burn-out from the dozer line thereby stopping the fire from spreading south into Yarnell and Glen Ilah.

Structure Protection Group 1 included four type 6 engines, 2 tenders, and one taskforce leader (TFLD) Tyson Esquibel. Approximately 12 to 20 firefighters were assigned to Esquibel in Glen Ilah. Based on initial size-up it was determined that insufficient resources were available to perform structure protection.

By 0930, the dozer line was approximately three quarters of the way to the east side of Division A. Two engines worked with Cordes, Blue Ridge IHC, and a dozer at Division Z improving the indirect line.

At or around 1400, the Yavapai County Sheriff began pre-evacuation notice for Yarnell and Glen Ilah.

As previously described, weather conditions dramatically changed throughout the afternoon. By 1530, the employer had evacuated the ICP and the outflow boundary of an advancing thunderstorm approached from the north bringing strong gusty winds blowing southward towards Yarnell and Glen Ilah.

At or around 1530, Cordes placed an evacuation order for citizens of Yarnell. At 1540 Cordes observed a spot fire one half mile ahead of the main fire and recognized that the dozer line was likely compromised. Cordes reported to his superior, Todd Abel, that he could not transmit on the air to ground radio frequency and wanted aviation to drop retardant and water on the fire at will. Abel relayed Cordes's message to aviation.

At or around 1550, Cordes advised Structure Group 1 crews to move out of Yarnell and Glen Ilah. He estimated the fire front to be traveling at 4 miles per hour.

At or around 1620, crews working the east side of Division Z began to assemble at their vehicles. A 45 mph wind was blowing smoke, ash, and embers onto the crews. At approximately 1630, Division Z crews drove out of the area to their safety zone.

At approximately 1630, fire was at the perimeter of Glen Ilah. The sky was dark and the atmosphere was smoky. During an approximate 15 minute period, fire pushed by high winds burned through Glen Ilah.

ASFD incident management (Esquibel, Cordes, Abel, Musser, Hall, and others): knew that the fire had recently transitioned to an extended attack potentially "life-threatening" condition; knew of forecasted afternoon thunderstorms, lightning, and gusty winds; observed approaching thunderstorms; observed thunderstorm outflow winds push the fire rapidly south; knew that employees were positioned downwind of the rapidly progressing wind driven fire, and knew that suppression strategies continued to focus on protection of non-defensible structures. Despite this knowledge, ASFD failed to re-evaluate, re-prioritize

and update suppression efforts and they made risk management decisions and planned operations based on values to be protected ahead of firefighter safety. The resulting failure to adequately plan for timely retreat when conditions changed unnecessarily exposed firefighters working in the path of active fire to impending hazards and associated life threatening exposure to smoke, burns, and death.

**Instance d:**

At or around 1500, the east flank of the fire was now a head moving east towards Sickles Ranch. Abel and other incident management focused their attention on structure protection operations at the ranch as well as structure protection in Model Creek and Peeples Valley.

Following a wind shift at 1530, Division A Supervisor (Eric Marsh) and Granite Mountain IHC rested near the top of the Weaver Mountains with an unobstructed view of the fire.

At approximately 1545, Marsh spoke with Operations Section Chief Todd Abel regarding the approaching storm and changes in the wind. Marsh conveyed to Abel that they were in a safe place. During interviews Abel stated that he believed at the time that Marsh and Granite Mountain IHC would stay in the black or hike west over the top of the ridge to avoid lightning.

At or around 1550, GMIHC lookout McDonough, located in a valley below his crew, retreated from his lookout position as fire crossed his trigger point.

At approximately 1559, Abel notified ADC to contact the Yavapai County Sheriff and evacuate Mountaineer Trailer Park located in Yarnell. Progressing fire reached the first trigger point set for a one-hour warning for evacuation of Structure Protection Group 1. Shortly thereafter, Structure Protection Group 1 trigger point number 2 was reached the decision was made to evacuate Yarnell.

At approximately 1600, Operations Section Chief Paul Musser radioed Granite Mountain IHC to ask if they could assist at Yarnell. Either Marsh or Granite Mountain IHC Captain Jesse Steed replied that they could not and suggested he contact Blue Ridge IHC.

At approximately 1630, Marsh spoke with Aerial Supervision Module B-33 and reported that they were going down their escape route to the safety zone. B-33 asks if everything is okay. Marsh responded that everything is okay they are just heading to the safety zone.

At approximately 1642, Marsh radioed on the air to ground frequency that their escape route had been compromised. He advised that they were cutting and burning out a safety zone and would call back after they got into their shelters. A couple of subsequent transmissions occurred but no words could be deciphered. Nineteen members of the Granite Mountain IHC were entrapped and burned-over resulting in 19 fatalities.

ASFD incident management (Marsh, Abel, Musser, Hall, and others): knew that the fire had recently transitioned to an extended attack potentially "life-threatening" condition; knew of forecasted afternoon thunderstorms, lightning, and gusty winds; observed approaching thunderstorms; observed thunderstorm outflow winds push the fire rapidly south; knew that Granite Mountain IHC was positioned south of the fire; and knew that suppression strategies continued to focus on protection of non-defensible structures. Despite this knowledge, ASFD incident management failed to re-evaluate, re-prioritize and update suppression efforts and they made risk management decisions and planned operations based on values to be protected ahead of firefighter safety. The resulting failure to adequately plan for a timely retreat of firefighters when conditions changed unnecessarily exposed firefighters to life threatening exposure to smoke, burns, and death.

**Note any other comments made by the employer, or other information relative to this citation, not already noted above.**

**Penalty calculation:**

**Probability:**

**Number of employees: 10+**

**Frequency of exposure:10**

**Proximity to hazard:10**

**Stress:10**

**Other:**

**TOTAL:40**

**Number of factors:4**

**Probability TOTAL:10G**

**Severity:10H**

Event Date	Event Code	Action Code	Citation Type	Penalty	Abate Date	Final Order
	Z Add transaction	A Add	SW Serious Willful	70000.00		



The Arizona Division of Occupational Safety and Health



Worksheet

Tue Nov 26, 2013 1:34pm

Inspection Number		317242683	
Opt. Insp. Number		0618	
Establishment Name	Arizona State Forestry Division		
Type of Violation	Citation Number	Item/Group	
Number Exposed	19	No. Instances	1
Std. Alleged Vio.	23.0418(01)		

Abatement Period	MultiStep Abatements			Final Abatement	Action Type/Dates
	PPE Period	Plan	Report		
30					
Abatement Documentation Required				Y	Date Verified

Substance Codes	
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AVD/Variable Information:

A.R.S. Section 23-418.01: An additional penalty of \$25,000 is assessed under A.R.S. section 23-418.01 for each employee that died, which shall be paid by ASFD to the following employees' dependents or the employee's estate if the employee did not have any dependents: Andrew Ashcraft, Robert Caldwell, Travis Carter, Dustin DeFord, Christopher MacKenzie, Eric Marsh, Grant McKee, Sean Misner, Scott Norris, Wade Parker, John Percin, Jr., Anthony Rose, Jesse Steed, Joe Thurston, Travis Turbyfill, William Warneke, Clayton Whitted, Kevin Woyjeck, and Garret Zuppiger. In assessing this penalty, the Commission finds that the following statutory elements of A.R.S. section 23-418.01 are met:

- Each employee sustained death caused by the violation cited in Citation 1, Item 1 and the Commission assessed a penalty to the Arizona State Forestry Division under section 23-418, subsection A, for that violation;
- Compensation benefits are paid under chapter six of Title 23 to the employee's dependents, or, if no dependents, would have otherwise been paid under chapter six of Title 23; and
- The violation for which the Arizona State Forestry Division is assessed a penalty under section 23-418, subsection A, did not result from the deceased employees' disobedience to specific instructions given to the employees regarding the job condition causing the employees' death or relating to the safety standards applicable to that job condition.

The additional penalty provided by this section is not a compensation benefit under Chapter six of Title 23.

Penalty Calculations				Adjustment Factors			Proposed Adjusted Penalty
Severity	Probability	Gravity	GBP	Size	Good Faith	History	
			0.00	0	0	0	475000.00
Repeat Factor		0					

Employee Exposure:

Instance Description: A. Hazard B. Equipment C. Location D. Injury/Illness E. Measurements

Event Date	Event Code	Action Code	Citation Type	Penalty	Abate Date	Final Order
	Z Add transaction	A Add		475000.00		



Worksheet

Wed Nov 27, 2013 12:24pm

					Inspection Number	317242683
					Opt. Insp. Number	0618
Establishment Name	Arizona State Forestry Division					
Type of Violation	S Serious	Citation Number	02	Item/Group	001	
Number Exposed	81	No. Instances	2	REC	A Accident	
Std. Alleged Vio.	23.0403(A)					

Abatement Period	MultiStep Abatements			Final Abatement	Action Type/Dates
	PPE Period	Plan	Report		
3					
Abatement Documentation Required			Y	Date Verified	

Substance Codes	
-----------------	--

AVD/Variable Information:

A.R.S. Section 23-403(A): The employer did not furnish to each of his employees employment and a place of employment which were free from recognized hazards that were causing or likely to cause death or serious physical harm to their employees, in that the employer failed to implement fire suppression plans consistent with A.R.S. Section 37-623 Suppression of wildfires and Arizona State Forestry Division - Standard Operational Guideline 701 Fire Suppression and Prescribed Fire Policy (2008) in a timely fashion during the life-threatening transition between initial attack and extended attack fire operations thereby reducing the risk of firefighter exposure to smoke inhalation, burns, and death:

- a) Yarnell Hill Fire, Yarnell, Arizona: On June 29, 2013, when the fire escaped initial attack, an incident complexity analysis was not conducted and reviewed by fire management to ensure that wildfires increasing in complexity are quickly identified and a safe transition occurs to the appropriate level incident response.
- b) Yarnell Hill Fire, Yarnell, Arizona: On June 29, 2013, when the fire escaped initial attack, an Escaped Fire Situational Analysis (EFSA) or similar Wildland Fire Situation Analysis (WFSa), Wildland Fire Decision Support System (WFDSS), or Operational Needs Assessment was not conducted by fire management to ensure a safe transition to extended attack.
- c) Yarnell Hill Fire, Yarnell, Arizona: On June 29, 2013, after the fire escaped initial attack and prior to transitioning to a more complex management team, an Incident Action Plan (IAP) containing objectives reflecting the overall incident strategy, specific tactical actions, and supporting information for the next operational period was not conducted by fire management to ensure a safe transition to extended attack.

Penalty Calculations				Adjustment Factors			Proposed Adjusted Penalty
Severity	Probability	Gravity	GBP	Size	Good Faith	History	
H High	G Greater	10	7000.00	0	0	0	7000.00
Repeat Factor		0					

Employee Exposure:						
Occupation	Wildland Firefighters		Employer	ASFD		
Nr of Employees	31	Duration	8+ hours	Frequency	Daily	
Employee Name	Structure Protection Group 2					
Address			Phone	( ) -		
Occupation	Wildland Fighter		Employer	ASFD		

Nr of Employees	1	Duration	3+ hours	Frequency	Daily
Employee Name	Brendan McDonough				
Address		Phone	( ) -		
Occupation	Wildland Firefighters	Employer	ASFD		
Nr of Employees	30	Duration	8+ hours	Frequency	Daily
Employee Name	Division Z				
Address		Phone	( ) -		
Occupation	Wildland Firefighters	Employer	ASFD		
Nr of Employees	19	Duration	6+ hours	Frequency	Daily
Employee Name	Granite Mountain IHC				
Address		Phone	( ) -		

Instance Description:	A. Hazard	B. Equipment	C. Location	D. Injury/Illness	E. Measurements
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**Date/time condition observed by CSHO:**

CSHO did not observe any of the cited instances. Details of exposure/violation were obtained through witness interviews, review of documents, and review of video and photographs taken by witnesses and other fire personnel working at the Yarnell Hill Fire.

**Instance description: Describe the hazardous condition. Include make, model/serial numbers and measurements where applicable.**

On the evening of Friday, June 28, 2013, a lightning strike started a small fire on the west side of the Weaver Mountains (State Trust Land) northwest of Yarnell, Arizona. Due to the location of the fire and land ownership, the Arizona State Forestry Division assumed suppression responsibility of the fire. The fire was in the assigned area of District Forester Jim Downey. Downey assigned a Type 4 Initial Attack Incident Commander, Russ Shumate (Assistant Fire Management Officer) working out of Prescott to the fire.

At approximately 1630 on Saturday, June 29, 2013, the fire, estimated to be 8 acres in size, jumped over the east control line (a two-track road) and began burning on the east side of the Weaver Mountains. The fire escaped initial attack and transitioned to a more complex fire requiring additional management and field resources.

By 2000 on June 29, 2013, ICT4 Shumate began ordering additional resources to staff a Type 2 incident management team. Additional ground and aviation suppression and support forces were ordered as well.

ASFD selected a short Type 2 incident management team without completing an incident complexity analysis, an Escaped Fire Situation Analysis (EFSA) required by ASFD Standard Operational Guideline 701, a Wildland Fire Situation Analysis (WFSA) and an Incident Action Plan (IAP) as required by interagency industry practice and standards. These standard analytical tools guide fire management decision-making to ensure that an adequate match exists between fire complexity, incident management capabilities, and fire suppression objectives.

At 1337 on Sunday, June 30, 2013, nearly 34 hours after the fire had started, District Forester Jim Downey and Type 2 Incident Commander Roy Hall completed a fire complexity analysis. Their analysis using the industry standard "Incident Analysis Type 1 & 2" checklist mistakenly indicated that the existing level of incident command (Type 4) would be sufficient for the fire. However, a hand written note at the bottom of the checklist indicated "Rates Type 2 - Upgrade to Type 1."

ADOSH performed the analysis using the same "Incident Analysis Type 1 & 2" checklist and consideration of known conditions. This analysis indicated that on the evening of June 29, 2013 the Yarnell Hill Fire was transitioning to a Type 1 complexity fire. The correct incident complexity was eventually chosen by Downey and Hall; however, it was more than a day late and resulted in the exposure of hundreds of firefighters to complex fire hazards that may have otherwise been controlled by an adequately staffed fire response operation.

Fire management's delay in completing a fire complexity analysis likely delayed assignment of a replacement incident commander. Initial Attack Incident Commander Russ Shumate worked a 30 hour shift before incident management was turned over to his replacement Roy Hall. During this time, Shumate was faced with ongoing logistical, planning, safety, communications and operational challenges as fire complexity changed.

The fire was originally managed by a Type 4 incident commander. On the evening of June 29, 2013, following the failure of initial attack efforts, fire complexity changed from a Type 4 incident to a Type 1 incident. Instead of conducting an incident complexity analysis, an Escaped Fire Situational Analysis and an Incident Action Plan, fire management assigned a Type 2 - short team to manage the fire. The Type 2-short incident command team members arrived at different times, which prevented key personnel from involvement in the development and implementation of fire suppression plans. Once fire activity picked up on the morning of Sunday, June 30, 2013, incident command became overwhelmed resulting in multiple firefighter exposures to smoke inhalation, burns, and death.

By the time Downey and Hall completed their analysis of fire complexity, the fire was completely out of control, and had burned an estimated 1,000 acres and four structures. By the end of that day, and before the arrival of the Type 1 Incident Management Team on July 1, 2013 at 1800, the fire burned over 8,000 acres, over one hundred structures, exposed dozens of firefighters to smoke inhalation, burns, and death, and resulted in the entrapment death of 19 firefighters.

The assigned Type 2 Short Incident Management Team and associated resources (ground crews and aviation) attempted to manage hazardous complex fire conditions that exceeded their capabilities.

**Describe employee exposure to the condition, including the relationship to this cited employer.**

Over 300 firefighters were employed directly by or under cooperative agreements with the Arizona State Forestry Division (ASFD) and were exposed to smoke inhalation, burns, and death by rapidly progressing wildland fire. The employer failed to implement wildfire suppression plans consistent with A.R.S. Section 37-623 Suppression of wildfires and ASFD SOG - 701 Fire Suppression and Prescribed Fire Policy (2008) which would include an incident complexity analysis, EFSA, WFSA or WFDSS and Incident Action Plan.

**There is no specific OSHA standard that addresses this hazard and a general duty citation is therefore recommended based on the following information:**

**A: Recognition of the Hazard:**

**A.1: Employer Recognition:**

Evidence the Arizona State Forester recognized the hazard includes documents the ASFD provided ADOSH that it uses in wildland fire operations and safety in Arizona.

A.R.S. Section 37-623 Suppression of wildfires; powers and duties of state forester; entry on private lands.

Arizona State Forestry Division, Standard Operational Guideline 701, Fire Suppression and Prescribed Fire Policy (2008).

NWCG Wildland Fire Incident Management Field Guide (2013)

NWCG Interagency Standards for Fire and Fire Aviation Operations (2013)

NWCG Incident Response Pocket Guide (2010)

Relevant excerpts from the SOG-701 are described below. Relevant excerpts from the NWCG documents, which apply to both employer and industry hazard recognition is described in the following section titled "Industry Recognition."

**A.2: Industry Recognition:**

The Arizona State Forester provided ADOSH with the following documents that it uses in wildland fire operations and safety in Arizona:

NWCG Wildland Fire Incident Management Field Guide (2013)

NWCG Interagency Standards for Fire and Fire Aviation Operations (2013)

NWCG Incident Response Pocket Guide (2010)

Arizona State Forestry Division, Standard Operational Guideline 701, Fire Suppression and Prescribed Fire Policy (2008)  
Policy, Page 2

1. **Safety:** Firefighter and public safety is the first priority. All fire management activities must reflect this commitment.
2. **Fire Management:** The full range of fire management activities will be used to hold wildfire losses on state lands to a level consistent with resource values at risk while providing adequate health and safety protection to the public and firefighters and with a minimum expenditure of state funds.
3. **Response to Wildfire:** Appropriate response to wildfires is based on environmental, social and legal considerations, and the likely consequences on firefighter and public safety and welfare, natural and cultural resources and the values to be protected, and the economic interests of the Land Trust and State Treasury.
4. **Use of Wildfire:** Wildfires will not be used to enhance natural resources. Wildfires will be controlled, contained, or confined at the least cost to the State, consistent with firefighter and public safety and welfare.
5. **Protection Priorities:** The protection of human life is the single, overriding suppression priority. Setting priorities among protecting human communities and community infrastructure, other property and improvements, and natural and cultural resources will be done based on the values to be protected, human health and safety, and the cost of protection. Once people have been committed to an incident, these human resources become the highest value to be protected.
6. **Wildland Urban Interface:** The operational roles of the State as partners in the wildland urban interface are wildland firefighting, hazard reduction, cooperative prevention and education, and technical assistance. Structural fire suppression is the responsibility of federal, tribal, or local governments. The State may assist with exterior structural fire protection activities under formal fire protection agreements that specify the mutual responsibilities of the partners.
7. **Suppression:** Wildfires are suppressed at minimum cost, considering firefighter and public safety, and all values to be protected, consistent with management objectives.
8. **Prevention:** The State will work with the federal wildland agencies and with local governments and partners and other affected groups and individuals to prevent unauthorized ignition of wildland fires.
9. **Standardization:** The State will implement training and qualification requirements, operational procedures and methodologies, and public education programs for all fire management activities that are compatible with the federal wildland agencies.
10. **Interagency Cooperation:** Fire management planning, preparedness, prevention, suppression, fire use, restoration and rehabilitation, monitoring, research, and education will be conducted on an interagency basis with the involvement of cooperators and partners.(emphasis added)

**Wildfire Suppression Strategies, Page 4:**

Transition from initial attack to extended attack can be especially dangerous. During this transition, the fire shall be managed as a potentially life-threatening event. Identification of the fire behavior thresholds at which large fires typically occur is important because these thresholds indicate fire danger levels that compromise safety and control. When such thresholds are approached, fire program managers shall require additional supervisory and suppression support.

When a potentially life-threatening event exists, action shall be taken to provide for the safety of firefighters, other personnel, and the public, regardless of suppression costs or resource losses. (emphasis added)

**Escaped Fires, Page 9:**

Wildfires and prescribed fires which are expected to exceed initial attack capabilities or prescription, or burn into the next burning period (10:00 a.m. to sundown) will be considered an escaped fires. All escaped fires will have an Escaped Fire Situation Analysis completed by the responsible District Forester, or their designated representative.

The District Forester shall promptly organize and activate sufficient resources to implement an appropriate suppression action for each escaped fire. Such action will be consistent with the fire suppression direction for the area and the decisions approved in the Escaped Fire Situation Analysis. The Escaped Fire Situation Analysis will be reviewed daily and updated as necessary. (emphasis added)

## 2013 Wildland Fire Incident Management Field Guide, National Wildfire Coordinating Group (NWCG)

### Chapter 2, Operational Guides, Extended Attack, Page 23

#### Definition of Extended Attack

Extended Attack is the suppression activity for a wildfire that has not been contained or controlled by initial attack or contingency forces and for which more firefighting resources are arriving, en route, or being ordered by the Initial Attack Incident Commander.

An Extended Attack Incident is the phase of the incident when Initial Attack capabilities have been exceeded. This has a high potential for more serious accidents and injuries. All planned actions must consider firefighter and public safety as the number one priority.

When complexity levels exceed Initial Attack capabilities, the appropriate ICS positions should be added to the command staff commensurate with the complexity of the incident. Complexity is usually Type 3; however complexity could be typed at any level. (emphasis added)

### Chapter 2, Operational Guides, Page 24

#### Change From an Initial Attack Incident to an Extended Attack Incident

Early recognition by the Initial Attack IC that the Initial Attack forces will not control a fire is important. As soon as the Initial Attack IC recognizes that additional resources are needed or knows additional forces are en route, the IC may need to withdraw from direct fireline suppression and must prepare for an Extended Attack mode of operation.

The Initial Attack IC will perform the following duties when changing to an Extended Attack Incident if all positions are not filled:

- o Establish an Incident Command Post (ICP) and check-in location(s) to receive, brief, and assign incoming resources.
- o Use complexity analysis to validate organizational needs (see IRPG).
- o Follow the risk management process in the IRPG. Review and update regularly during the incident. (emphasis added)

### Chapter 2, Operational Guides, Page 27

#### Extended Attack Safety Checklist

After your initial sizeup of the fire and/or transition from an Initial Attack IC, answer the following questions (repeat this analysis whenever there is a change in conditions on the fire or a predicted change in fire conditions). If the answer is **NO** to any of the checklist questions, you **MUST** take corrective action(s) **IMMEDIATELY**. (emphasis added)

### Chapter 2, Operational Guides, Page 30

#### TRANSFER OF COMMAND

Many safety problems emerge as an incident becomes larger and/or more complex. Incident transfer of command historically has been one of the most dangerous phases of incident management. Incidents should transfer command at a specific time, preferably at the start of a new operational period. The operational effort should continue during transfer period with command and control of the incident firmly in place, and with clear, achievable, and sound strategy and tactics communicated to and implemented by all firefighting resources. (emphasis added)

#### Agency Administrator(s)' Responsibility for the Transfer of Command and Release of Incident Management Teams

The following guidelines are for the orderly transfer of command of fire management authorities to incoming ICs and their teams as well as their release. Agency Administrator(s) always maintain responsibility for the incident. Some information will need to be in writing and some may be verbal. (emphasis added)

### Chapter 2, Operational Guides, Page 32

#### Transfer of Authority

1. *The IC in place is in charge until officially released. Release should not occur until incoming IC and team members are briefed by their counterparts and ready to take full command of incident.*
2. *The operational effort should continue during the transfer period, with command and control of the incident firmly in place, and with clear, achievable, and sound strategy and tactics communicated to and implemented by all firefighting resources. As a general rule, command transfer should occur at the end of an operational period.*
3. *The requesting unit should specify the expected time of arrival and expected time of transfer of command to the incoming team.*
4. *The current IC should contact the local Agency Administrator in advance for location and time for Agency Administration briefing.*
5. *The requesting agency should accomplish the following before the arrival of the incoming team:*
  - a. *Make contact with incoming IC before his or her arrival. Give IC an update on progress of fire and inquire if there are any special needs for the team.*
  - b. *Determine ICP, Base, and Staging Area locations.*
  - c. *Order support equipment, supplies, and initial basic support organization for the incident.*
  - d. *Determine transportation needs of the team, and obtain needed vehicles.*
  - e. *Schedule the Agency Administrator briefing time and location.*
  - f. *Obtain necessary information for the Agency Administrator briefing.*
  - g. *Obtain necessary communications equipment and support for the incident.*
6. *It is the responsibility of the jurisdictional Agency Administrator(s) to ensure that, where required, the Wildland Fire Decision Support System (WFDSS) is used.*
7. *The existing IC at the ICP should brief the incoming IC and team. The time of transfer of command will depend upon incident complexity, expertise of the existing team, and/or other problems.*
8. *Complete a written Delegation of Authority, per agency policy, for the incoming IC to review.*

The fire was originally managed by a Type 4 incident commander. On the evening of Saturday, June 29, following the failure of initial attack efforts, fire complexity changed from a Type 4 incident to a Type 1 incident. Rather than conduct a complexity analysis, fire management assigned a Type 2 - short team to manage the fire. The Type 2 incident command team members arrived at different times which prevented key personnel from involvement in the development and implementation of fire suppression plans. Once fire activity picked up on the morning of Sunday, June 30, 2013, incident command became overwhelmed resulting in multiple firefighter exposures to smoke inhalation, burns, and death.

#### **Chapter 4, References, Incident Complexities, Page 137** **Incident Complexity Analysis (Type 1 or 2)**

*Guide to completing the following table:*

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-G), the primary factor should be considered as a positive response.*
3. *If any three of the primary factors (A-G) are positive responses, this indicates the fire situation is or is predicted to be of Type 1 complexity.*
4. *Factor H should be considered after numbers 1-3 are completed. If more than two of the items in factor H are answered Yes, and three or more of the other primary factors are positive responses, a Type 1 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 2 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.*

#### **NWCG Interagency Standards for Fire and Fire Aviation Operations (2013)**

#### **Chapter 11, Incident Management and Response, Page 11-1**

##### **Incident Command System (ICS)**

*The ICS is the on-site management system used in NIMS. The ICS is a standardized emergency management system specifically designed to provide for an integrated organizational structure that reflects the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries. ICS is the combination of facilities, equipment, personnel, communications, and procedures operating within a common organizational structure to manage incidents. ICS will be used by the agencies to manage wildland fire operations and all-hazard incidents.*

### **Wildland Fire Complexity**

*Wildland fires are typed by complexity, from Type 5 (least complex) to Type 1 (most complex). The ICS organizational structure develops in a modular fashion based on the complexity of the incident. Complexity is determined by completing an Incident Complexity Analysis - (Refer to samples in appendix E & F). Units may develop their own Incident Complexity Analysis format to replace appendix F.*

*Incidents not meeting the recommended incident typing characteristics below 1 should have a documented Complexity Analysis (Appendix F) verifying the 2 command organization is appropriate. (emphasis added)*

Note: The Incident Complexity Analysis (1&2) contained in Appendix E of the 2013 Interagency Standards for Fire and Aviation is identical to the Incident Complexity Analysis contained in the 2013 Wildland Fire Incident Management Field Guide discussed previously.

### **Chapter 11, Incidence Management & Response, Page 11-3**

*For purposes of initial attack, the first IC on scene qualified at any level will assume the duties of initial attack IC. The initial attack IC will assume the duties and have responsibility for all suppression efforts on the incident up to his/her level of qualification until relieved by an IC qualified at a level commensurate with incident complexity.*

*As an incident escalates, a continuing reassessment of the complexity level should be completed to validate the current command organization or identify the need for a higher level of incident management.*

*An IC is expected to establish the appropriate organizational structure for each incident and manage the incident based on his/her qualifications, incident complexity, and span of control. If the incident complexity exceeds the qualifications of the current IC, the IC must continue to manage the incident within his/her capability and span of control until replaced.*

### **A.3: Arizona Industry Common Practice, pursuant to A.R.S. Section 23-403(C):**

*Notwithstanding subsection A of this section, a condition or practice which is common within an industry is not deemed a recognized hazard unless a standard or regulation concerning the condition or practice has been developed pursuant to section 23-410 or 23-414.*

It is a common practice in the industry to perform the required analysis and planning. The failure to perform an incident complexity analysis, an Escaped Fire Situational Analysis, a Wildland Fire Situational Analysis or Wildland Fire Decision Support System and Incident Action Plan is deemed a recognized hazard

### **B: Probability of death or serious physical harm:**

The probability of employee exposure to serious physical harm and death is directly related to fire behavior, weather, and distance employees work from fire and smoke. Should wind driven wildland fire or smoke overtake an employee the probability of serious physical harm or death is extremely high due to exposure to toxic gases and extreme high temperature.

### **C: What feasible abatement methods are available to address this hazard?**

The employer can abate by actions that include, timely performing the following when a fire escapes an initial attack:

*Early recognition by the Initial Attack IC that the Initial Attack forces will not control a fire is important. As soon as the Initial Attack IC recognizes that additional resources are needed or knows additional forces are en route, the IC may need to withdraw from direct fireline suppression and must prepare for an Extended Attack mode of operation.*

Incident complexity analysis, Escaped Fire Situational Analysis, and

Wildland Fire Situational Analysis or

Wildland Fire Decision Support System,

and an Incident Action Plan.



**D: Appropriateness of the penalty amount:**

An employee exposure value of 10 was selected as more than 10 employees were exposed to wildland fire.

Frequency of exposure was estimated to be a value of 10 (16 hour workday and up to 14 consecutive days).

Proximity was estimated to be a value of 10 (at the point, high risk hazards).

Stress was estimated to be a value of 10 (high management stress, very poor conditions).

A severity factor of 10 was selected as employee exposure to smoke inhalation or burns would likely result in serious debilitating injuries or death.

**Describe employer knowledge of the condition and of employee exposure to the condition.**

Pursuant to Arizona Revised Statutes, A.R.S. Section 37-623, The Arizona State Forestry Division has responsibility for management of fires on State lands and private property outside of incorporated areas. The Yarnell Hill Fire initially started on State trust land yet mostly burned private lands outside of incorporated areas.

On the evening of Friday, June 28, 2013, a lightning strike ignited a small fire on the west side of the Weaver Mountains (State Trust Land) north and west of Yarnell, Arizona. Due to the location of the fire the Arizona State Forestry Division (ASFD) took control of the fire. ASFD District Forester Jim Downey was assigned to manage the fire.

In the late afternoon of Saturday, June 29, 2013, the Yarnell Hill Fire escaped initial attack and became an extended attack operation. Photographs taken by aviation (air attack) on the afternoon of June 29, 2013, show that the fire jumped the east control line (defined as a slop over) and began burning on the eastern slope of the Weaver Mountains. The Incident Commander, Russ Shumate, was in contact with aviation and knew of the fire's escape from the east control line.

Interviews of fire management and employees uniformly demonstrated knowledge of expected extreme fire behavior based on extended drought conditions, high fuel loading, excessive heat, and forecasted afternoon thunderstorms. In addition, fire management and incident command knew that structures in Peoples Valley, Yarnell, and Glen Ilah would be threatened by the fire.

Additionally, the ASFD provided to ADOSH documentation of the practices it uses in managing fire, the documents included the NWCG 2013 Interagency Standard for "Fire and Fire Aviation Operations," the NWCG 2013 "Wildland Fire Incident Management Field Guide" and the NWCG "Incident Response Pocket Guide". These documents refer to the need to complete a Fire Complexity Analysis, an Escaped Fire Situational Analysis and an Incident Action Plan when transitioning from a Type 4 incident to a Type 2 incident.

ASFD knew that a complexity analysis was necessary; however, the analysis wasn't completed until after fire management had transitioned to a more complex team. The completed complexity analysis indicated that the highest level management team was necessary.

Despite this knowledge, fire management did not complete a Fire Complexity Analysis until the following day.

Fire management did not complete an Escaped Fire Situational Analysis (EFSA).

A Wildland Fire Situational Analysis (WFSA) decision and/or Wildland Fire Decision Support System (WFDSS) was not published until July 4, 2013.

An Incident Action Plan (written or oral) with objectives reflecting the overall incident strategy and specific tactical actions and supporting information for the next operational period was not completed and should have been articulated to the incoming Type 2 Incident Commander during the transitional period.

ASFD fire management knew or should have known that this fire complexity analysis was required to be performed on June 29, 2013 when the fire escaped initial attack. This delay exposed firefighters to hazards of smoke inhalation, burns, and death which otherwise could have been avoided had sufficient incident management staff been assigned and present at the fire on June 30, 2013.

Note any other comments made by the employer, or other information relative to this citation, not already noted above.

**Penalty calculation:**

**Probability:**

**Number of employees: 10+**

**Frequency of exposure:10**

**Proximity to hazard:10**

**Stress:10**

**Other:**

**TOTAL:40**

**Number of factors:4**

**Probability TOTAL:10G**

**Severity:10H**

Event Date	Event Code	Action Code	Citation Type	Penalty	Abate Date	Final Order
	Z Add transaction	A Add	S Serious	7000.00		



Worksheet

Wed Nov 27, 2013 12:20pm

		Inspection Number	317242683		
		Opt. Insp. Number	0618		
Establishment Name	Arizona State Forestry Division				
Type of Violation	S Serious	Citation Number	02	Item/Group	002
Number Exposed	81	No. Instances	2	REC	A Accident
Std. Alleged Vio.	23.0403(A)				

Abatement Period	MultiStep Abatements			Final Abatement	Action Type/Dates
	PPE Period	Plan	Report		
3					
Abatement Documentation Required			Y	Date Verified	

Substance Codes	
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AVD/Variable Information:

A.R.S. Section 23-403(A): The employer did not furnish to each of his employees employment and a place of employment which were free from recognized hazards that were causing or likely to cause death or serious physical harm to their employees, in that pursuant to Arizona State Fire Division Standard Operating Guideline SOG-701, transition from initial attack to an extended attack operations is extremely dangerous and critical incident management personnel necessary to support the planning and implementation of fire suppression operations arrived late or were absent from their assigned positions during the life-threatening transition thereby increasing the risk of firefighter exposure to smoke inhalation, burns, and death:

- a) Yarnell Hill Fire, Yarnell, Arizona: On or about June 30, 2013, fire management positions of Safety Officer and Planning Section Chief were unfilled and therefore unable to participate during critical fire suppression planning, transition planning, and oversight of ongoing wildfire suppression operations.
- b) Yarnell Hill Fire, Yarnell, Arizona: On June 30, 2013, at approximately 1330, Division Z Supervisor departed from his assigned position which left Division Z without supervision during ongoing wildfire suppression operations.

Penalty Calculations				Adjustment Factors			Proposed Adjusted Penalty
Severity	Probability	Gravity	GBP	Size	Good Faith	History	
H High	G Greater	10	7000.00	0	0	0	7000.00
Repeat Factor		0					

Employee Exposure:							
Occupation	Wildland Firefighters			Employer	ASFD		
Nr of Employees	31	Duration	8+ hours	Frequency	daily		
Employee Name	Structure Protection Group 2						
Address				Phone	( ) -		
Occupation	Wildland Firefighter			Employer	ASFD		
Nr of Employees	1	Duration	3+ hours	Frequency	Daily		
Employee Name	Brendan McDonough						
Address				Phone	( ) -		
Occupation	Wildland Firefighters			Employer	ASFD		

Nr of Employees	30	Duration	8+ hours	Frequency	Daily
Employee Name	Division Z				
Address		Phone	( ) -		
Occupation	Wildland Firefighters	Employer	ASFD		
Nr of Employees	19	Duration	6+ hours	Frequency	Daily
Employee Name	Granite Mountain IHC				
Address		Phone	( ) -		

Instance Description:	A. Hazard	B. Equipment	C. Location	D. Injury/Illness	E. Measurements
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**Date/time condition observed by CSHO:**

CSHO did not observe any of the cited instances. Details of exposure/violation were obtained through witness interviews, review of documents, and review of video and photographs taken by witnesses and other fire personnel working at the Yarnell Hill Fire.

**Instance description: Describe the hazardous condition. Include make, model/serial numbers and measurements where applicable.**

Wildland fire suppression response actions follow the National Incident Management System whereby fire incident management teams of varied complexity are ordered by wildland protection agencies, through a network of national, regional, and local dispatch centers to suppress fires on public and private lands. The complexity of an incident management team is determined by the complexity of the incident they have been assigned to manage. Incident complexity ranges from Type 5 (least complex) to a Type 1 (most complex).

When incident complexity requires Type 1, 2, or 3, incident management teams, each member of the team is charged with specific duties to ensure that management of the fire is consistent with the objectives of the wildland management agency while considering firefighter safety, resources to be protected, and cost. When management team members are not present, their duties must either be performed by others or left undone thereby increasing the probability of employee exposure to wildland fire hazards.

**Instance a:**

On or about 1600 on Saturday, June 29, 2013, the Yarnell Hill Fire, under the command of Type 4 Incident Commander Russ Shumate, escaped initial attack and burned onto the east slope of the Weaver Mountains one mile south of the communities of Peoples Valley, and two miles northwest of the communities of Yarnell and Glen Ilah. That afternoon, and into the evening, fire management ordered and dispatched resources and personnel to arrive at the fire the following morning.

On June 29, 2013, at 2120, Yarnell Hill Fire Deputy Incident Commander Glenn Joki contacted Norval Tyler at the Arizona Dispatch Center (ADC) and requested two safety officers be assigned to the Yarnell Hill Fire. The following day, at 1248 on Sunday, June 30, 2013, ADC dispatched two safety officers to the fire.

On June 30, 2013, Safety Officer Tony Sciacca arrived to the fire at approximately 1430, which was more than 22 hours after the fire had escaped initial attack efforts and more than six hours after fire suppression operations had begun that day. Safety Officer Marty Cole arrived to the fire at approximately 1600, which was 24 hours after the fire had escaped initial attack and more than eight hours after fire suppression operations had begun that day. In the interim, the Incident Commander had the responsibility to ensure completion of the Safety Officer's duties, which included: analyze safety aspects of selected and alternative suppression strategies/tactics; prepare, review, and manage the safety portion of the Incident Action Plan; jointly develop the Incident Action Plan Safety Analysis with the Operations Section Chief; present safety briefings to overhead which emphasize hazards and risks associated in action plan components; establish a system to monitor fire activities for hazards and risks; review and approve medical plan, monitor operational period lengths and ensure firefighter compliance with work/rest guidelines; monitor food, potable water, and sanitation service inspections; monitor firefighter personal protective equipment requirements, and monitor all air operations, etc.

At 1430 on June 30, 2013, when Safety Officer Tony Sciacca arrived, fire suppression operations were fully implemented, over 300 firefighters were assigned to positions throughout the 8,000 acre fire area, and an approaching thunderstorm would

quickly result in abandonment of suppression plans. Dozens of firefighters working at isolated portions of the fire were exposed to fire and smoke from the rapidly progressing wind driven wildland fire. Nineteen firefighters would die as a result of an entrapment and burnover.

Although safety is the responsibility of all firefighters and management, the specific incident management team position of Safety Officer is intended to ensure a focused evaluation of firefighter safety independent of pressures associated with suppression objectives, suppression progress, resource protection, and cost. Had a Safety Officer been involved in suppression planning, oversight of suppression operations, and re-evaluation of firefighter exposure when conditions changed, the chosen suppression strategies and tactics implemented on June 30, 2013 may have been different.

On June 29, 2013, at 2120, Yarnell Hill Fire Deputy Incident Commander Glenn Joki contacted Norval Tyler at the Arizona Dispatch Center (ADC) and requested Planning Section Chief Brian Lauber respond to the fire.

At 2249 on June 29, 2013, Planning Section Chief Brian Lauber was contacted by ADC and accepted the assignment. He was scheduled to arrive at the fire at 0800 the following day. However, Lauber arrived at the fire on June 30, 2013 at 1630, more than eight hours after his assigned response time. In the interim, Incident Commander Roy Hall was required to ensure that completion of the Planning Section Chief's duties, which included: conduct planning meetings and operational briefings, supervise development of an Incident Action Plan and ensure that copies are distributed to Unit Leaders, advise general staff of significant changes in incident status, prepare and distribute Incident Commander's orders, ensure that information regarding special environmental protection needs are included in the Incident Action Plan, assemble information on alternative fire suppression strategies, and ensure the collection and reporting of agency required information is completed, etc.

By 1630 on June 30, 2013, when Planning Section Chief Lauber arrived to the fire, suppression operations were chaotic. Firefighters were retreating to avoid a fire that had significantly increased in intensity and changed directions. Dozens of firefighters working at isolated portions of the fire were exposed to fire and smoke from the rapidly progressing wind driven wildland fire. Nineteen firefighters would ultimately die as a result of an entrapment and burnover.

The incident management team position of Planning Section Chief is responsible for collecting, evaluating, disseminating, and updating information about the development of the incident and status of resources. The information collected, assembled, and distributed by the Planning Section Chief provides fire management with an understanding of current conditions, predicted probable course of incident events, alternative strategies, and control of operations. Because this position was vacant, the Incident Commander had to balance his own workload and determine which Planning functions he would perform himself or delegate to someone else. A major function associated with the Planning Section is ensuring that field personnel have appropriate maps of the fire area. This function was not completed until the evening of Sunday, June 30, 2013. Had a Planning Section Chief been involved in preliminary suppression planning, firefighter safety associated with suppression strategies and tactics implemented on June 30, 2013 may have been different.

**Instance b:**

On June 30, 2013, at 1030, Rance Marquez arrived to the incident command post and received a personalized briefing and was assigned to be Supervisor of Division Z. He cloned his radio and drove out to his assigned position as Division Z Supervisor for a geographical area located north of Yarnell and adjacent to Division A. Operations Section Chief Todd Abel was his direct supervisor.

By the time Marquez arrived at his work location, the existing team had already built a 2 mile long dozer line. Marquez, Blue Ridge IHC Superintendent Brian Frisby, and Division A Supervisor Eric Marsh discussed roles and responsibilities. Marquez cannot determine a good Division break and believes the existing plan is problematic as fuels were heavy, the terrain was difficult, and the resources assigned were limited. Marquez departs the area, returns to the incident command post and reports his findings to Musser. He never returns to Division Z and no other Supervisor was assigned as his replacement.

As a result, Division Z Supervisor duties including the following were not performed: use of the risk management process to ensure firefighter safety, supervision of assigned operations; accountability of assigned resources at all times; coordination of activities with adjacent Divisions; keeping direct supervisor informed of situation and resources status; conducting safety briefing to subordinate resources; briefing and assignment of specific work tasks to Task Forces/Strike Team Leaders; provide Incident Communications of all status changes of assigned resources; ensure that assigned personnel and equipment get on and off the fireline in a timely and orderly manner; resolve logistics problems within the Division/Group; and approve and turn in time for all resources in Division/Group to the Time Unit.

On June 30, 2013, at approximately 1600, firefighters working on Division Z were faced with retreat from rapidly progressing wind driven wildland fire. Fire crews were unsure as to when to evacuate and it was not until they became engulfed by smoke

and windblown embers that firefighters recognized that emergency escape was necessary. Had a Division Supervisor been present at Division Z, accountability of assigned forces would have been managed, and the timing and decision to evacuate may have been clearly conveyed to all forces in advance of exposure to smoke, windblown embers, and possible entrapment.

**Describe employee exposure to the condition, including the relationship to this cited employer.**

Over 300 firefighters were employed directly by or under cooperative agreements with the Arizona State Forestry Division (ASFD) and were exposed to smoke inhalation, burns, and death by rapidly progressing wildland fire in that critical fire management personnel were not involved in fire suppression planning and implementation of fire suppression operations.

**There is no specific OSHA standard that addresses this hazard and a general duty citation is therefore recommended based on the following information:**

**A: Recognition of the Hazard:**

**A.1: Employer Recognition:**

Evidence the Arizona State Forester recognized the hazard includes documents the ASFD provided ADOSH that it uses in wildland fire operations and safety in Arizona.

A.R.S. Section 37-623 Suppression of wildfires; powers and duties of state forester; entry on private lands.

Arizona State Forestry Division, Standard Operational Guideline 701, Fire Suppression and Prescribed Fire Policy (2008).

NWCG Wildland Fire Incident Management Field Guide (2013)

NWCG Interagency Standards for Fire and Fire Aviation Operations (2013)

NWCG Incident Response Pocket Guide (2010)

**Arizona State Forestry Division, Standard Operational Guideline 701, Fire Suppression and Prescribed Fire Policy (2008)**

**Policy, Page 2**

1. **Safety:** *Firefighter and public safety is the first priority. All fire management activities must reflect this commitment.*
2. **Fire Management:** *The full range of fire management activities will be used to hold wildfire losses on state lands to a level consistent with resource values at risk while providing adequate health and safety protection to the public and firefighters and with a minimum expenditure of state funds.*
3. **Response to Wildfire:** *Appropriate response to wildfires is based on environmental, social and legal considerations, and the likely consequences on firefighter and public safety and welfare, natural and cultural resources and the values to be protected, and the economic interests of the Land Trust and State Treasury.*
4. **Use of Wildfire:** *Wildfires will not be used to enhance natural resources. Wildfires will be controlled, contained, or confined at the least cost to the State, consistent with firefighter and public safety and welfare.*
5. **Protection Priorities:** *The protection of human life is the single, overriding suppression priority. Setting priorities among protecting human communities and community infrastructure, other property and improvements, and natural and cultural resources will be done based on the values to be protected, human health and safety, and the cost of protection. Once people have been committed to an incident, these human resources become the highest value to be protected.*
6. **Wildland Urban Interface:** *The operational roles of the State as partners in the wildland urban interface are wildland firefighting, hazard reduction, cooperative prevention and education, and technical assistance. Structural fire suppression is the responsibility of federal, tribal, or local governments. The State may assist with exterior structural fire protection activities under formal fire protection agreements that specify the mutual responsibilities of the partners.*
7. **Suppression:** *Wildfires are suppressed at minimum cost, considering firefighter and public safety, and all values to be protected, consistent with management objectives.*

8. **Prevention:** *The State will work with the federal wildland agencies and with local governments and partners and other affected groups and individuals to prevent unauthorized ignition of wildland fires.*

9. **Standardization:** *The State will implement training and qualification requirements, operational procedures and methodologies, and public education programs for all fire management activities that are compatible with the federal wildland agencies.*

10. **Interagency Cooperation:** *Fire management planning, preparedness, prevention, suppression, fire use, restoration and rehabilitation, monitoring, research, and education will be conducted on an interagency basis with the involvement of cooperators and partners.*  
(emphasis added)

#### **Wildfire Suppression Strategies, Page 4:**

Transition from initial attack to extended attack can be especially dangerous. During this transition, the fire shall be managed as a potentially life-threatening event. Identification of the fire behavior thresholds at which large fires typically occur is important because these thresholds indicate fire danger levels that compromise safety and control. When such thresholds are approached, fire program managers shall require additional supervisory and suppression support.

When a potentially life-threatening event exists, action shall be taken to provide for the safety of firefighters, other personnel, and the public, regardless of suppression costs or resource losses.

#### **Escaped Fires, Page 9:**

*Wildfires and prescribed fires which are expected to exceed initial attack capabilities or prescription, or burn into the next burning period (10:00 a.m. to sundown) will be considered an escaped fires. All escaped fires will have an Escaped Fire Situation Analysis completed by the responsible District Forester, or their designated representative.*

The District Forester shall promptly organize and activate sufficient resources to implement an appropriate suppression action for each escaped fire. Such action will be consistent with the fire suppression direction for the area and the decisions approved in the Escaped Fire Situation Analysis. The Escaped Fire Situation Analysis will be reviewed daily and updated as necessary.  
(emphasis added)

**There is no specific OSHA standard that addresses this hazard. However, this hazard is recognized by the employer, his industry, or both, in the following manner:**

#### **A.2: Industry Recognition:**

The Arizona State Forester provided ADOSH with the following documents that it uses in wildland fire operations and safety in Arizona:

NWCG Wildland Fire Incident Management Field Guide (2013)

NWCG Interagency Standards for Fire and Fire Aviation Operations (2013)

NWCG Incident Response Pocket Guide (2010)

#### **2013 NWCG Wildland Fire Incident Management Field Guide**

##### **Preface, Page i**

##### ***Purpose***

*The Wildland Fire Incident Management Field Guide states, references, or supplements wildland fire incident management and operational standards established by the National Wildfire Coordinating Group (NWCG).*

#### **Chapter 2, Operational Guides, Extended Attack, Page 23**

### ***Definition of Extended Attack***

*Extended Attack is the suppression activity for a wildfire that has not been contained or controlled by initial attack or contingency forces and for which more firefighting resources are arriving, en route, or being ordered by the Initial Attack Incident Commander.*

*An Extended Attack Incident is the phase of the incident when Initial Attack capabilities have been exceeded. This has a high potential for more serious accidents and injuries. All planned actions must consider firefighter and public safety as the number one priority.*

### **Chapter 2, Operational Guides, Control or Transfer to Type 2 Incident, Page 26**

*The primary objective of all ICs [incident commanders] is to provide for firefighter and public safety. Discharge of this objective applies the appropriate suppression response. This objective may require transfer of command. A measurable performance element with safety implications is the execution of this transfer of command. Adequate staffing, ordering of needed resources, good planning, good documentation, and quality briefings are all important elements of transfer of command.*

### **Chapter 2, Operational Guides, Large Fire Management Teams, Page 28**

#### Type 2 Organization

*A Type 2 Organization is the first level at which most or all of the Command and General Staff positions are activated and are filled by a Type 2 Incident Management Team (IMT). The IC and Command and General Staff must function as a team, handling many aspects, such as:*

- o Supervising a large organization.*
- o Planning during multiple operational periods.*
- o Gathering information to develop a written IAP.*
- o Providing logistical support, including the establishment and operation of a Base and possibly Camps.*

### **Chapter 2, Operational Guides, Transfer of Command, Page 30**

*Many safety problems emerge as an incident becomes larger and/or more complex. Incident transfer of command historically has been one of the most dangerous phases of incident management. Incidents should transfer command at a specific time, preferably at the start of a new operational period. The operational effort should continue during transfer period with command and control of the incident firmly in place, and with clear, achievable, and sound strategy and tactics communicated to and implemented by all firefighting resources.*

### **Chapter 3, Position Responsibilities, Position Checklists, Safety Officer, Page 43**

#### *Safety Officer (SOF1/2, SOFR)*

*The Safety Officer, a member of the Command Staff, is responsible for monitoring and assessing hazardous and unsafe situations and developing measures for assuring personnel safety. The Safety Officer will correct unsafe acts or conditions through the regular line of authority, although they (Safety Officer) may exercise emergency authority to stop or prevent unsafe acts when immediate action is required.*

*Only one Safety Officer will be assigned for each incident. The Safety Officer may have assistant Safety Officers as necessary, and the assistant Safety Officer may represent assisting agencies or jurisdictions. Assistant Safety Officers may have specific responsibilities, such as air operations, hazardous materials, etc.*

#### *Critical Safety Responsibilities*

- o Analyze proposed and selected strategic alternatives from a safety perspective, ensuring that risk management is a priority consideration in the selection process.*
- o Direct intervention will be used to immediately correct a dangerous situation.*
- o Prepare the safety message included in the IAP.*
- o Develop the Incident Action Plan Safety Analysis (ICS 215A) planning matrix with the Operations Section Chief.*



*o Present safety briefing to overhead. Safety briefing should emphasize hazards and risks involved in action plan components.*

*Other Duties*

- o Establish systems to monitor fire activities for hazards and risks. Take appropriate preventive action.*
- o Priority of recommendations will start with risks having the highest potential for death or serious injury and follow through to those of lesser degree.*
- o Establish operating procedures for assistant Safety Officers.*
- o Evaluate operating procedures. Update or modify procedures to meet the safety needs on the fire.*
- o Review and approve Medical Plan (ICS 206).*
- o Review IAPs to ensure that safety issues have been identified and mitigated.*
- o Analyze observations from staff and other personnel.*
- o Ensure accidents are investigated.*
- o Prepare accident report upon request of the Incident Commander.*
- o Monitor operational period lengths of incident personnel to ensure work/rest guidelines are followed; recommend corrective action to Incident Commander.*
- o Monitor food, potable water, and sanitation service inspections. Request assistance from health departments as needed.*
- o Monitor incident PPE needs.*
- o Inspect incident facilities, hand tools, power equipment, vehicles, and mechanical equipment.*
- o Monitor driver or operator qualifications and operational periods.*
- o Monitor all air operations; review aircraft incidents and accident reports.*
- o Ensure appropriate accident, incident, and other safety reports (such as SAFECOMs and SAFENETs) are completed and submitted.*
- o Prepare final safety report upon request of the Incident Commander.*

**Chapter 3, Position Responsibilities, Position Checklists, Planning Section Chief, Page 65**  
*Planning Section Chief (PSC1/2)*

*The Planning Section Chief, a member of the General Staff, is responsible for collecting, evaluating, disseminating, and using information about the development of the incident, status of resources, and demobilization of the incident.*

*Information is needed to understand the current situation, predict probable course of incident events, prepare alternative strategies and control operations for the incident, and provide for an orderly and economical demobilization of the incident.*

*Critical Safety Responsibilities*

- o Conduct Planning Meetings and operational briefings.*
- o Supervise preparation of IAP [Incident Action Plan] (see Planning Process), and ensure sufficient copies are available for distribution through Unit Leader level.*
- o Advise General Staff of any significant changes in incident status.*
- o Prepare and distribute Incident Commander's orders.*
- o Ensure that information concerning special environmental protection needed is included in the IAP.*
- o Establish information requirements and reporting schedules for all ICS Organizational elements for use in preparing the IAP.*
- o Instruct Planning Section Units in distribution of information.*

*Other Duties*

- o Assemble information on alternative strategies.*
- o Perform operational planning for Planning Section.*
- o Ensure that normal agency information collection and reporting requirements are met.*
- o Prepare recommendations for release of resources (for approval by the Incident Commander).*
- o Ensure demobilization plan and schedule are developed and coordinated with Command, General Staff, and Agency Dispatchers.*
- o Establish a communications link between the agency Demobilization Organization and the incident Demobilization Unit.*

**Chapter 3, Position Responsibilities, Position Checklists, Division/Group Supervisor (DIVS), Page 48**

The Division/Group Supervisor is responsible for implementing the assigned portion of the IAP.

*Critical Safety Responsibilities*

- o Use the risk management process, and supervise operations in the Division.*
- o Maintain accountability of assigned resources at all times.*
- o Coordinate activities with adjacent Divisions.*
- o Keep supervisor informed of situation and resources status.*
- o Provide safety briefing to subordinate resources.*

*Other Duties*

- o Brief and assign specific work tasks to Task Forces/Strike Team Leaders.*
- o Inform Incident Communications of all status changes of assigned resources.*
- o Ensure that assigned personnel and equipment get on and off the fireline in a timely and orderly manner.*
- o Resolve logistics problems within the Division/Group.*
- o Approve and turn in time for all resources in Division/Group to the Time Unit.*

**A.3: Arizona Industry Common Practice, pursuant to A.R.S. Section 23-403(C):**

*Notwithstanding subsection A of this section, a condition or practice which is common within an industry is not deemed a recognized hazard unless a standard or regulation concerning the condition or practice has been developed pursuant to section 23-410 or 23-414.*

Incident command transitions are required and common in the industry of wildland fire suppression. This transitional period is recognized throughout the industry as a highly hazardous condition. Arizona State Forestry Division and Interagency wildfire policy and procedures clearly identify transition from initial attack to extended attack as a particularly dangerous period in the evolution of a wildland fire requiring prompt organization and activation of suppression resources.

**B: Probability of death or serious physical harm:**

The probability of employee exposure to serious physical harm and death is directly related to fire behavior, weather, and distance employees work from fire and smoke. Should wind driven wildland fire or smoke overtake an employee the probability of serious physical harm or death is extremely high due to exposure to toxic gases and extreme high temperature.

**C: What feasible abatement methods are available to address this hazard?**

Feasible abatement includes:

ASFD could ensure that a sufficient number of Type 1 and 2 incident command and general staff personnel are available during the fire season for rapid deployment consistent with State and Interagency policy and procedures. If adequate State personnel are not available, then ensure that regional resources are promptly dispatched.

ASFD could ensure that implementation of suppression operations are adequately supervised to assure the safety and accountability of firefighters.

**D: Appropriateness of the penalty amount:**

An employee exposure value of 10 was selected as more than 10 employees were exposed to wildland fire.

Frequency of exposure was estimated to be a value of 10 (16 hour workday and up to 14 consecutive days).

Proximity was estimated to be a value of 10 (at the point, high risk hazards).

Stress was estimated to be a value of 10 (high management stress, very poor conditions).

A severity factor of 10 was selected as employee exposure to smoke inhalation or burns would likely result in serious debilitating injuries or death.

**Describe whether the employer knew, or with the exercise of reasonable diligence, could have known of the presence of the hazardous condition and of employee exposure to the condition.**

Pursuant to Arizona Revised Statutes, A.R.S. Section 37-623, The Arizona State Forestry Division has responsibility for management of fires on State lands and private property outside of unincorporated areas. The Yarnell Hill Fire initially started on State trust land yet mostly burned private lands outside of incorporated areas.

On the evening of Friday, June 28, 2013, a lightning strike ignited a small fire on the west side of the Weaver Mountains (State Trust Land) north and west of Yarnell, Arizona. Due to the location of the fire the Arizona State Forestry Division (ASFD) took control of the fire. ASFD District Forester Jim Downey was assigned to manage the fire. ASFD employee Russ Shumate was the initial attack Incident Commander. On Sunday, June 30, 2013, ASFD employee Roy Hall was designated the extended attack Incident Commander.

Between June 28, 2013 and July 1, 2013, ASFD personnel operating in the capacity of Fire Management Officer, District Forester, Incident Commanders (IC4 and IC2) and support staff managed Yarnell Hill Fire suppression operations. Incident Command positions as well as ground and aviation operations were managed and conducted by ASFD staff or by staff from other agencies working under cooperative agreements with ASFD.

Interviews of fire management and employees uniformly demonstrated knowledge of expected extreme fire behavior based on extended drought conditions, high fuel loading, excessive heat, and forecasted afternoon thunderstorms. Incident command reported this information to fire crews during morning briefings and throughout the day as new information became available. One week earlier a number of firefighters worked the Doce Fire, near Prescott, Arizona, and experienced similar fire conditions.

On the afternoon of Saturday, June 29, 2013, ASFD knew that initial attack of the fire failed and assigned crews were overwhelmed by conditions. The fire had transitioned to a more complex incident and a higher complexity incident management team was needed. The Arizona Dispatch Center (ADC) managed by ASFD coordinated the ordering and dispatch of personnel and resources to the fire.

ASFD knew that fire complexity transition is dangerous as the condition is termed "Life-Threatening" in their policies outlined above. Additionally, ASFD follows NWCG Interagency policies and procedures which also recognize fire complexity transitions as highly hazardous periods for firefighters.

On June 30, 2013, extreme fire behavior combined with strong thunderstorms created an extremely active fire that burned relatively uninhibited by suppression resources. Wind direction changed multiple times and wind intensity picked-up substantially ahead of forecasted thunderstorms. During this period, multiple incidences of employee exposure to smoke, burns, and death occurred because fire management failed to promptly remove employees working downwind of a rapidly progressing wind driven wildland fire.

ASFD fire management (Geyer, Downey, Shumate, Hall, Abel, Musser, and others): ordered and dispatched personnel to the Yarnell Hill Fire; knew that the fire had escaped initial attack and increased in complexity with a high potential for rapid growth; knew that incident management transitions represent a particularly dangerous period for firefighters; determined the level of incidence response; knew that critical incident management personnel necessary to support the planning and implementation of fire suppression operations would not arrive to the fire until well after operations were underway; and knew that Division Z Supervisor position was vacant. Despite this knowledge, ASFD incident management did not prioritize firefighter safety ahead of the value of structures and pastureland in that key planning, safety, and field management roles and responsibilities were known to be unfilled, which was inconsistent with ASFD and Interagency policy, procedures, and guidelines thereby increasing the potential for firefighter exposure to impending hazards and associated life threatening exposure to smoke, burns, and death.

**Instance a:**

ASFD knew that a Safety Officer was not assigned to the fire until 14 hours after the transitioning incident management team had been assigned to the fire.

ASFD knew that a Safety Officer was not present at the fire when fire planning occurred.

ASFD knew that a Planning Section Chief was not present at the fire when fire planning occurred.

**Instance b:**

ASFD through Operations Section Chief Paul Musser knew that the Supervisor of Division Z abandoned his assigned position and no replacement was assigned.

ASFD knew that supervision of firefighters is an essential function to assure the safety and accountability of firefighters.

Note any other comments made by the employer, or other information relative to this citation, not already noted above.

**Penalty calculation:**

**Probability:**

**Number of employees: 10+**

**Frequency of exposure:10**

**Proximity to hazard:10**

**Stress:10**

**Other:**

**TOTAL:40**

**Number of factors:4**

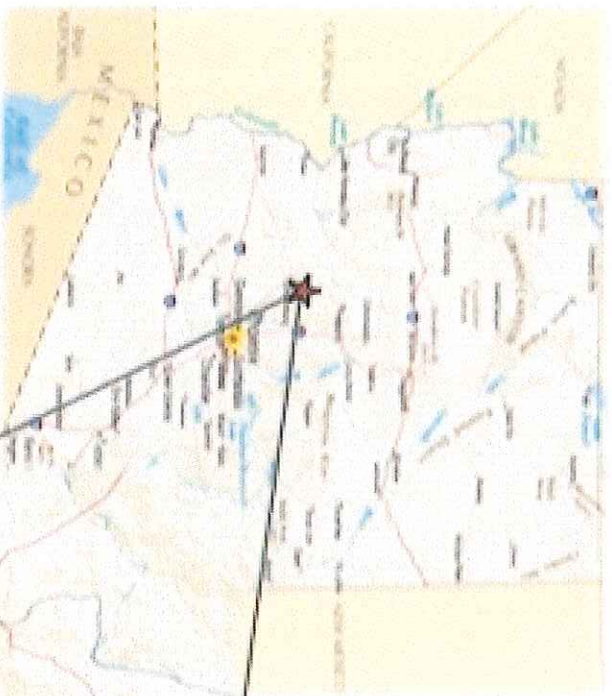
**Probability TOTAL:10G**

**Severity:10H**

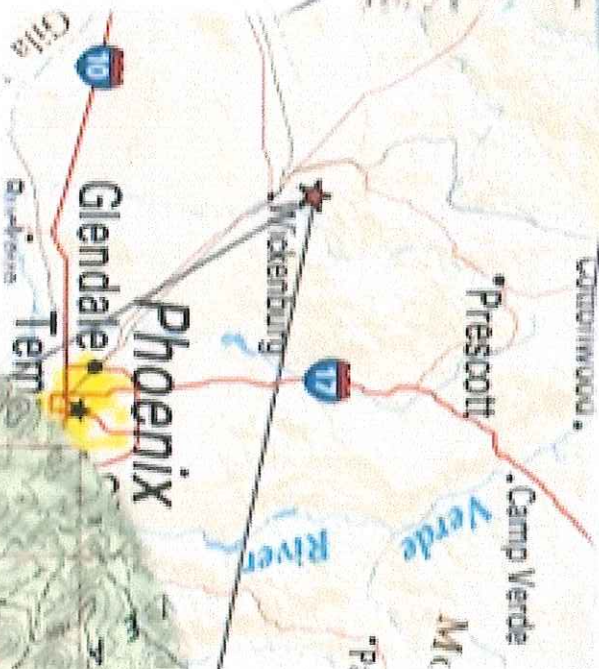
Event Date	Event Code	Action Code	Citation Type	Penalty	Abate Date	Final Order
	Z Add transaction	A Add	S Serious	7000.00		

# General Vicinity Map for Yarnell Hill Fire

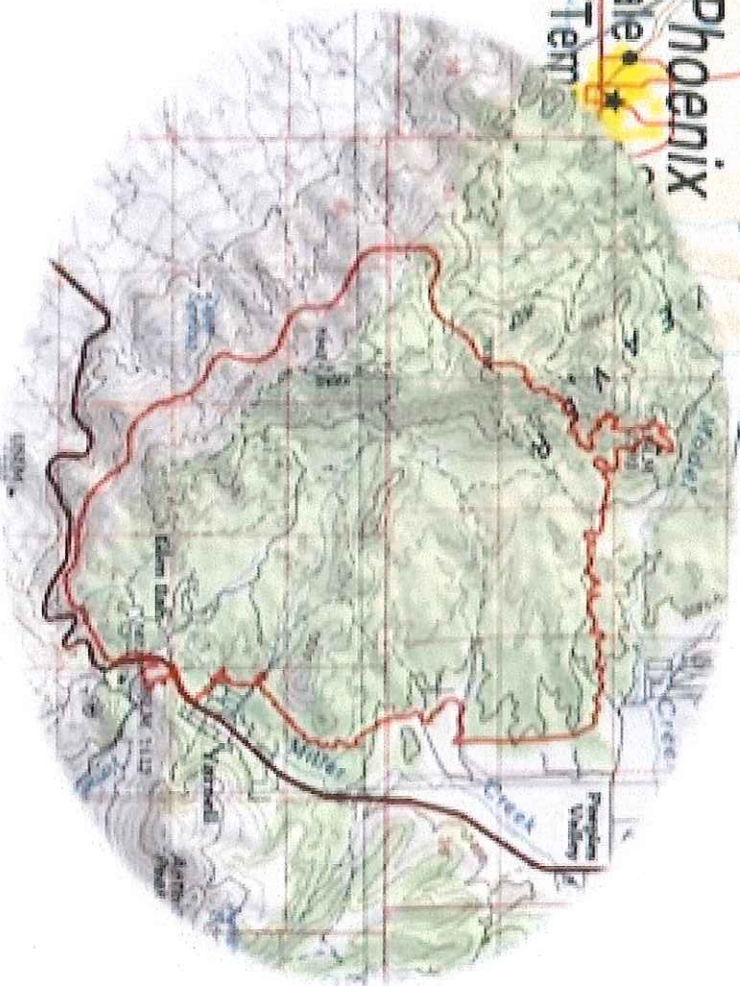
Yarnell Hill Fire:  
West-central Arizona



Yarnell Hill Fire:  
Yavapai County,  
Northeast of Wickenburg,  
And South of Prescott, AZ



Yarnell Hill Fire:  
North and West of US Highway 89,  
West of Yarnell, AZ, and Southwest  
Of Peoples Valley, AZ

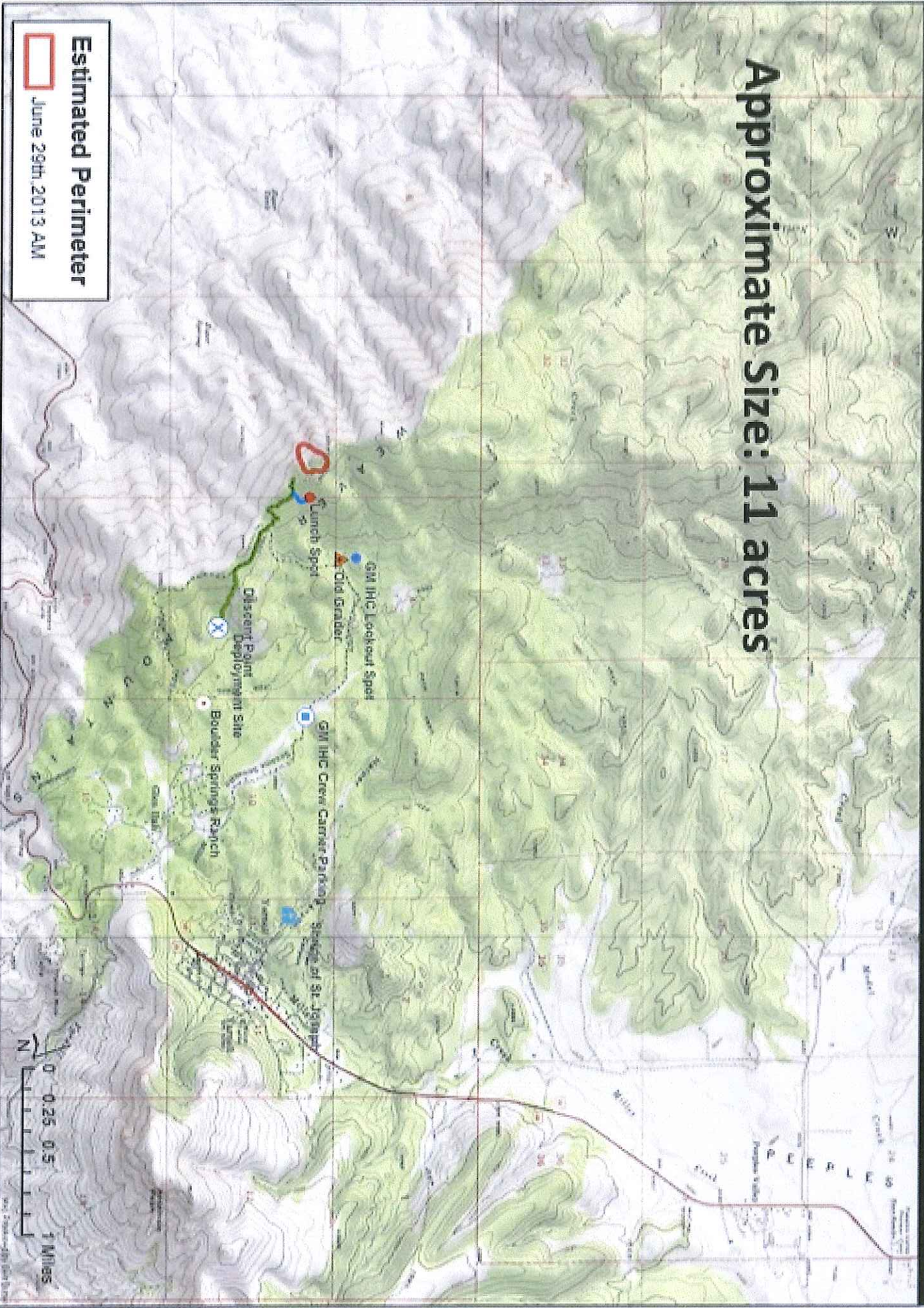




# Yarnell Hill Fire Estimated Perimeter

June 29th, 2013 AM Estimate

## Approximate Size: 11 acres



Estimated Perimeter

June 29th 2013 AM



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/29/2013	10:30 AM

Citation #	Item #	Photo #
1	1	1

**Photo Description**

Aerial photo of fire 1030 6/29/13 by BLM Representative Dean Fernandez. View of the western side of the mountain. Fire was estimated at approximately 11 acres at this time.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/29/2013	10:31 AM

Citation #	Item #	Photo #
1	1	2

**Photo Description**

Aerial photo of fire 1031 6/29/13 by BLM Representative Dean Fernandez. View of the eastern side of the mountain and the two-track trail. Fire was estimated at approximately 11 acres at this time.



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division

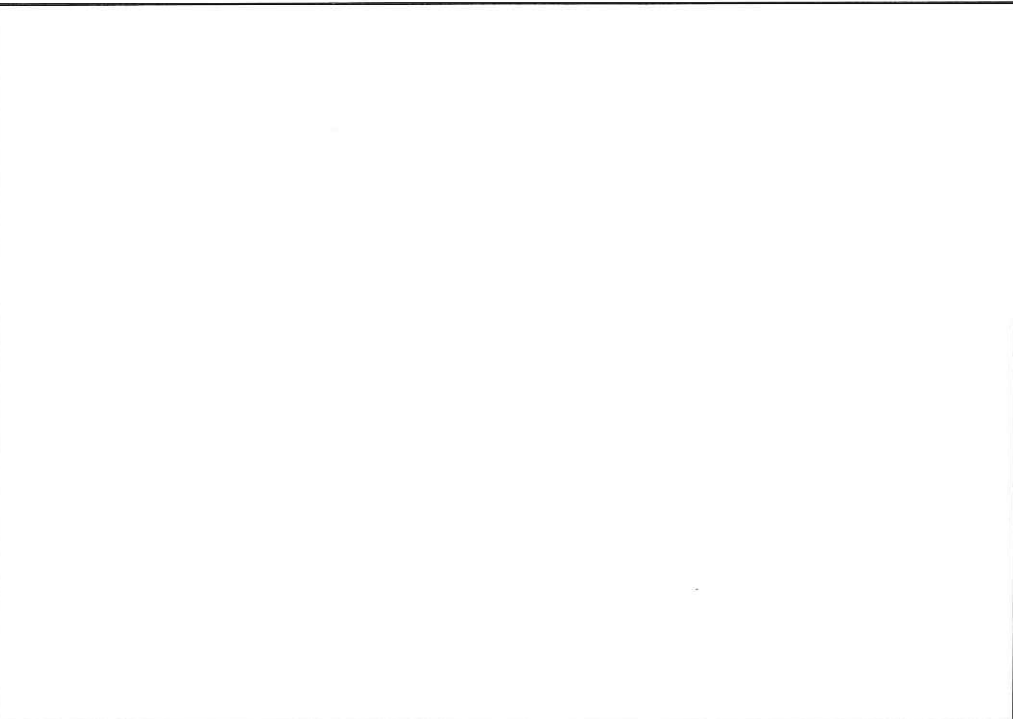


Inspection #	Date	Time
317242683	6/29/2013	10:31 AM

Citation #	Item #	Photo #
1	1	3

**Photo Description**  
 Aerial photo of fire 1031 6/29/13 by BLM Representative Dean Fernandez. Photo of ridgeline looking south. Red arrow indicates the Boulder Springs Ranch (Helm Ranch) in the background.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683		

Citation #	Item #	Photo #

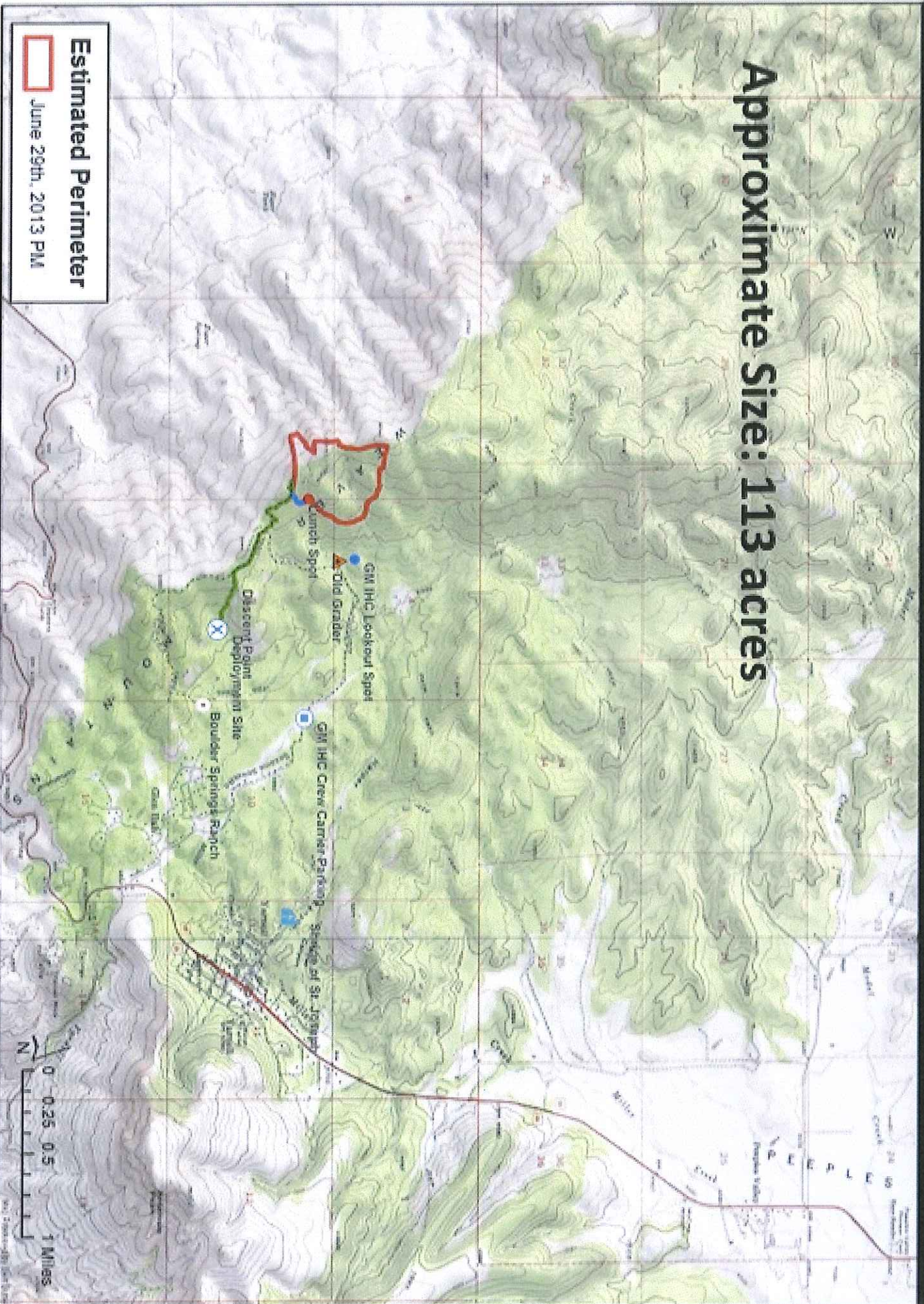
**Photo Description**



# Yarnell Hill Fire Estimated Perimeter

June 29th, 2013 PM Estimate

## Approximate Size: 113 acres





# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/29/2013	4:51 PM

Citation #	Item #	Photo #
1	1	4

**Photo Description**

Aerial photograph of the Yarnell Hill Fire looking west by Air Tactical Group Supervisor (ATGS) Rory Collins (Oregon Department of Forestry). 1651 June 29, 2013.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/29/2013	5:10 PM

Citation #	Item #	Photo #
1	1	5

**Photo Description**

Aerial photo of fire looking south, note SEAT retardant drop near smoke. Red arrow indicates the location of the old grader. Photo by ATGS Rory Collins (Oregon Department of Forestry) 1710 June 29, 2013.



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/29/2013	7:30 PM

Citation #	Item #	Photo #
1	1	6

**Photo Description**  
 Aerial photograph of the Yarnell Hill Fire by ATGS Rory Collins (Oregon Department of Forestry) 1930 June 29, 2013.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/29/2013	8:23 PM

Citation #	Item #	Photo #
1	1	7

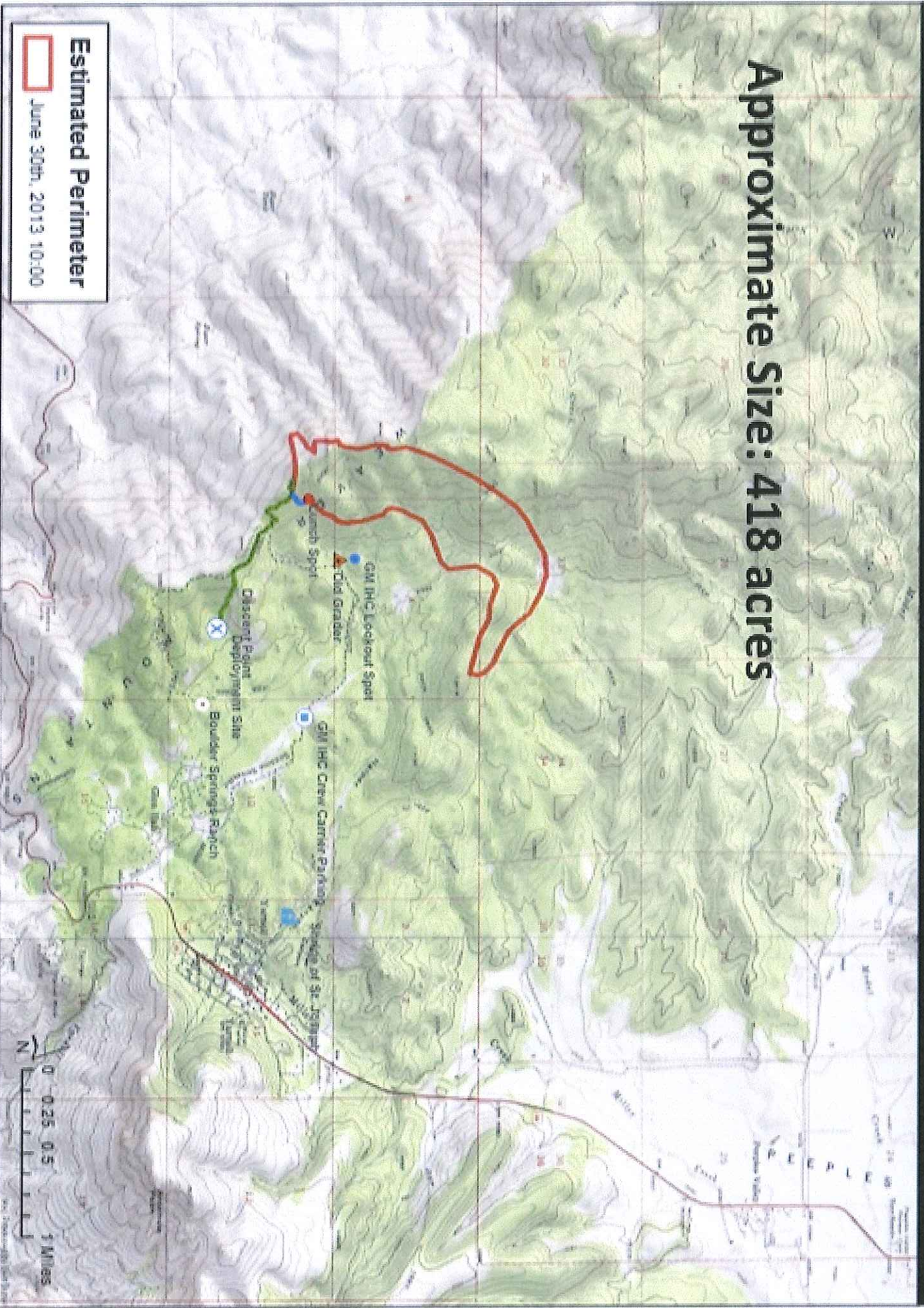
**Photo Description**  
 Photo of Yarnell Hill fire at dusk, photo by Joshua Hudson 2023 6/29/13. The fire had increased from approximately 11 acres in the a.m. to 113 acres in the p.m.



# Yarnell Hill Fire Estimated Perimeter

June 30th, 2013 10:00 Estimate

## Approximate Size: 418 acres



**Estimated Perimeter**



June 30th, 2013 10:00



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	Morning

Citation #	Item #	Photo #
1	1	8

**Photo Description**  
 Granite Mountain IHC hiking up Yarnell hill 6/30/13. Photo by Hiker Joy A Collura. Note: Exact time of photo is unknown.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	Morning

Citation #	Item #	Photo #
1	1	9

**Photo Description**  
 Granite Mountain IHC cutting line, Yarnell hill 6/30/13. Photo by Hiker Joy A Collura. Note: Exact time of photo is unknown.

# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division

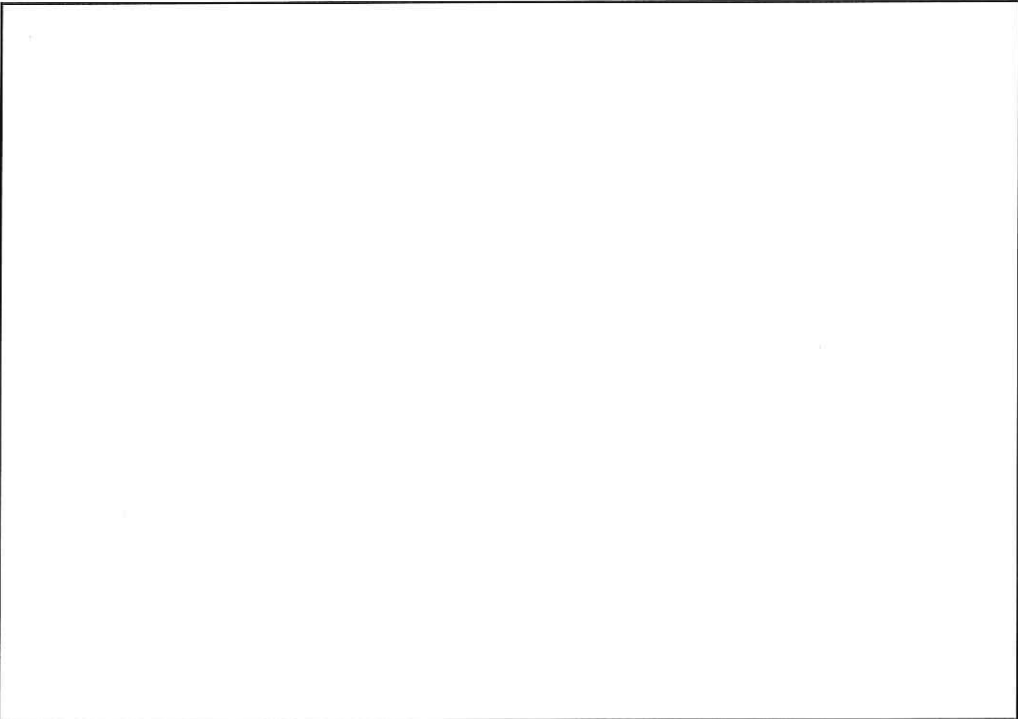


Inspection #	Date	Time
317242683	6/30/2013	Morning

Citation #	Item #	Photo #
1	1	10

**Photo Description**  
 Old grader. Granite Mountain IHC lookout was located north of this position. Photo by Hiker Joy A Collura. Note: Exact time of photo is unknown.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683		

Citation #	Item #	Photo #

**Photo Description**



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	10:22 AM

Citation #	Item #	Photo #
1	1	11

**Photo Description**  
 North end of Yarnell Hill Fire (looking south), photo by Structure Protection Group 2 Supervisor, Darrell Willis, 1022 6/30/13.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	10:28 AM

Citation #	Item #	Photo #
1	1	12

**Photo Description**  
 Yarnell Hill Fire, photo by Blue Ridge Hotshot Squad Boss, Cory Ball, 1028 6/30/13.



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	10:39 AM

Citation #	Item #	Photo #
1	1	13

**Photo Description**  
 Yarnell Hill Fire photo by Blue Ridge Hotshot, McCord, 1039 6/30/13.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	11:09 AM

Citation #	Item #	Photo #
1	1	14

**Photo Description**  
 North end of Yarnell Hill Fire, photo by Structure Protection Group 2 Supervisor, Darrell Willis, 1109 6/30/13.



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	11:14 AM

Citation #	Item #	Photo #
1	1	15

**Photo Description**  
 North end of Yarnell Hill Fire, photo by Structure Protection Group 2 Supervisor, Darrell Willis, 1114 6/30/13.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	11:30 AM

Citation #	Item #	Photo #
1	1	16

**Photo Description**  
 Double Bar A Ranch, before fire reaches structures. Photo by Task Force Leader trainee (TFLD(t)), Cory Moser, 1130 6/30/13. Moser was assigned to Double Bar A Ranch.



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	12:20 PM

Citation #	Item #	Photo #
1	1	17

**Photo Description**  
 Southern side of fire looking north by Blue Ridge Hotshot, Wardemups, 1220 6/30/13. Note Granite Mountain IHC buggies parked in the left of the photo.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	12:48 PM

Citation #	Item #	Photo #
1	1	18

**Photo Description**  
 Yarnell Hill Fire, photo by Task Force Leader trainee (TFLD(t)), Cory Moser 1248 6/30/13. Moser was assigned to Structure Protection Group 2, which was assigned the north (Double Bar A Ranch) portion of the fire.

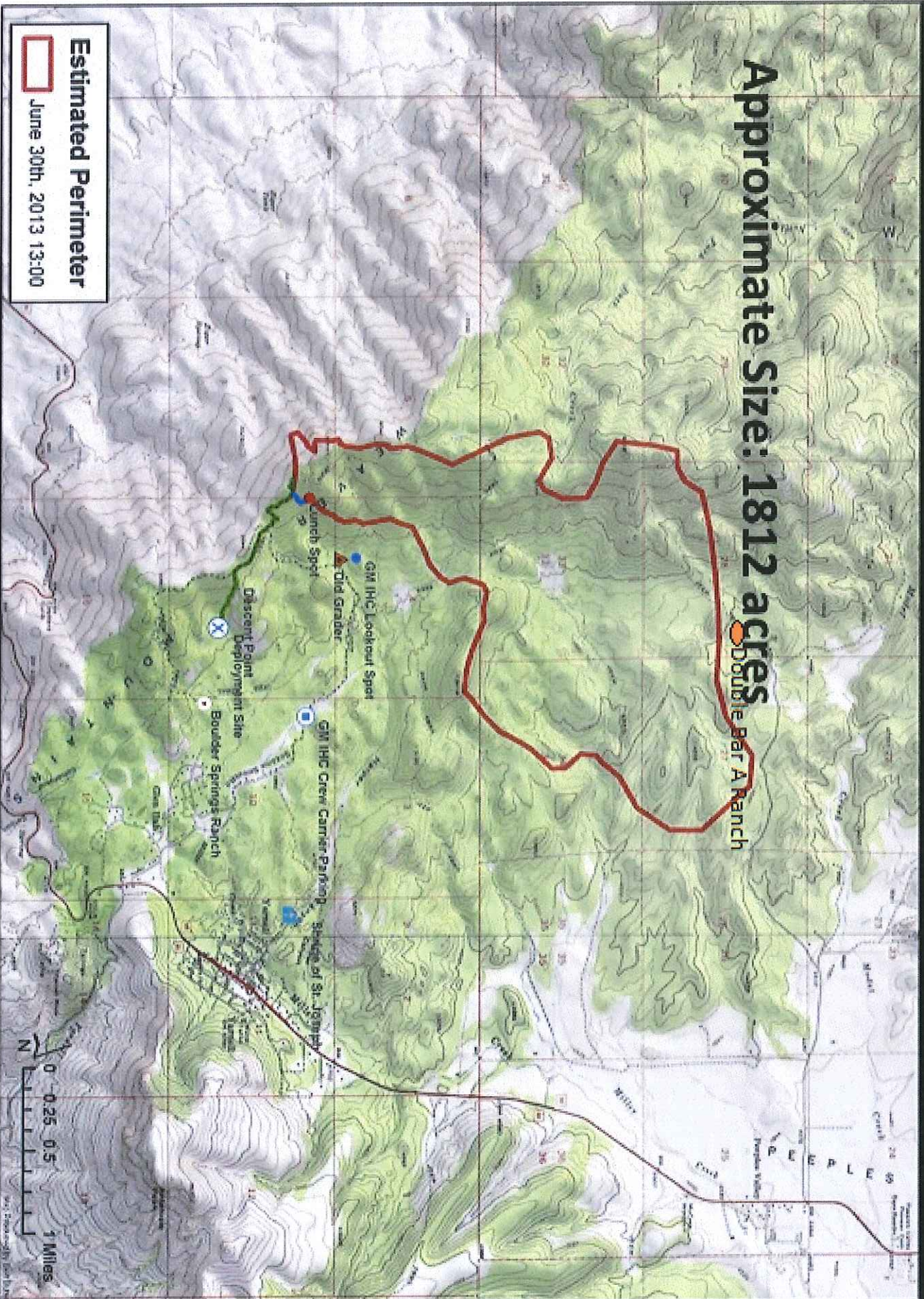


# Yarnell Hill Fire Estimated Perimeter

June 30th, 2013 13:00 Estimate

## Approximate Size: 1812 acres

Douglas Bar A Ranch



Estimated Perimeter

June 30th, 2013 13:00



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	1:30 PM

Citation #	Item #	Photo #
1	1	19

**Photo Description**  
 Aerial photo of the Yarnell Hill Fire by ATGS, Rory Collins, 1330 6/30/13.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	2:33 PM

Citation #	Item #	Photo #
1	1	20

**Photo Description**  
 Aerial photo of Yarnell Hill Fire by ATGS, Rory Collins, 1433 6/30/13.

# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	2:34 PM

Citation #	Item #	Photo #
1	1	21

**Photo Description**  
 Aerial photo of the Yarnell Hill Fire by ATGS, Rory Colins, 1434 6/30/13.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	14:52

Citation #	Item #	Photo #
1	1	22

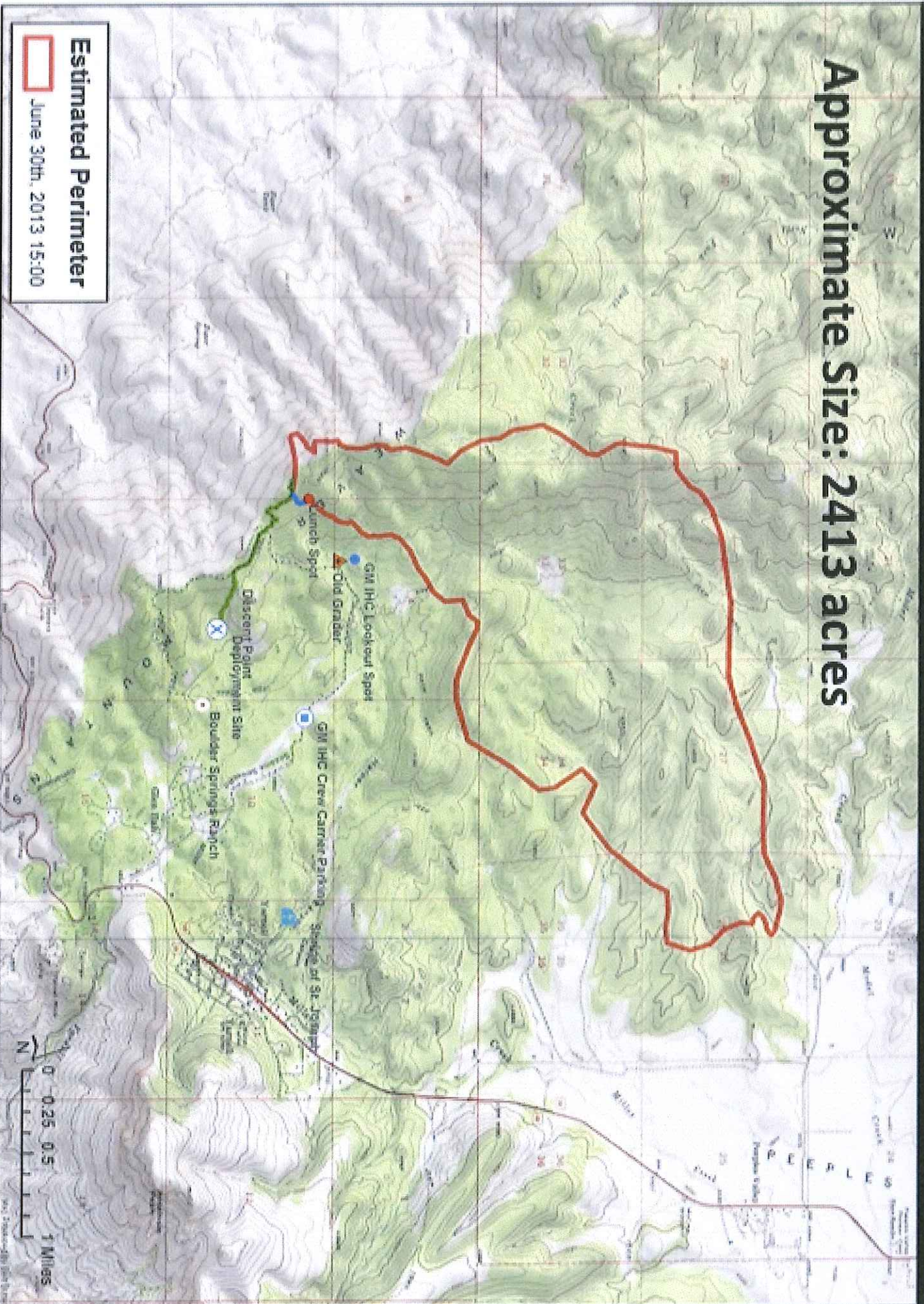
**Photo Description**  
 Yarnell Hill Fire reaching structures at Double Bar A Ranch. Photo by Task Force Leader trainee (TFLD(t)), Cory Moser 1452 6/30/13.



# Yarnell Hill Fire Estimated Perimeter

June 30th, 2013 15:00 Estimate

## Approximate Size: 2413 acres



**Estimated Perimeter**



June 30th, 2013 15:00



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	3:09 PM

Citation #	Item #	Photo #
1	1	23

**Photo Description**  
 Photo of Yarnell Hill Fire from the Incident Command Post (ICP), by GIS Specialist, Glen Buettner, 1509 6/30/13.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	3:37 PM

Citation #	Item #	Photo #
1	1	24

**Photo Description**  
 Photo of Yarnell Hill Fire, by Task Force Leader trainee (TFLD(t)), Cory Moser 1537 6/30/13.



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	3:39 PM

Citation #	Item #	Photo #
1	1	25

**Photo Description**  
 Aerial photo of Yarnell Hill Fire, by ATGS, Rory Collins, 1539 6/30/13.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	3:49 PM

Citation #	Item #	Photo #
1	1	26

**Photo Description**  
 Yarnell Hill Fire, photo by Granite Mountain Hotshot, Chris MacKenzie, 1549 6/30/13. The red arrow indicates the approximate location of the Granite Mountain IHC lookout.



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	3:49 PM

Citation #	Item #	Photo #
1	1	27

**Photo Description**  
 Southern end of Yarnell Hill Fire, photo by Granite Mountain IHC lookout, Brendan McDonough, 1549 6/30/13 after leaving lookout spot.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	3:49 PM

Citation #	Item #	Photo #
1	1	28

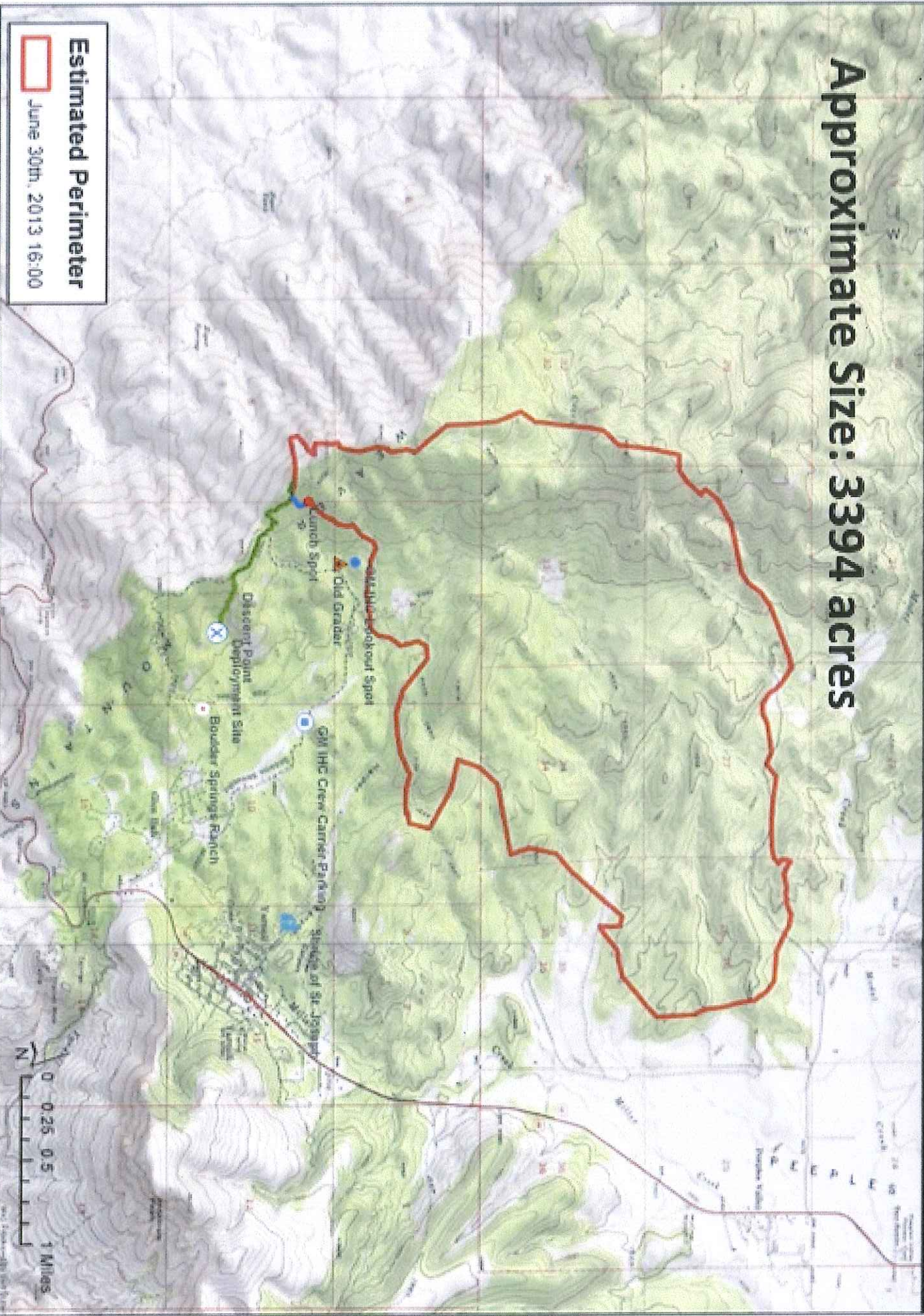
**Photo Description**  
 Southern end of Yarnell Hill Fire, photo by Granite Mountain IHC lookout, Brendan McDonough, 1549 6/30/13 after leaving lookout spot.



# Yarnell Hill Fire Estimated Perimeter

June 30th, 2013 16:00 Estimate

## Approximate Size: 3394 acres





# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	3:52 PM

Citation #	Item #	Photo #
1	1	29

**Photo Description**  
 Yarnell Hill Fire, photo by Granite Mountain IHC, Chris MacKenzie, 1552 6/30/13.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	3:54 PM

Citation #	Item #	Photo #
1	1	30

**Photo Description**  
 Yarnell Hill Fire, photo by Granite Mountain IHC, Scott Norris photo texted to his mother (Karen Norris) at 1554 with the following message, "This fire is running at Yarnell". The red arrow indicates the approximate location that the GMIHC McDonough was using as his lookout spot.

# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	4:01 PM

Citation #	Item #	Photo #
1	1	31

**Photo Description**

Yarnell Hill Fire photo by Granite Mountain IHC, Chris MacKenzie, 1601 6/30/13.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683		

Citation #	Item #	Photo #

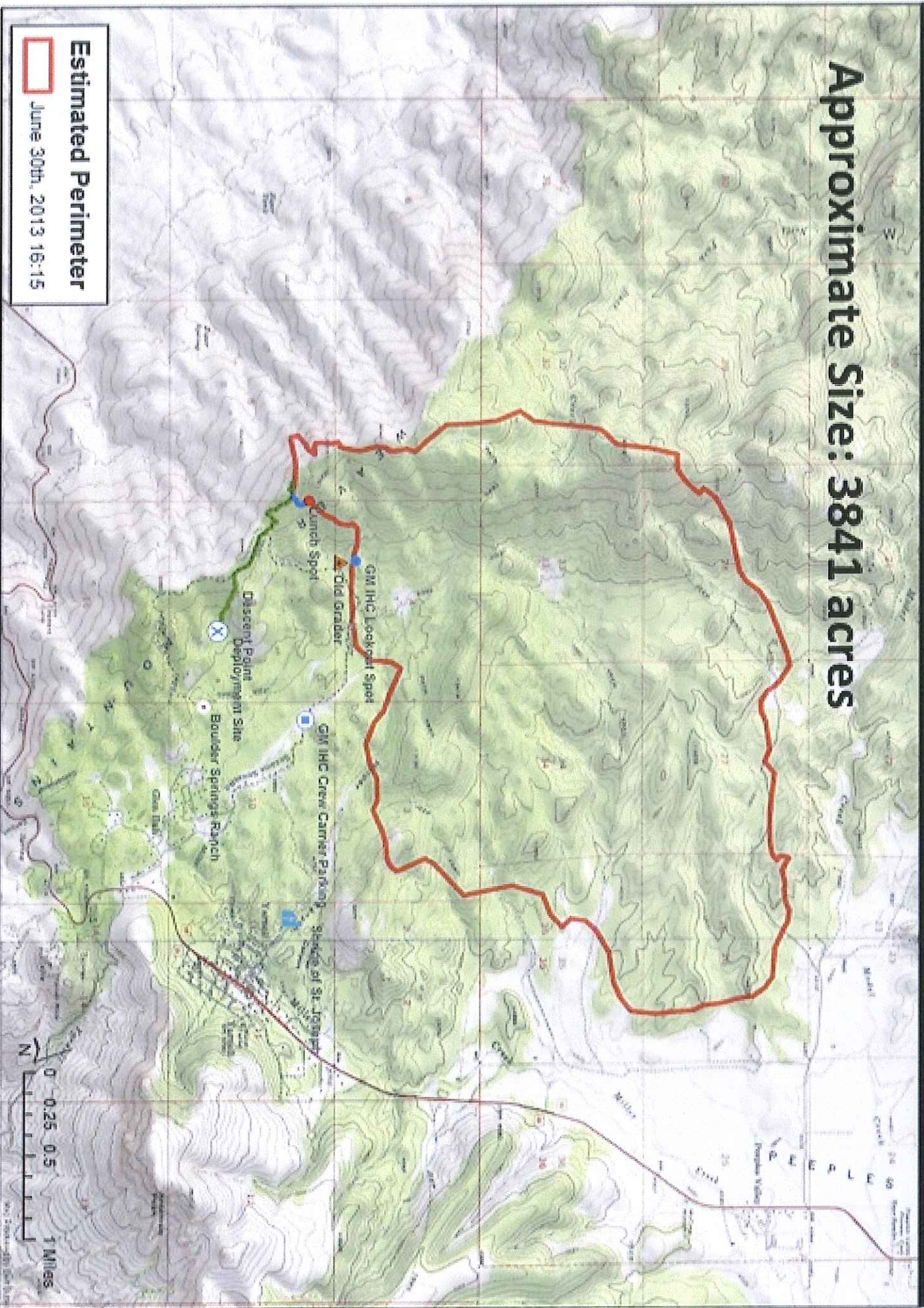
**Photo Description**



# Yarnell Hill Fire Estimated Perimeter

June 30th, 2013 16:15 Estimate

## Approximate Size: 3841 acres

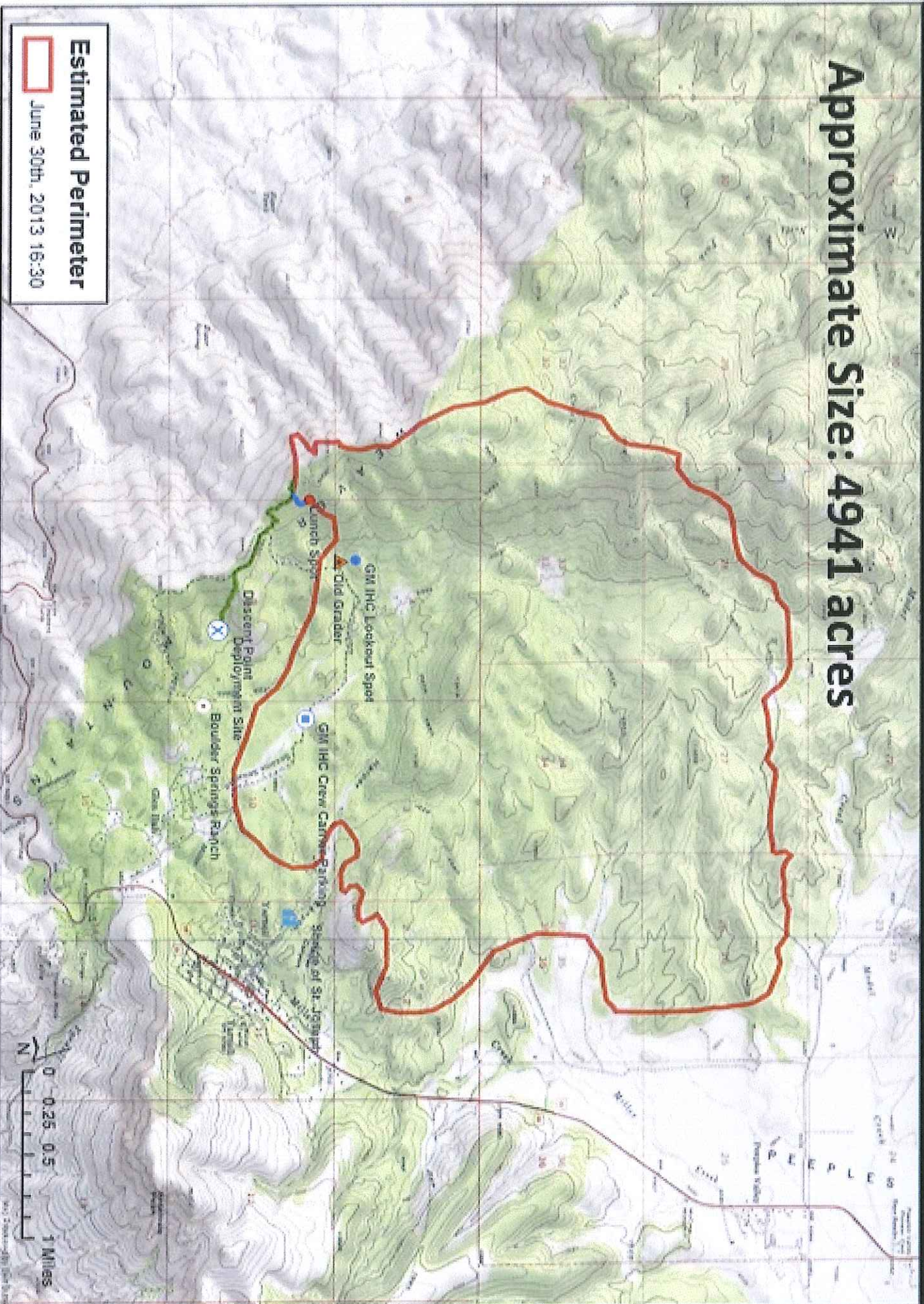




# Yarnell Hill Fire Estimated Perimeter

June 30th, 2013 16:30 Estimate

## Approximate Size: 4941 acres



**Estimated Perimeter**



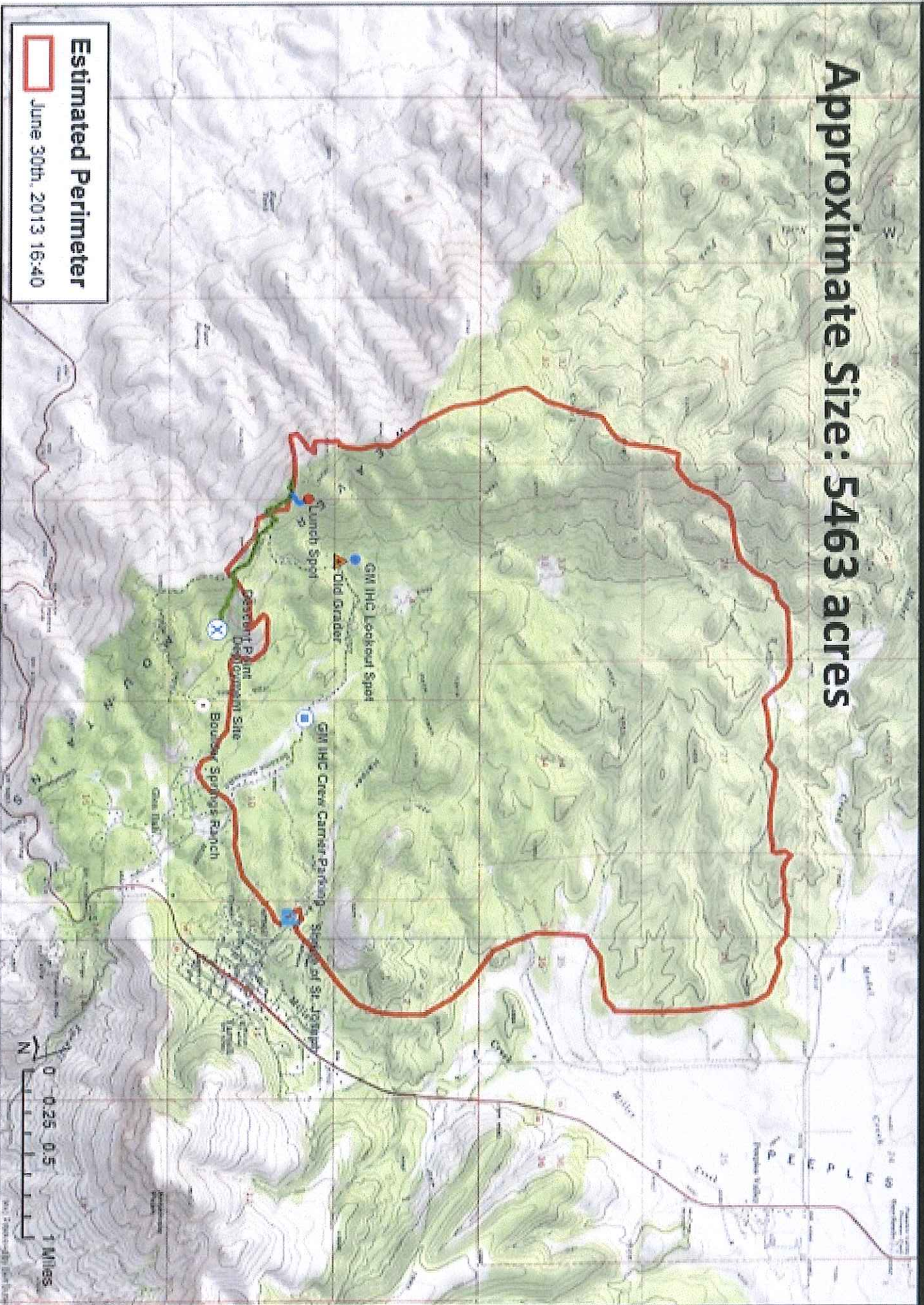
June 30th, 2013 16:30



# Yarnell Hill Fire Estimated Perimeter

June 30th, 2013 16:40 Estimate

## Approximate Size: 5463 acres



**Estimated Perimeter**



June 30th, 2013 16:40





# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	4:40 PM

Citation #	Item #	Photo #
1	1	32

**Photo Description**  
 North end of Yarnell Hill Fire, photo by Task Force Leader trainee (TFLD(t)), Cory Moser, 1640 6/30/13. Structures burning at Double Bar A Ranch.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	4:45 PM

Citation #	Item #	Photo #
1	1	33

**Photo Description**  
 Fire west of structures in Glen Ilah photo by Fire Behavior Analyst, Bryon Kimball, 1645 6/30/13.



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division

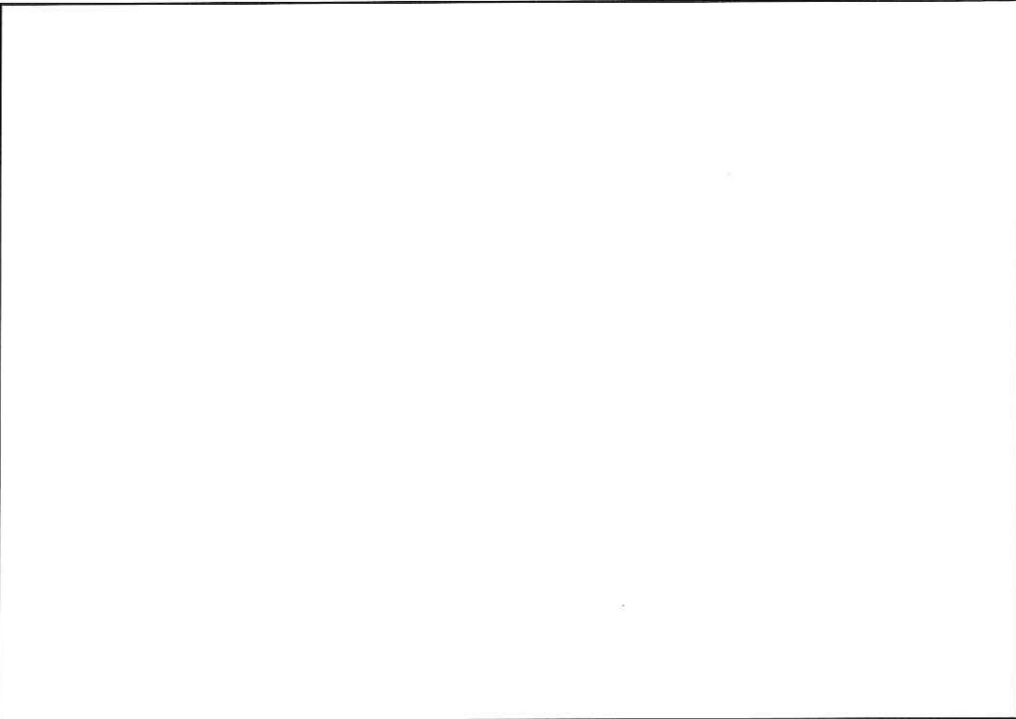


Inspection #	Date	Time
317242683	6/30/2013	4:47 PM

Citation #	Item #	Photo #
1	1	34

**Photo Description**  
 Yarnell Hill Fire at the approximate time the Granite Mountain IHC were deploying emergency fire shelters. Photo by GIS Specialist, Glen Buettner, 1647 6/30/13.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683		

Citation #	Item #	Photo #

**Photo Description**







# Photo Mounting Worksheet

Company Name Arizona State Forestry Division

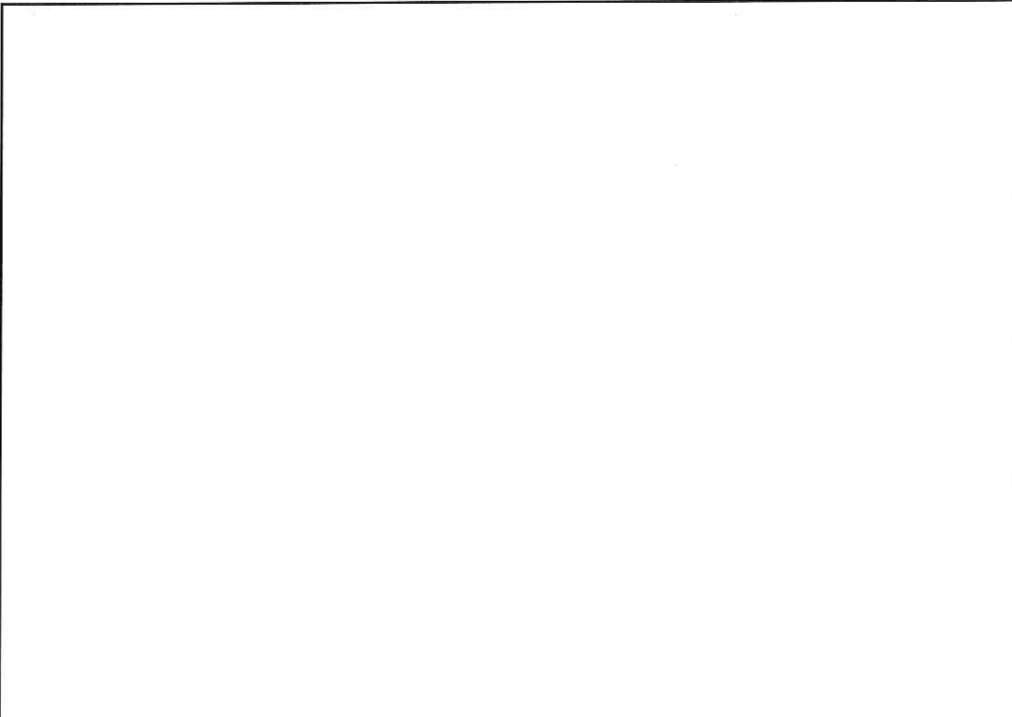


Inspection #	Date	Time
317242683	6/30/2013	4:57 PM

Citation #	Item #	Photo #
1	1	35

**Photo Description**  
Yarnell Hill Fire burning in Glen Ilah, photo by Tom Story, 1657 6/30/13.

Company Name Arizona State Forestry Division



Inspection #	Date	Time
317242683		

Citation #	Item #	Photo #

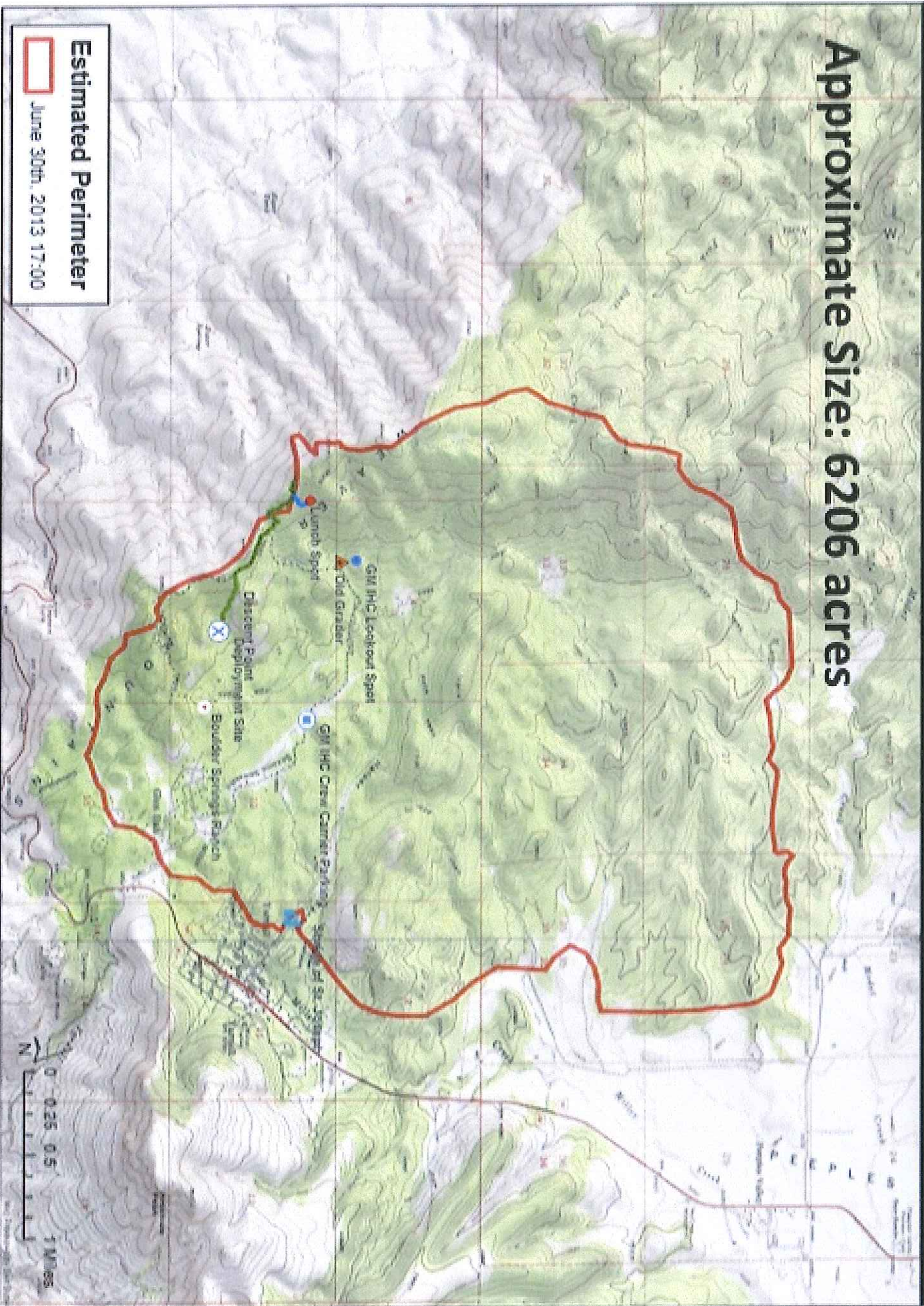
**Photo Description**



# Yarnell Hill Fire Estimated Perimeter

June 30th, 2013 17:00 Estimate

## Approximate Size: 6206 acres



**Estimated Perimeter**



June 30th, 2013 17:00



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	5:01 PM

Citation #	Item #	Photo #
1	1	36

**Photo Description**  
 Structure in Glen Ilah burns, photo by Tom Story, 1701 6/30/13.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	6/30/2013	5:05 PM

Citation #	Item #	Photo #
1	1	37

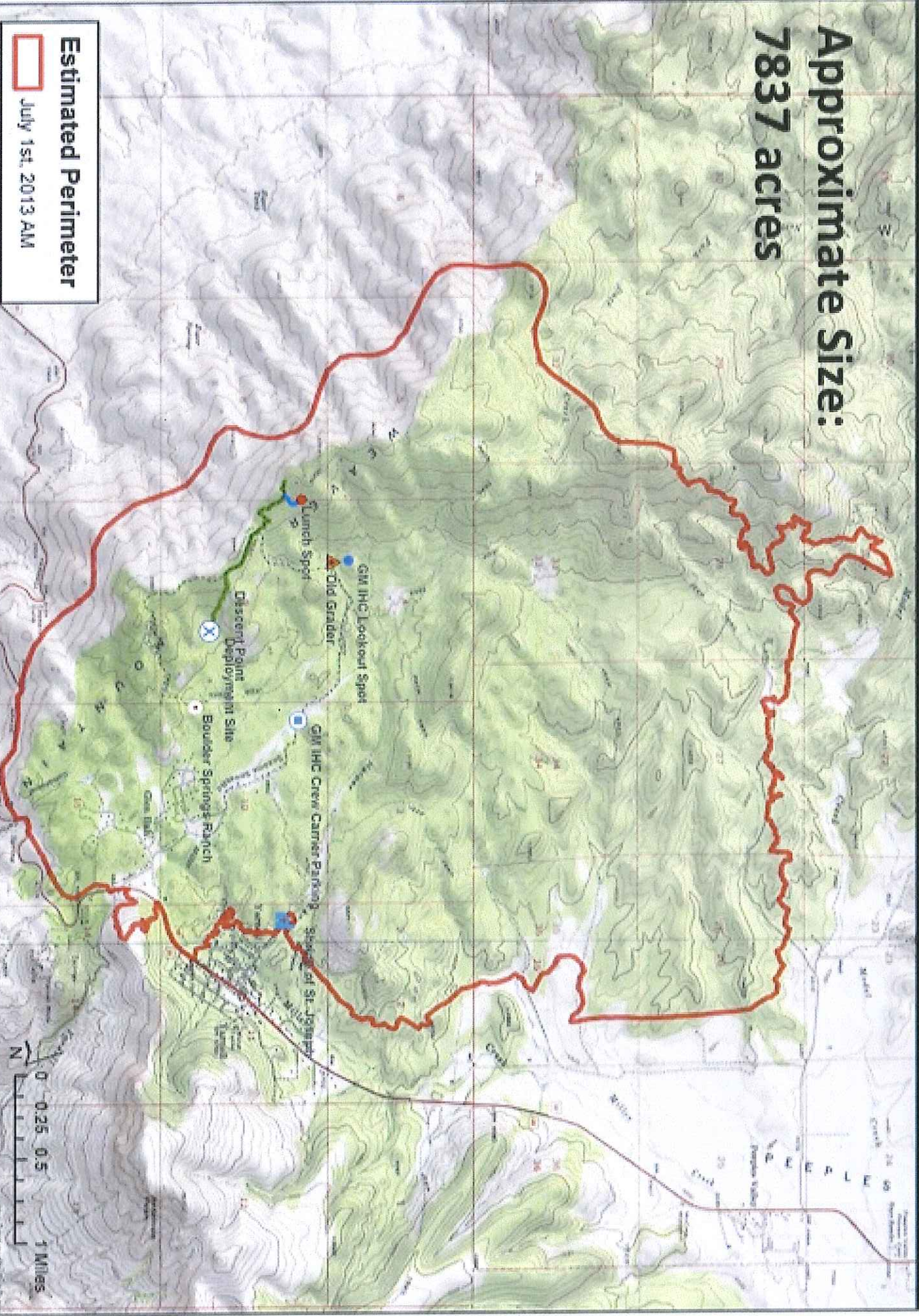
**Photo Description**  
 Column lays down and moves through Glen Ilah, photo by Fire Behavior Analyst, Bryon Kimball, 1705 6/30/13.



# Yarnell Hill Fire Estimated Perimeter

July 1st, 2013 AM Estimate

## Approximate Size: 7837 acres

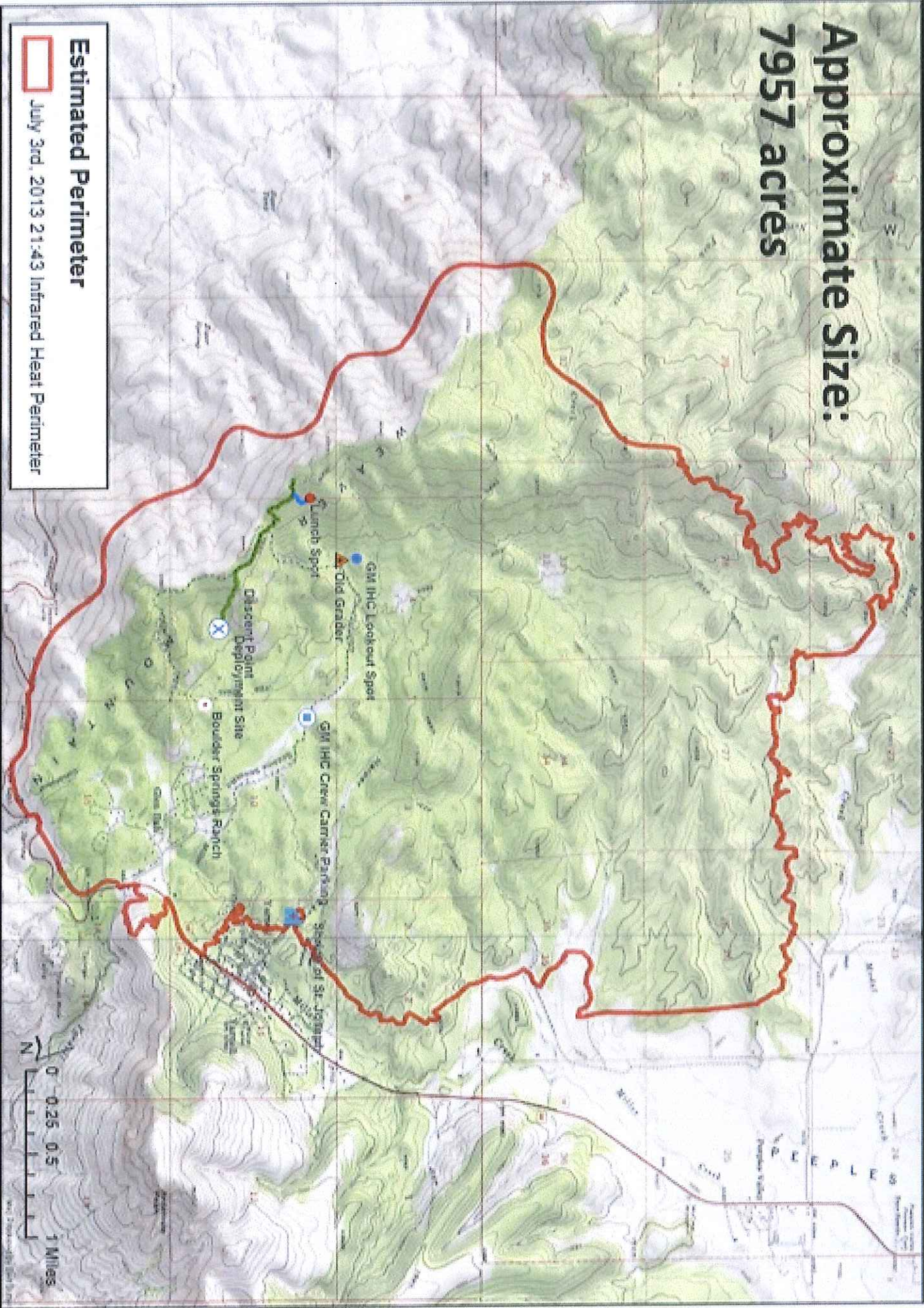




# Yarnell Hill Fire Estimated Perimeter

July 3rd, 2013 21:43 Estimate

## Approximate Size: 7957 acres





# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	7/4/2013	5:12 PM

Citation #	Item #	Photo #
1	1	38

**Photo Description**  
 Photo from ridgeline saddle. Site visit photo by Brent Wachter, member of the Serious Accident Investigation Team (SAIT). Note: GMIHC deployment site (red arrow) and Boulder Springs Ranch (blue arrow). 1712 7/4/13.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	7/4/2013	

Citation #	Item #	Photo #
1	1	39

**Photo Description**  
 Aerial photo by Tony Petrilli, member of the Serious Accident Investigation Team (SAIT). He took these photos during a flight over the site on July 4, 2013. Note: Boulder Springs Ranch (blue arrow). GMIHC deployment site (red arrow). Two-track trail that leads north to the heel of the fire (yellow arrow).



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	7/4/2013	

Citation #	Item #	Photo #
1	1	40

**Photo Description**  
 Deployment site. Aerial photo by Tony Petrilli, member of the Serious Accident Investigation Team (SAIT), took these photos during a flight over the site on July 4, 2013. Deployment site (red arrow), two-track trail that leads north to the heel of the fire (yellow arrow).

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683	7/16/2013	

Citation #	Item #	Photo #
1	1	41

**Photo Description**  
 Deployment site photo by ADOSH Compliance Officer, Steurer. He took this photo of the site on July 16, 2013. Exact time of photo is unknown.



# Photo Mounting Worksheet

Company Name: Arizona State Forestry Division

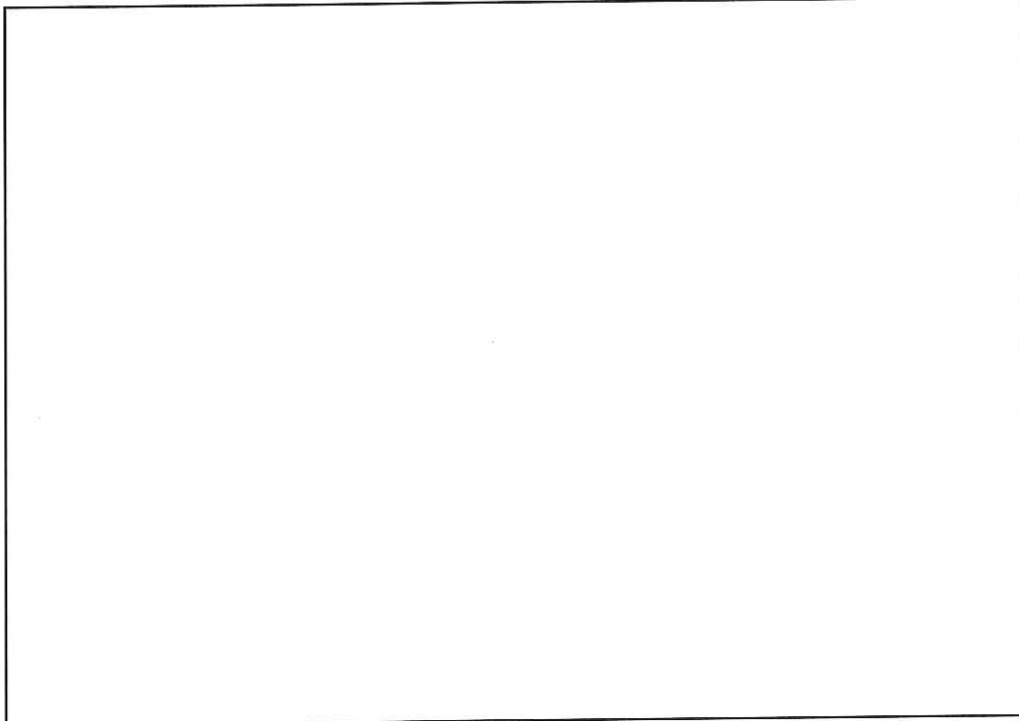


Inspection #	Date	Time
317242683	7/14/2013	

Citation #	Item #	Photo #
1	1	42

**Photo Description**  
 Old grader after the fire had burned through the area. Photo by Hiker Joy A Collura. Note: Time of photo is unknown.

Company Name: Arizona State Forestry Division



Inspection #	Date	Time
317242683		

Citation #	Item #	Photo #

**Photo Description**

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# Granite Mountain IHC Entrapment and Burnover Investigation

Yarnell Hill Fire – June 30, 2013

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Prepared for:

Arizona Division of Occupational Safety and Health

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Prepared by:



Wildland Fire Associates

November, 2013



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# ACRONYMS

ACRONYM	DESCRIPTION
<b>- A -</b>	
A/G	Air to Ground
ADC	Arizona Dispatch Center
ADOSH	Arizona Division of Occupational Safety and Health
AFMO	Assistant Fire Management Office
AOBD	Air Operations Branch Director
ASFD	Arizona State Forestry Division
ASM	Aerial Supervision Module
ATGS	Air Tactical Group Supervisor
<b>- BC -</b>	
BCMG	Base Camp Manager
BLM	Bureau of Land Management
BRIHC	Blue Ridge Interagency Hotshot Crew (Hotshots)
C&G	Command and General (Staff)
COML	Communications Unit Leader
<b>- DEF -</b>	
DIVS	Division Supervisor
DOC	Department of Corrections
FBAN	Fire Behavior Analyst
FMO	Fire Management Officer
FSC	Finance Section Chief
<b>- GH -</b>	
GIS	Geographic Information System
GM	Granite Mountain Hotshots
GMIHC	Granite Mountain Interagency Hotshot Crew (Hotshots)
HEQB	Heavy Equipment Boss
<b>- I -</b>	
IA	Initial Attack/Incident Action
IAP	Incident Action Plan
ICT1	Incident Commander Type 1
ICT2	Incident Commander Type 2
ICT3	Incident Commander Type 3
ICT4	Incident Commander Type 4
ICP	Incident Command Post
IHC	Interagency Hotshot Crew (Hotshots)
IMT	Incident Management Team
IMT2	Incident Management Team, Type 2

ACRONYM	DESCRIPTION
<b>- JKLMN -</b>	
LAT	Large Air Tanker
LCES	Lookouts Communication Escape Routes and Safety Zones
LSC	Logistics Section Chief
NCDC	National Climatic Data Center
NOAA	National Oceanic and Atmospheric Administration
NWCG	National Wildfire Coordinating Group
NWS	National Weather Service
<b>- OPQR -</b>	
OSC	Operations Section Chief
ORDM	Ordering Manager
PSC	Planning Section Chief
RH	Relative Humidity
ROS	Rate of Spread
ROSS	Resource Ordering Status System
<b>- S -</b>	
SAIT	Serious Accident Investigation Team
SEAT	Single Engine Air Tanker
SOF	Safety Officer
SPGS1	Structure Protection Group 1 Supervisor
SPGS2	Structure Protection Group 2 Supervisor
SPUL	Supply Unit Leader
STPS	Structure Protection Specialist
SWCC	
<b>- T -</b>	
TAC1	Tactical Frequency 1
TAC3	Tactical Frequency 3
TIME	Time Unit Leader
<b>- UWXYZ -</b>	
UTV	Utility Terrain Vehicle
WFA	Wildland Fire Associates
WFDSS	Wildfire Decision Support System
WFSA	Wildland Fire Situation Analysis
VLAT	DC-10 Very Large Air Tanker
YFD	Yarnell (Volunteer) Fire Department



## INTRODUCTION

On June 30, 2013, 19 members of the Granite Mountain Interagency Hotshot Crew died after being entrapped and burned over on the Yarnell Hill Fire in Yarnell, Arizona. The purpose of this document is to provide:

- ▲ A TIMELINE OF EVENTS THAT OCCURRED BETWEEN THE TIME OF IGNITION ON JUNE 28 AND THE ENTRAPMENT AND BURNOVER ON JUNE 30;
- ▲ AN ANALYSIS OF THE FIRE BEHAVIOR AND FIRE WEATHER ON JUNE 30;
- ▲ A DISCUSSION OF OVERHEAD MANAGEMENT, STRATEGIES AND TACTICS USED ON THE FIRE, AND DOCUMENTATION OF DECISION POINTS LEADING UP TO THE ENTRAPMENT AND BURNOVER THAT CLAIMED THE LIVES OF THE FIREFIGHTERS.

This document was prepared by Wildland Fire Associates (WFA) under contract with Arizona Division of Occupational Safety and Health (ADOSH). Wildland Fire Associates participated in the investigation by ADOSH that included visits to the deployment site, interviews, reviews of incident documents including weather maps and data, and communication logs and field notes.

During this investigation, we looked at all phases and aspects of the Yarnell Hill Fire that we thought were relevant. In doing so, we made numerous requests for data and information pertinent to this incident. Through ADOSH, we were given access to all information and personnel that we requested with the exception of the employees of the USDA Forest Service. The USDA Forest Service declined the request to allow their employees to be interviewed for this investigation.

### WILDLAND FIRE ASSOCIATES

Wildland Fire Associates is a private company staffed with career wildland fire managers who are highly trained and have many years of experience from initial attack and hotshots through Type 1 Incident Command and Area Command. The five-member team that reviewed incident documents, conducted interviews and wrote this report are:

- ▲ DAN O'BRIEN, TEAM LEADER
- ▲ ELIZABETH ANDERSON, DEPUTY TEAM LEADER
- ▲ BARRY HICKS, ANALYSIS OF FIRE OPERATIONS & AVIATION
- ▲ DAVE LARSEN, ANALYSIS OF FIRE OPERATIONS & OVERHEAD TEAM
- ▲ DARRELL SCHULTE, FIRE BEHAVIOR ANALYST

Curricula vitae are located in Appendix A.

## TIMELINE

This timeline includes details from the 2013 Arizona Fire Season Outlook, as well as events as they occurred on the Yarnell Hill Fire from ignition to the time of the entrapment and burnover.

### PRE 2013 FIRE SEASON ACTIVITIES

On March 28, 2013, the Arizona Fire Season Outlook was released by the Arizona State Forestry Division (ASFD). The area of Yavapai County that includes Yarnell was listed as having high fire potential due to low live fuel moistures, and the county as a whole was predicted to see a moderate increase in fire potential compared to the 2012 fire season:

*“The chaparral vegetation type on State lands around Prescott, Yarnell, Mayer, and Bagdad is expected to have a below average live fuel moisture that will lead to high fire potential. Many of the chaparral stands are older with a high dead/live ratio that may prove resistant to control efforts due to the low live fuel moistures. Seasonal new fine fuel growth has been delayed due to the dry winter & late seasonal moisture.”*

*“Temperatures and ground moistures have not started the green up/growth of seasonal grasses. Grass loading is expected to be average in the perennial grasslands areas in the 3000 to 5000 foot elevations near Cordes Junction, Mayer, Prescott Valley, Chino Valley, Verde Valley, and Peeples Valley. Fire potential is predicted to be moderate to high in these areas.<sup>1</sup>”*

### YARNELL HILL FIRE TIMELINE NARRATIVE

*June 28, 2013*

On June 28 at approximately **1700** hours, the Yarnell Hill Fire was started by a lightning strike. The initial report was made to the Arizona Dispatch Center (ADC) at approximately **1740** by the volunteer fire department in Congress, Arizona (10 miles southwest of Yarnell, Arizona).

An ASFD Assistant Fire Management Officer (AFMO), who is also a qualified Incident Commander Type 3 (ICT3), traveled to Yarnell to be closer to the location of multiple new fire starts that resulted from the lightning activity.

Land jurisdiction in the Yarnell area includes private land, Arizona State Lands Department (for which Arizona State Forestry has fire suppression responsibilities) and Bureau of Land Management (BLM). The AFMO met with the BLM Fuels Specialist to coordinate actions on fires on either jurisdiction.

The Air Tactical Group Supervisor (ATGS) for the Doce Fire was requested to fly over the area to size-up the Yarnell Hill Fire and look for any more fires started by lightning. The ATGS stated that the Yarnell Hill Fire was in a boulder field with no vehicle access. The initial assessment was that the fire was less than a half-acre, only active in one corner and did not pose a threat to structures or people. Based upon the initial assessment, the inaccessibility of the fire and concerns about being able to adequately support firefighters overnight, the AFMO, who had become the initial attack Incident Commander (ICT4) at approximately **1940**, decided to delay initial attack of the fire until the following

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<sup>1</sup> 2013 Arizona Fire Season Outlook, Arizona State Forestry Division, March 28, 2013. page 10.

morning. The ICT4 planned for suppression activities the following morning and ordered two Arizona Department of Corrections (DOC) crews, a Type 6 engine and a Type 3 helicopter.

The strategy for the fire was full suppression. The tactic for the next day was to use a helicopter to transport people to and from the fire. A spot weather forecast was received at **2207**.

*June 29, 2013*

At **0651**, the ICT4 requested that the Single Engine Air Tanker Base at Wickenburg Airport be opened so that two Single Engine Air Tankers (SEATs) could be used. The plan was to use fire retardant on the north and south sides of the fire, but leave the west and east flanks open. There was a two-track road on the east side of the fire.

In the morning, a BLM Representative took a flight to update the status of the fire. The Yarnell Hill Fire was estimated to be approximately eight acres with little fire activity. From this assessment, the ICT4 and BLM Representative jointly developed an initial attack plan to put six firefighters from the DOC Lewis Crew and one helitack crewmember on the fire using the helicopter for transportation. ICT4 also planned to remove the firefighters from the fire by 1530 due to lightning risk from afternoon storms.



Figure 1. Photo taken by a Granite Mountain Interagency Hotshot Crew (GMIHC) member on two-track road early on June 30, 2013 during test-fire operations.

At **1011**, ICT4 requested a helicopter to shuttle crews.

The SEATs arrived mid-morning and dropped fire retardant on the flanks of the fire, each SEAT making two retardant drops to hold the fire perimeter.

At **1100**, a BLM helicopter transported seven firefighters to the top of the ridge. The one helitack and six DOC Lewis Crew firefighters hiked in the rest of the way into the fire.

At approximately **1225**, the ICT4 reported the fire size was about two acres. The ATGS reported that the fire retardant had secured the south and west flanks, and indicated that a ridge flanked the fire to the north and that a two-track road secured the eastern flank.

At **1442**, the ICT4 released the ATGS and the SEATs because the fire was holding on all four sides and no other fires ignited the previous day were still burning. The original plan by ICT4 was to fly crews down off the fire by **1530**.

At **1500**, a weather alert for thunderstorms was issued by the National Weather Service (NWS). However, the storms dissipated prior to reaching the Yarnell Hill Fire.

At **1540**, the ICT4 released the BLM brush engine and a local Peoples Valley fire engine that were being held in the event any new fires from the lightning on June 28 appeared.



During the afternoon, the temperature reached a high of 116°F (recorded in Phoenix, Arizona).

At **1600**, weather conditions were hot and dry. Winds from the west-southwest increased which led to increased fire activity.

At **1610**, the ICT4 requested two SEATs and the ATGS to return to the Yarnell Hill Fire. The ADC sent one SEAT but held the second aircraft so that it could be available for the Dean Peak Fire.

About **1630**, the Yarnell Hill Fire jumped the two-track road on the east side of the fire, despite lack of winds associated with thunderstorm activity. ICT4 indicated to ADC that there were concerns about containment, and at **1655** ordered a Type 1 Heavy Helitanker and a Large Airtanker (LAT).

At **1730**, 13 firefighters were assigned to contain the fire that had jumped the two-track road. The Yarnell Hill Fire was estimated at six acres. At some point near this time, the ICT4 learned that the DOC Lewis Crew was out of chainsaw gas which seriously hindered their effectiveness in chaparral.

Near the time the fire jumped the two-track road, approximately **1730**, the BLM representative who was a qualified ICT3 made an inquiry to the ICT4 whether the ICT4 wanted the BLM representative to “take over the fire.” The ICT4 declined the offer.

At **1742**, additional requested air resources declined dispatch due to high winds and severe weather between their home base and the fire location. The ICT4 continued to use SEATs to drop fire retardant on the Yarnell Hill Fire.

Soon after **1743**, dispatch offered a Very Large Air Tanker (VLAT) from Albuquerque in place of a heavy air tanker that could not respond due to weather. Based on discussion with ATGS and the local BLM representative, the ICT4 declined the VLAT offer.

Between **1730** and **1924**, the fire behavior and complexity continued to escalate. Based upon his interview and dispatch logs, ICT4 communicated a request to ADC for an Incident Commander Type 3 (ICT3), and then changed it to a State of Arizona Incident Management Team (IMT2) with the intention of having them take over the fire on June 30. ICT4 voiced concerns about potential threats to Peoples Valley and Yarnell, Arizona, in the following 24 to 48 hours. In addition, two structure group specialists were requested (one for the north end of the fire at Model Creek and Peoples Valley, and one for the south end of the fire at Yarnell and Glen Ilah). The ICT4 also requested three Interagency Hotshot Crews (IHC). Three IHCs were assigned to the Yarnell Hill Fire: Blue Ridge IHC, Granite Mountain IHC, and Arroyo Grande IHC (who ultimately missed the assignment due to mechanical problems).

At **1924**, the fire burned into chaparral to the north and northeast. Temperatures were above 100°F and relative humidity was 12%. Sustained winds of 10 miles per hour were reported with gusts up to 20 miles per hour out of the south and southwest. Estimated flame lengths were reported between 10 to 20 feet, and rate of spread was estimated at 5 to 10 chains per hour (1 chain = 66 feet).

“Not everyone agreed with the selected strategy and tactics. We were not gonna put it out with aircraft. Apparently they had tried aircraft on Saturday. That didn’t hold.” ~ ADOSH interview with SPGS2

By **1938**, the Yarnell Hill Fire was an estimated 100 acres. The fire was approximately one mile from structures in Peeples Valley and 2.5 miles from Yarnell, Arizona.

At **2200**, the dispatch logs note that the ICT4 ordered additional resources including 14 engines, six water tenders, two Type 2 Hotshot Crews, two bulldozers, and numerous aircraft.

At approximately **2340**, the Structure Protection Group 1 Supervisor (SPGS1) arrived. After a briefing from ICT4, SPGS1 was assigned to structure protection for Yarnell and began assessing infrastructure threats, including structures at risk, road networks and location of safety zones, including Boulder Springs Ranch as well as other locations for structure protection personnel. The second Structure Protection Group 2 Supervisor (SPGS2) arrived late in the evening of June 29 and worked with SPGS1 and the ICT4 to order additional resources and start formulating a plan for June 30. SPGS2 described abnormally active fire behavior throughout the night. 13 firefighters remained on the fire.

*June 30, 2013*

On June 30, the ICT4, BLM Representative and SPGS1 met at **0100** to discuss using roads for indirect attack and the use of point protection strategy (a firefighting strategy that involves protecting specific points from the fire while not actively trying to line the entire fire's edge<sup>2</sup>).

Between **0000 - 0400** minimum temperatures ranged from 70 to 80°F and maximum relative humidity ranged from 25 to 35%.

At **0300**, the ICT4, SPGS1 and SPGS2 ordered additional resources.

Afterwards at **0330**, the SPGS2 and ICT4 discussed the fire situation, very active fire behavior and probable outcomes for the strategy.

At **0700**, a discussion between the ICT4, personnel from the previous shift, and incoming personnel occurred and continued as personnel moved to the Incident Command Post (ICP) at Model Creek School. The discussion included the incoming Incident Commander Type 2 (ICT2), two Operations Section Chiefs (Planning OSC and Field OSC), SPGS1, a fire behavior analyst (FBAN), and deputies from the Yarnell County Sheriff's Office. The Granite Mountain IHC (GMIHC) Superintendent, who had arrived prior to this meeting, listened in on much of the information sharing.

All personnel present were informed of the fire situation and tactics for June 30. The GMIHC Superintendent was assigned as the Alpha Division Supervisor (DIVS A), transferring leadership of the crew to the GMIHC Captain. The GMIHC were assigned to DIVS A with the task of establishing the anchor point at the heel of the fire, using direct and indirect attack.

"The fire burned actively until about 0330, maybe 0400. You could still see a lot of flames until about 0600. Could see light smoke, but that's a deceptive thing, if you're around fire much, you know that there's still a lot of heat out there." ~ ADOSH interview with SPGS2

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<sup>2</sup> ICS-209, page 2.

After **0700** and before leaving for the ICP, the ICT2 informed everyone that the first priority was to have an air operations plan developed so that air resources could operate safely over the fire. ICT2 stated:

*“...the second priority was that we had people at the school that were gathering and that there would be a briefing of those resources. And that none of us were to go anywhere including ICT4 until we got that briefing done at the school to give clear leader intent.”<sup>3</sup>*

This briefing occurred at **0930**. GMIHC was not at the 0930 briefing at the ICP because they had already been given their assignment and had departed for the fire. The ICT2 stated in an interview that, at that time, he was unaware that the GMIHC had not been at the 0930 briefing.

At approximately **0800**, the GMIHC arrived at the ICP. DIVS A received an operational briefing from the Field OSC which included a safety briefing and weather forecast. The SPGS1 took them through Yarnell and they stopped along Sesame Street. They discussed the location of the safety zone at the Boulder Springs Ranch, and the SPGS1 reminded the DIVS A that the crew also had the previously burned black area as a safety zone. In addition, during their internal crew briefing, all GMIHC crewmembers were told the escape routes would be into the burned area or back to the crew carriers.



Figure 2. Photo taken by a GMIHC member on two-track road early on June 30, 2013 during test-fire operations.

At **0854**, a VLAT was ordered by ICT4. The Incident Command Post (ICP) was designated at the Model Creek School in Peoples Valley.

At **0900**, the Blue Ridge Interagency Hotshot Crew (BRIHC) arrived at the ICP and received a briefing.

At **0930**, the incoming ICT2 and overhead team members and firefighters were briefed by ICT4 at the ICP. Immediately after the briefing, the Planning OSC assigned several resources to Structure Protection Group 2 to protect homes. Sometime after the briefing, the Planning OSC directed the SPGS1 to

assess structures in the Yarnell area. SPGS1 confirmed that most homes were indefensible with available resources.

The BRIHC was instructed by Field OSC to drive to the fire area and to meet with the SPGS1 on their way to the fire. Soon after, DIVS A contacted BRIHC to discuss the fire.

At approximately **0930**, DIVS A was briefed over the radio by a helitack crewmember who had been on the fire overnight. Weather and fire behavior observations were relayed to DIVS A along with a fire size estimate of 500 acres. DIVS A was at the top of the ridge near a helispot.

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<sup>3</sup> ADOSH Interview with ICT2.



At **1000**, during a reconnaissance flight, a helicopter crewmember saw the GMIHC. The crew was about 100 yards from the fire's edge, heading for the burned area. By this time, the BRIHC had been assigned to connect their line with GMIHC's line.

At **1022**, formal transfer of command from ICT4 to ICT2 was announced via radio.

Around **1030**, the BRIHC parked their crew carriers next to the GMIHC carriers. The BRIHC Superintendent and Captain unloaded their utility task vehicle (UTV) and continued along Sesame Street. They encounter SPGS1 who requested a Heavy Equipment Boss (HEQB) to manage a dozer. The dozer was to clear out the two-track road on both sides as far as possible to provide access and prepare for a possible burnout. BRIHC assigned one of their squad leaders, a qualified HEQB, to help.

The BRIHC Superintendent and Captain scouted the fire edge while the HEQB took the dozer as far as an old abandoned grader to push a clear area around it. HEQB turned in the direction of the saddle near GMIHC's anchor point, then planned to turn around and clear out the two-track road between Sesame Street and Shrine Road. During these operations, the remaining crewmembers of the BRIHC stayed with the crew carriers.

"Fire behavior was extreme and it occurred early in the day... There was a line of fire a mile and ½ long... There were 40 to 50 foot flame-lengths at 1030 in the morning... It was moving early that morning. This is unusual for Arizona." ~ ADOSH interview with SPGS2

At **1030**, the SPGS2 described the head of the fire as a 1.5-mile line of fire at the north end towards Peeples Valley.

At **1045**, the Yarnell County Sheriff's Office issued evacuation notices to the residents of Model Creek and the Double Bar A Ranch.

At **1100**, the fire front in the basin was moving to the northeast. The tactics were to continue to use SEATs at the heel of fire. Fire activity continued to increase as the day got warmer and drier. Cumulus clouds built up to the north. Planning OSC contacted DIVS A via radio to determine if DIVS A could see the cloud formations. DIVS A indicated that he could see the clouds and would keep an eye on the weather.

By this time, the BRIHC Superintendent and Captain reached the old grader and were able to see GMIHC working on the east side of the ridge, slowly burning off the two-track road. Over the radio, the BRIHC Superintendent and Captain noted that the GMIHC was trying to get the fireline connected with the two-track road so the fire could not burn back up the ridge.

Based on the escalating fire danger, the ICT2 informed the State of Arizona FMO that the Yarnell Hill Fire needed a full IMT2.

At **1130**, fire behavior became much more active. Fire personnel became engaged in structure protection.

Between **1130** and **1145**, the GMIHC conducted burnout operations, and DIVS A and ATGS discussed tactical options. ATGS directed two SEAT drops at **1136** and **1145** directly onto the burnout operations.

DIVS A indicated via radio that the drops were not what he wanted. As a result of the drops, GMIHC shifted tactics from building indirect line to going direct along the fire edge. During this same period, a short squad of the GMIHC moved to the west side of the ridge and tied into the burned area and steep rocky terrain. DIVS A considered this connection a good anchor point.

At **1154**, after driving the two-track road on a UTV, the BRIHC Superintendent and Captain met DIVS A and the GMIHC Captain at the anchor point. Over the next half hour, they discussed tactics and agreed to use a GMIHC crewmember as a lookout (GM Lookout). The GM Lookout identified a lookout spot down near the old grader at the bottom of the slope, and the GMIHC Captain agreed it would be a good vantage point. DIVS A and the GMIHC Captain discussed communication problems which included inappropriate tone guards on some radios with the BRIHC Superintendent and Captain.

Between **1200 – 1230**, a weak southwest-northeast frontal boundary developed west of the fire locations.

At **1204**, ICT2 held a quick meeting with Command and General Staff, during which a VLAT was dropping retardant on the fire. On top of the ridge, the short squad of the GMIHC rejoined their crew on the east side of the ridge near the anchor point.

At **1210**, Division Supervisor Zulu (DIVS Z) arrived at the BRIHC crew carriers and called DIVS A to discuss a division break and resource assignments. DIVS Z also had radio problems, so he used a BRIHC crew radio to talk with DIVS A over the Blue Ridge intra-crew frequency. DIVS A and DIVS Z could not agree on the division break location or associated supervisory responsibilities.



Figure 3. Photo taken by a GMIHC member on two-track road early on June 30, 2013 during retardant drop on their burn out operations.

At **1227**, the BRIHC Superintendent and Captain left the top of the ridge and brought the GM Lookout down to the old grader site and drop him off to be a lookout for BRIHC and GMIHC. The BRIHC Superintendent and Captain continued to drive roads looking for a way to connect the planned suppression action.

At **1230**, radio communication frequency changed to Tactical Frequency 3 (TAC3) due to increased communication from SPGS2.

At **1239**, the GM Lookout was dropped off at the old grader. After hiking to the lookout spot (roughly 120 yards north of the old grader), both DIVS A and the GM Lookout confirmed they had a good view of each other and the fire edge. At

this time, the head of the fire had pushed north toward structures in Peeples Valley. The fire was also backing towards the GMIHC location. Drainages were located between the crew and the fire. The crew anticipated the fire would become more active around mid-afternoon, and expected no additional support because the focus of aircraft and firefighters was at the head of the fire on the north end. Consequently, the GMIHC planned to construct line directly along the fire edge. When GMIHC reached

a rock face they stopped to eat lunch. After lunch, the crew worked their way back, reinforcing their line as they went, ensuring they had a good anchor point.

For lookouts, they had DIVS A on a knob, GM Lookout down by the grader and GMIHC Captain near the anchor or in the immediate vicinity of the crew. Each of these individuals had been looking out for the other two lookouts, the crew and the fire. In the event the fire changed direction, the GM Lookout had geographic trigger points established for the crew and for himself. The crew had on-going contact with the BRIHC, SPGS1, and Planning OSC and talked among themselves about the incoming thunderstorms. They also contacted air resources and adjoining forces as needed.

At **1300**, the weak southwest-northeast frontal boundary sharpened and slowly moved over the fire area. The ASFD District Forester and the ICT2 developed a complexity analysis. Based upon this analysis, the ICT2 recommended ordering a full Type 2 IMT. However, the District Forester and the State FMO changed the recommendation to a Type 1 IMT and placed the order through ADC.

By **1330**, the fire had advanced towards the ICP and forced personnel to move vehicles to keep them from being burned.

At **1402**, the FBAN received a weather update from the NWS. The FBAN was informed that thunderstorms were predicted to occur east of the fire and might produce wind gusts up to 35 to 45 miles per hour with winds out of the northeast. This information was relayed to Planning OSC and Field OSC via Tactical Frequency 1 (TAC1).

At **1420**, the resources assigned to Structure Protection Group 2 located north of the fire retreated due to the fire near the Double Bar A Ranch.

At **1447**, the second Aerial Supervision Module (ASM2) arrived to relieve ASM1. After a 10 minute briefing, ASM2 met an arriving VLAT and supported structure protection north of the fire. However, fire conditions changed which shifted priorities towards Yarnell. The ATGS was still on scene overhead.

At **1500**, the outflow boundary originated from thunderstorms to the northeast of the fire area.

At **1526**, the FBAN received an update from the NWS. North to northeast winds of up to 40 and 50 miles per hour were now expected from the thunderstorm outflows. This information was relayed to Planning OSC and Field OSC via TAC1.



Figure 4. Photo taken by a GMIHC Crew member on two-track road on June 30, 2013.



At **1530**, winds changed course by 90° to the south-southwest. There was approximately three miles of an active flaming front. Between **1530** and **1545**, Planning OSC and DIVS A discussed the thunderstorm cells both to the north and south of the fire. Also at this time, the wind picked up and shifted direction from the southwest to the west-northwest. There was spotting and heavy ash fell onto fire personnel working in the youth camp area. The two-mile flanking fire started to look like a head fire and was moving to the southeast.

At **1540**, the fire reached the first geographic trigger point for SPGS1 and an evacuation of the city of Yarnell was requested. DIVS A called Planning OSC and communicated that the retardant line and dozer lines were compromised but that GMIHC was in the burned area.

At **1545**, the SPGS1 met up with Field OSC. The Field OSC called ASM2, indicating that the winds were getting erratic and requested that ASM2 check on the GMIHC when they got a chance.

At **1550**, several communications occurred at or near the same time. Field OSC called DIVS A by radio to make sure that DIVS A was aware of the latest weather update. DIVS A confirmed the update and noted that the winds were getting “squirrely” on the ridge. DIVS A informed Field OSC that GMIHC moving off the top.

At around the same time, the ATGS informs DIVS A that the fire was headed toward Yarnell and could reach the town in one to two hours. In addition, the GMIHC’s crew carriers were in the path of the fire. DIVS A acknowledged this information and planned to address the problem.

At about **1550**, the GM Lookout was taking weather observations when the GMIHC Captain called to relay the weather update. GM Lookout acknowledged the message and continued to take weather observations. By the time the GM Lookout completed the weather observations and scanned the surroundings as well as the crew location, the fire had started building and the wind was beginning to shift. GM Lookout recognized the fire had hit the first trigger point established for his safety. After informing the GMIHC Captain, GM Lookout moved towards the open area at the old grader. The GMIHC Captain received the information relatively calmly.

As the GM Lookout hiked toward the grader, he noted the options open to himself including an alternate lookout spot further up the road, a possible shelter deployment site near the grader, and a little clearing just down from his original lookout spot where he could deploy his fire shelter if needed. The BRIHC Superintendent was driving back to meet DIVS A for a face-to-face meeting. He met with the GM Lookout as he reached the grader.

The BRIHC Superintendent and Captain picked up GM Lookout with their UTV, and called GMIHC on the radio. GMIHC informed BRIHC Superintendent and Captain that they had good visibility, they were in the burned area and they were assessing their situation. As GM Lookout departed the lookout spot, he believed the GMIHC was in the black and were watching the fire and that DIVS A was scouting<sup>4</sup>.

“...it wasn't like an outflow. It was pushing the fire in this direction. It wasn't a ten-minute bust and things got back to normal. It was two solid hours...”  
~ ADOSH interview with SPGS2

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<sup>4</sup> ADOSH Interview with GM Lookout.

Between **1550** and **1554**, some GMIHC crewmembers took photos of the fire and sent text messages to family members about the fire.

At **1555**, fire was burning along the ridge north of Yarnell. The SPGS1 lost use of an air-to-ground radio frequency, and communication was interrupted. The BRIHC Superintendent dropped the GM Lookout off at the GMIHC Superintendents truck. The GMIHC crew carriers were moved. On the GMIHC intra-crew frequency, GM Lookout heard the DIVS A and GMIHC Captain discussing the options of whether to stay in the black or to move<sup>5</sup>.

At **1558**, ATGS abruptly leaves the fire and goes to Deer Valley. He turned air tactical operations over to ASM2 who was busy dealing with lead plane duties at the time. ASM2 got a very brief update from ATGS that did not include division breaks locations and the location of the on-the-ground firefighters<sup>6</sup>. ASM2 had been ordered as a lead plane because ATGS functions were covered.

At **1600**, the fire reached Yarnell, Arizona and evacuations were underway. About this time, the ASM2 overhears radio communication referring to a safety zone. ASM2 contacted Field OSC to clarify the exchange. Planning OSC confirmed that the GMIHC was in “a good place,” in the burned area. ASM2 was asked to check on the crew, but it was not an urgent request. Soon after, ASM2 communicated directly with DIVS A. DIVS A informed ASM2 that they were moving and indicated that everything was okay.

At **1604**, a GMIHC crewmember sent a photo of the fire to family members with a text message about the fire.

At **1618**, the outflow boundary neared the northern end of fire area moving at 16 miles per hour.

At **1620**, thunder was heard by fire personnel near Yarnell.

At **1622**, the fire had reached the second geographic trigger point and firefighters in the Shrine area started moving out of the area towards Highway 89. The BRIHC had left the fire area and attempted to contact the SPGS1 to affirm that the rest of the firefighters were out of the fire area.

At **1624**, Dopplar radar showed a fire plume at a height of approximately 31,500 feet that grew to 38,700 feet by **1633**.

At **1630**, the outflow boundary moved across the southern end of fire. Also at this time, firing operations are completed in the Peeples Valley area. The wind changed direction and fire activity diminished in this area.



Figure 5. Photo taken from Congress, Arizona on June 30, 2013. Courtesy of Matt Oss.

<sup>5</sup> ADOSH Interview with GM Lookout.

<sup>6</sup> ADOSH Interview with ASM2.

At **1634**, the outflow boundary crested the ridge for the first time in the direction of Yarnell (Figure 5, previous page).

At **1637**, ASM2 flew a drop path for a VLAT north of Yarnell from west to east. This drop went over DIVS A location at the time. DIVS A communicated with ASM2 confirming the drop path. ASM2 circled the south end of the fire above Yarnell to line up a final flight path for a tanker drop.

At **1639**, ASM2 was in the middle of a discussion with Field OCS on the air-to-ground frequency when an over-modulated and static-filled transmission came over the air-to-ground frequency. More broken communication was exchanged and due to poor reception, ASM2 could only understand fragments. The rapid advance of the fire toward Yarnell had generated much radio traffic about structure protection. ASM2 assumed the broken and unclear transmission was one of the structure protection units calling to request a retardant drop. ASM2 did not suspect it was GMIHC since they had been in a safe area when he talked to them earlier.

By **1640**, the last firefighters, with the exception of the GMIHC, reached Highway 89 and confirmed on TAC1 with SPGS1 that they were safe. At approximately the same time, SPGS1 directed ASM2 to drop retardant at his discretion to stop the fire from reaching Yarnell.

At **1642**, the outflow boundary crested the ridge for the second time (Figure 6).

Between **1640** and **1642**, the final communication occurred between GMIHC, the ASM2, and Field OSC. The exchange affirmed that GMIHC needed air support. Field OSC released ASM2 from structure suppression to help GMIHC. ASM2 contacted DIVS A to request their location. DIVS A informed ASM2 that their escape route had been cut off and that they were preparing a deployment site. They were burning out the brush around them. ASM2 asked if they were on the south side of the fire and DIVS A affirmed that location. That was the last communication with DIVS A.

Soon after **1642**, the GMIHC deployed their fire shelters and were overrun by the Yarnell Hill Fire.



Figure 6. Photo taken from Congress, Arizona on June 30, 2013. Courtesy of Matt Oss.



# FIRE BEHAVIOR AND FIRE WEATHER SUMMARY

The review completed by WFA of the documented weather and fire behavior events during the Yarnell Hill fire (June 28 to 30, 2013) concurs with the Serious Accident Investigation Team (SAIT) Final Report detailing the weather and fire behavior events of the Yarnell Hill Fire (published on September 23, 2013). The following summary will contain analysis as well as excerpts from the SAIT Final Report and from other independent sources.

## Fire Environment

Central Arizona is in the physiographic Transition Zone, typified by an overall northwest-trending, mountainous terrain. As indicated by its title, the Transition Zone is a large area between the northern half of Arizona typified by the semi-arid Colorado Plateau, and the southern half of Arizona that is part of the large Basin and Range Province.

The Transition Zone has characteristics from both regions, consisting of steep, rugged terrain interspersed by valleys. Because of this, weather conditions can vary within relatively small areas.

Within this large physiographic region, the Weaver Mountains are located in central-west Yavapai County, bounded by the Hassayampa River, and typical of the Transition Zone. The Yarnell Hill Fire occurred roughly in the center of the Weaver Mountains.

Elevations in the fire area ranges from 4,500 to 6,052 feet above sea level. The immediate area is bounded by a north-south trending mountain ridge to the west (see Figure 7), with a spur-ridge, trending west-northwest to the east-southeast, projecting from the main ridge at about the mid-point of the fire and extending towards Yarnell, Arizona.

Relatively flat terrain typify the northeastern side of the fire area. Slopes of up to 50%, with isolated steeper sites, can be found on the western ridges of the fire area.

Rock outcroppings in the fire area are common and scattered throughout the hills west of Yarnell, Arizona.

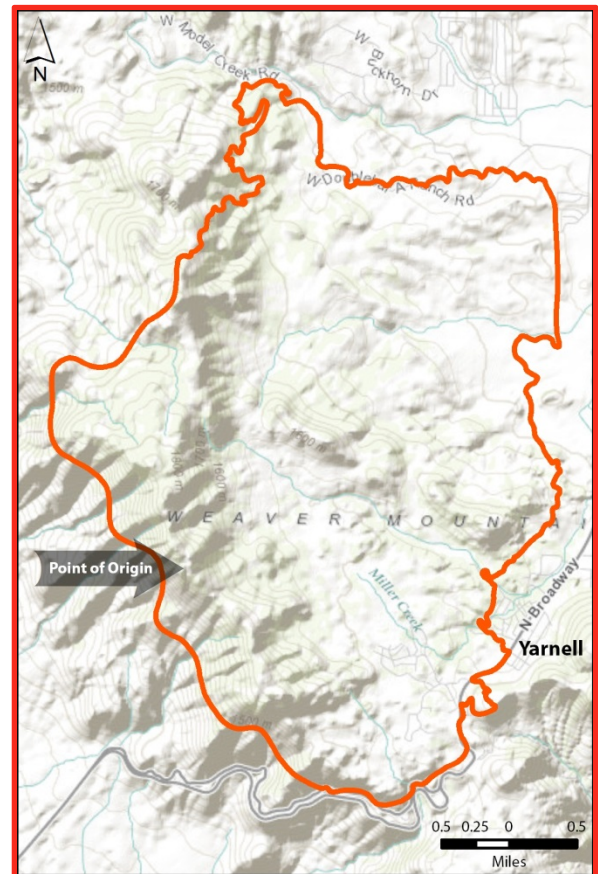


Figure 7. Topographic map west of Yarnell, Arizona. The Yarnell Hill Fire perimeter outlined in red, and the point of origin indicated with a large, black arrow.

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## Fuel/Vegetation Conditions

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Prior to the Yarnell Hill Fire, the area west of Yarnell, Arizona supported scattered, short trees such as juniper (*Juniperus deppeana*) within dense stands of brush consisting of chaparral species such as turbinella oak (*Quercus turbinella*), catclaw acacia (*Acacia greggii*), and manzanita (*Arctostaphylos spp.*). The brush vegetation varied in height from three to eight feet depending on site conditions.

Due to better soil conditions (higher moisture), drainages on the site supported thicker and taller vegetation. There was also a heavier than average cured grass component in the fuel complex due to abundant rain during the 2012 monsoon season.

In addition, no major vegetation disturbance are known to have occurred in the fire area for more than 40 years (the last documented fire was in 1966).

These conditions characterize substantial fuel continuity, both horizontally and vertically, which has the potential to support high fire rate of spreads and intensities, which in turn can introduce challenges to firefighter mobility.

On June 30, 2013, recorded fine fuel moistures (an indication of the probability of a fire start or the ease at which a fire will start) were:

- ▼ 6% FOR SHADED FUELS AND
- ▼ 3% FOR NON-SHADED FUELS.

Calculated probability of ignition was:

- ▼ 60% IN THE SHADE AND
- ▼ 90% IN NON-SHADED AREAS.

Live fuel moisture (an indication of the water stress on live vegetation as well as the flammability of live fuel) measurements were taken five miles from the fire location. These indicated varying levels of deviation from average. Ceanothus and mahogany had much lower than average moisture contents while juniper and oak were at or slightly above average<sup>7</sup>. The National Live Fuels Database records indicate that the Sonoran Scrub Oak live fuels were also below average in their moisture content as of June 15, 2013<sup>8</sup>.

Coupled with the right weather conditions, these fuel characteristics ensure moderate to extreme fire behavior.

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<sup>7</sup> Yarnell Hill Fire, SAIT Report, September 23, 2013.

<sup>8</sup> See Appendix B – National Fuel Moisture Database Figure B-1.

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## Fire Weather

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The National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) monitors and assesses climatic weather data that describe drought conditions. For the months leading up to the Yarnell Hill Fire, the described drought conditions indicated an abnormally dry fuel bed in the fire area.<sup>9</sup>

Coupled with the unusually low live fuel moisture readings, these conditions prompted the Predictive Services Section of the Southwest Coordination Center (SWCC) to issue a Fuels and Fire Behavior Advisory that discussed the area's fire potential. This included a section titled *Concerns to Firefighters and the Public*. Below is their list of concerns:

- ▲ SURFACE FIRE WILL QUICKLY TRANSITION TO CROWN FIRE AND ONLY REQUIRES LOW TO MODERATE SURFACE FIRE INTENSITY TO TRANSITION.
- ▲ ACTIVE/RUNNING CROWN FIRE HAS PRODUCED LONG RANGE SPOTTING UP TO ONE MILE UNDER THE INFLUENCE OF AN UNSTABLE ATMOSPHERE.
- ▲ ACTIVE FIRE BEHAVIOR CAN EXTEND WELL INTO NIGHT AND EARLY MORNING HOURS EVEN WITH MODERATE RELATIVE HUMIDITY (RH) RECOVERY.
- ▲ THUNDERSTORM ACTIVITY WILL CREATE A MOSAIC PATTERN OF SURFACE FUEL MOISTURES. SURFACE FIRE INTENSITY AND FIRE BEHAVIOR MAY CHANGE ABRUPTLY WHEN FIRES CROSS THESE BOUNDARIES OF MOIST AND DRY SURFACE FUELS.

On pages 68 to 76 of the SAIT Final Report, the weather discussion describes a very detailed analysis of the weather events and timing of these events during the Yarnell Hill Fire. The Cliff Mass weather blog also gives a detailed analysis of the thunderstorm movements and outflow progression as it impacted the Yarnell Fire area on June 30, 2013<sup>10</sup>. These summaries show a clear progression of weather and fuel conditions that would lead to extreme fire behavior.

Specifically, the Stanton RAWS weather graphs<sup>11</sup> for the 30th of June 2013 clearly indicate a shift in wind direction as it occurred at the Stanton site, approximately four miles south-southeast of Yarnell. At around 1700, the Stanton RAWS wind speed readings also indicate an abrupt increase in the sustained winds from 10 to 25 miles per hour, as well as wind gusts increasing to over 40 miles per hour in that same time frame. With the outflow boundary moving at about 16 miles per hour<sup>12</sup>, the outflow should have impacted the fire area at least one half hour earlier assuming the fire's northern edge was in the Peoples Valley area at the time.

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<sup>9</sup> See Appendix B – Figures B-2 and B-3.

<sup>10</sup> Cliff Mass Weather Blog: The Yarnell Hill Fire: The meteorological Origins (Yarnell Hill Fire, SAIT Report, September 23, 2013, accessed on October 28, 2013).

<sup>11</sup> See Appendix B – Figures B-4, B-5, B-6.

<sup>12</sup> SAIT Final Report, page 72.

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## USING WEATHER AND FUEL CONDITIONS TO PREDICT FIRE BEHAVIOR

The National Fire Danger Rating System (NFDRS) takes into account current and antecedent weather, fuel types, and both live and dead fuel moisture to predict burning conditions and threat of fire<sup>13</sup>. The aim of the system is to provide fire fighting personnel with qualitative and/or numeric indices to describe an area's protection needs, and are based on pre-determined fuel models.

Below is a presentation of the NFDRS fuel models that represent fuels found in the Yarnell area at the time the Yarnell Hill Fire occurred.

*Fuel Model B represents mature, dense fields of brush 6 feet or more in height. One-fourth or more of the aerial fuel in such stands is dead. Foliage burns readily. Model B fuels are potentially very dangerous, fostering intense fast-spreading fires. This model is for California mixed chaparral generally 30 years or older. The B model may be used for the New Jersey pine barrens. The F model is more appropriate for pure chamise stands.*

*Fuel Model K represents slash fuels from light thinnings and partial cuts in conifer stands.. Typically the slash is scattered about under an open overstory. This model applies to hardwood slash and to southern pine clearcuts where the loading of all fuels is less than 15 tons per acre.*

*Fuel Model T represents the bothersome sagebrush-grass types of the Great Basin and the Intermountain West. The shrubs burn easily and are not dense enough to shade out grass and other herbaceous plants. The shrubs occupy at least one-third of the site. Fuel Model T might be used for immature scrub oak and desert shrub associations in the West, and the scrub oak-wire grass type in the Southeast.*

*Fuel Model G is used for dense conifer stands where there is a heavy accumulation of litter and downed woody material. Such stands are typically over-mature and may also be suffering insect, disease, wind, or ice damage - natural events that create a very heavy buildup of dead material on the forest floor. The duff and litter are deep and much of the woody material is more than 3 inches in diameter. The undergrowth is variable, but shrubs are usually restricted to openings. Types meant to be represented by Fuel Model G are hemlock-sitka spruce, Coast Douglas-fir, and wind-thrown or bug-killed stands of lodgepole pine and spruce. This model is often used as a reference for tracking the effects of long-term drought on an area's fuels.*



Figure 8. Helm's Ranch pre-fire photo of fuels and topography.

Using the Stanton RAWS historical data (13 years of weather data) and Fuel Model B (California chaparral) pocket card as prepared for the Tonto National Forest, the Energy Release Component (ERC) for June 30, 2013 was 119. This ERC value is above the 90th percentile and indicates that only

<sup>13</sup> USFS – Wildland Fire Assessment System website (<http://www.wfas.net/index.php/nfdrs-fuel-model-static-maps-44>, access on November 3, 2013).

10% of the 13,252 days from 1968 to 2009 were hotter and drier than the conditions on June 30, 2013. The prepared pocket cards for this area and this time period shows that two significant historical fires occurred in 2000 and 2004 with ERC's of 113 and 119. Using the NFDRS pocket card prepared for the Prescott Forest West Zone<sup>14</sup> (which encompasses the Yarnell area) and using the Stanton RAWS data in a NFDRS Fuel Model G, the calculated ERC for June 30, 2013 was 108.

If the fire fighters on the Yarnell Hill Fire had either the Tonto National Forest or Prescott National Forest Pocket Card, and during a briefing were told that the predicted ERC for the day (June 30, 2013) was 100 or greater in any fuel model, the pocket card would have indicated an elevated potential for large, rapidly growing, and difficult to manage fires<sup>15</sup>.

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## Fire Behavior

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Fire personnel analyse fire behavior to provide fire fighters in the field with current and anticipated fire behavior based upon current and predicted fire weather and fuel conditions. [BehavePlus](#) is a Microsoft Windows software application used to predict wildland fire behavior for fire management purposes, and is designed for use by trained, professional wildland fire planners and managers familiar with fuels, weather, topography, wildfire situations, and the associated concepts and terminology. Using the recorded local weather as well as the observations recorded by various fire personnel on the Yarnell Hill Fire, the following fire behavior outputs were modeled using BehavePlus.

On June 30, 2013, the Fire Behavior Analyst (FBAN) selected two fuel models from a set of 40 fuel models developed by Scott and Burgan<sup>16</sup> that best matched the existing vegetation and fuel loadings in the Yarnell area.

The FBAN chose to use GS2 which represents a Grass-Shrub fuel bed with moderate grass loads, high spread rates and moderate flame lengths. This model represents shrubs up to 3 feet high. The primary carrier of fire in this model is grass and the moisture of extinction is low. This model would best represent the grass-sage areas within the Yarnell Hill Fire area.

The FBAN also chose to use SH5 which represents a high load, dry climate shrub fuel complex where the primary carrier of fire is woody shrubs and shrub litter. Depth of fuels is 4 to 6 feet with a high rate of spread and very high flame lengths are possible. The moisture of extinction in this model is high. This fuel model would best represent the chaparral-like conditions for the Yarnell area fuels and is a good choice.

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<sup>14</sup> The Prescott National Forest West Zone pocket card is based on two weather stations, Crown King and Iron Springs RAWS, both of which are within 40 miles of the Yarnell Hill Fire area.

<sup>15</sup> Appendix B – Figures B-7 to B-12.

<sup>16</sup> Scott and Burgan, 2005, RMRS-GTR-153.

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Using model SH5, the following fire behavior outputs were produced for the June 30 conditions, using a mid-flame windspeed from 5 to 40 miles per hour.

MIDFLAME WIND SPEED MI/H	RATE OF SPREAD (MAX) MI/H	FLAME LENGTH FT
0	.1	5.9
5	1.1	18.2
10	2.4	26.1
15	3.8	32.3
20	5.2	37.7
25	6.8	42.5
30	8.4	46.9
35	10.1	51.0
40	11.8	51.0

Table 1. Rate of spread and flame length predictions.

The Rate of Spread (ROS) is the speed at which the fire could travel under the modeled weather and fuel conditions. Table 1 shows the outputs in miles per hour for ROS. Before the wind shift impacted the Yarnell Hill fire, the measured windspeeds at Stanton RAWS were an average of 10 to 15 miles per hour, the expected rate of spread would have been up to 3.8 miles per hour at the head of the fire, with flame lengths up to 30 feet in the brush model. This would help explain the difficulty of control that the suppression forces were having with the Yarnell Hill fire as it headed north and west toward Peeples Valley.

After the wind shift and increase in wind speed occurred, with the outflow boundary reaching the fire area and the wind speeds increased to 40 miles per hour, the ROS would have reached up to 12 miles per hour for the flaming front. With wind speeds of this nature, spotting (lofting of embers ahead of the flaming front which in turn can start new fires) would have been irrelevant as the fire was moving so fast any spots would have been immediately over run by the flaming front. As noted in the SAIT report, when the fire moved around the granite ridge and the GMIHC were again able to see the fire, they would have had from 4 to 6 minutes to prepare a deployment site.

The SAIT report modelled the fire's spread, intensities and flame lengths using the Wildfire Decision Support System (WFDSS). The following figures are Google Earth™ outputs from this modeling effort and they are used to clarify the fire's rapid spread and change in direction.

At 1000, the model used the existing perimeter and indicated potential flow paths for the fire as it spread to the north toward Peeples Valley (Figure 9 – next page).



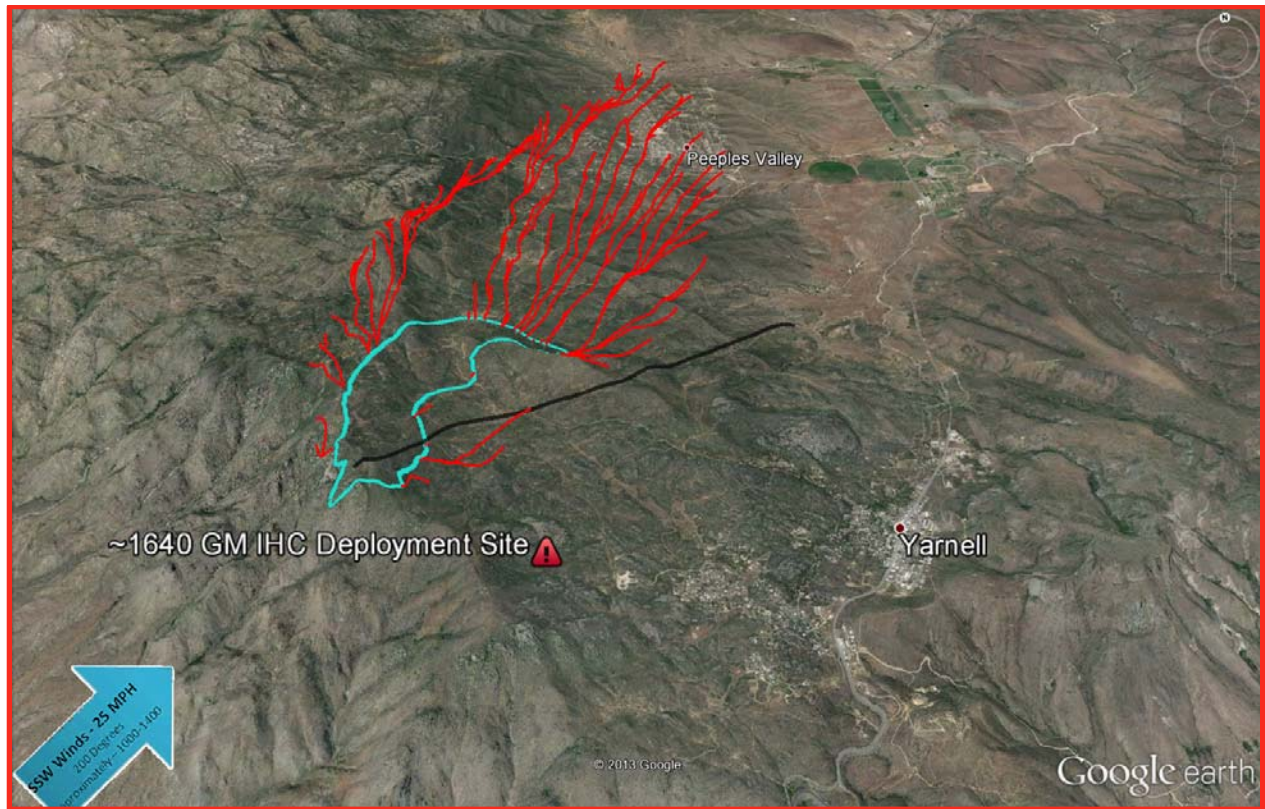


Figure 9. Yarnell Hill Fire outlined in cyan. Red lines indicate fire growth and path, and the black line represents aerial suppression efforts. The deployment site is labeled and marked with a red triangle. Winds are shown from the south-southwest at 25 miles per hour. Photo courtesy of SAIT, 2013.

At 1500, the fire had spread to the east of Peeples Valley and is beginning to turn toward Yarnell (Figure 10).

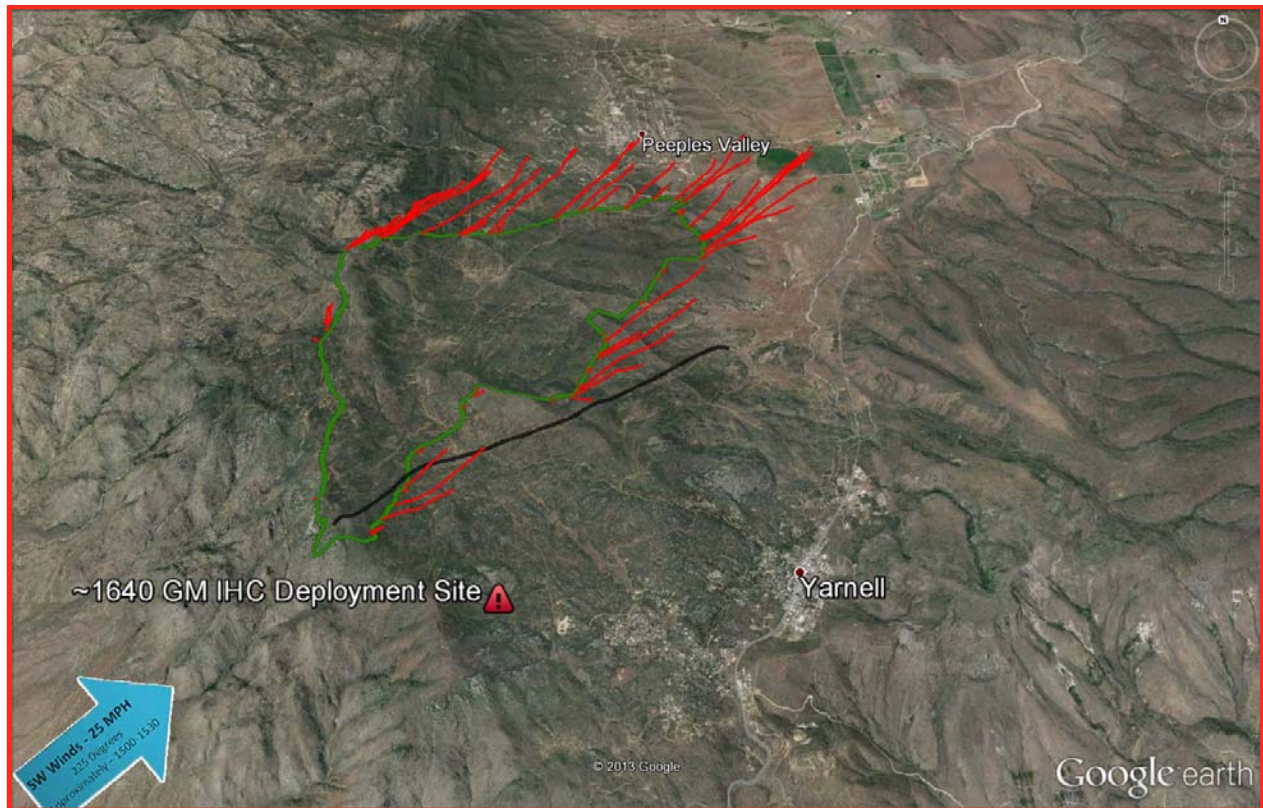


Figure 10. Yarnell Hill Fire outlined in green. Red lines indicate fire growth and path, and the black line represents aerial suppression efforts. The deployment site is labeled and marked with a red triangle. Winds are shown from the southwest at 25 miles per hour. Photo courtesy of SAIT, 2013.



Between 1600 and 1630, the fire has moved further east and crossed the retardant line and dozer line as it moves toward Yarnell (Figure 11).

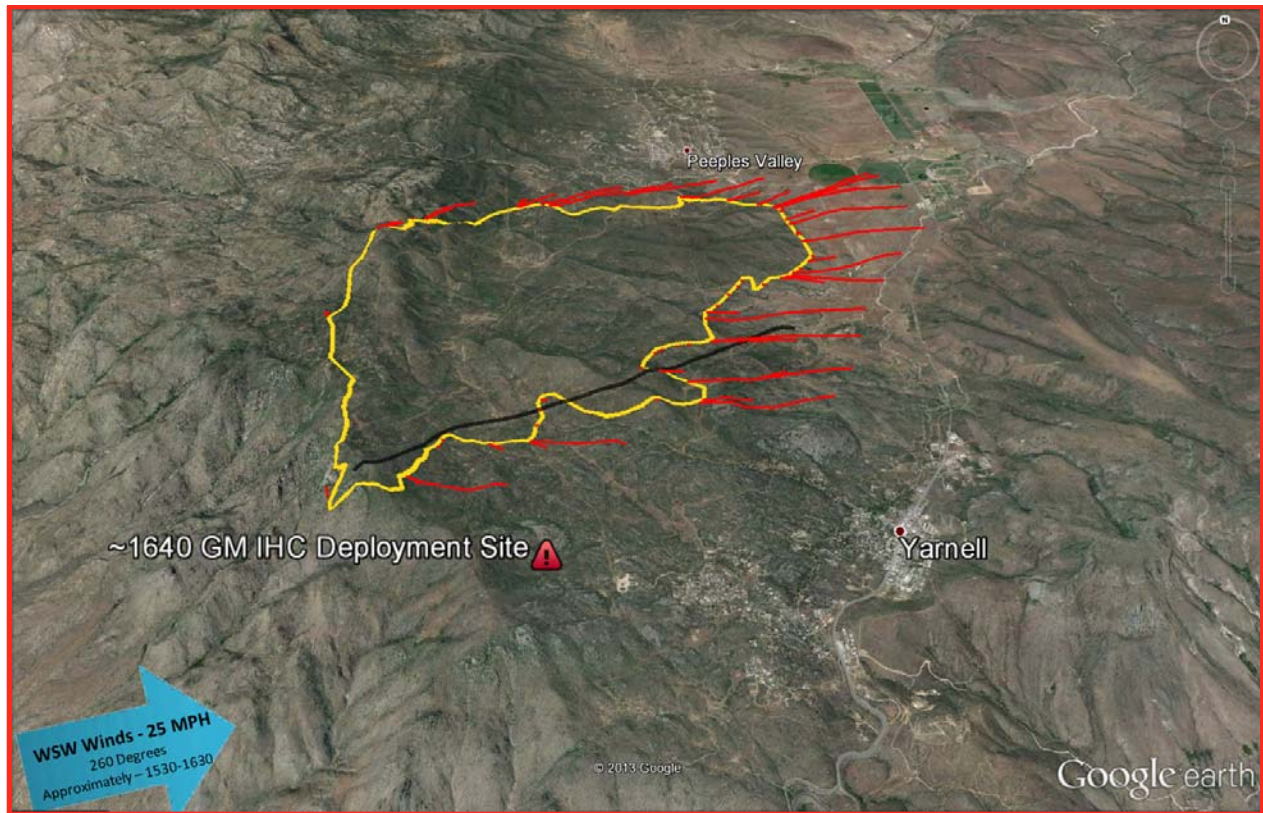


Figure 11. Yarnell Hill Fire outlined in yellow. Red lines indicate fire growth and path, and the black line represents aerial suppression efforts. The deployment site is labeled and marked with a red triangle. Winds are shown from the west-southwest at 25 miles per hour. Photo courtesy of SAIT, 2013.



By 1650, the model shows it past the deployment site and the Boulder Ranch and entering Yarnell (Figure 12).

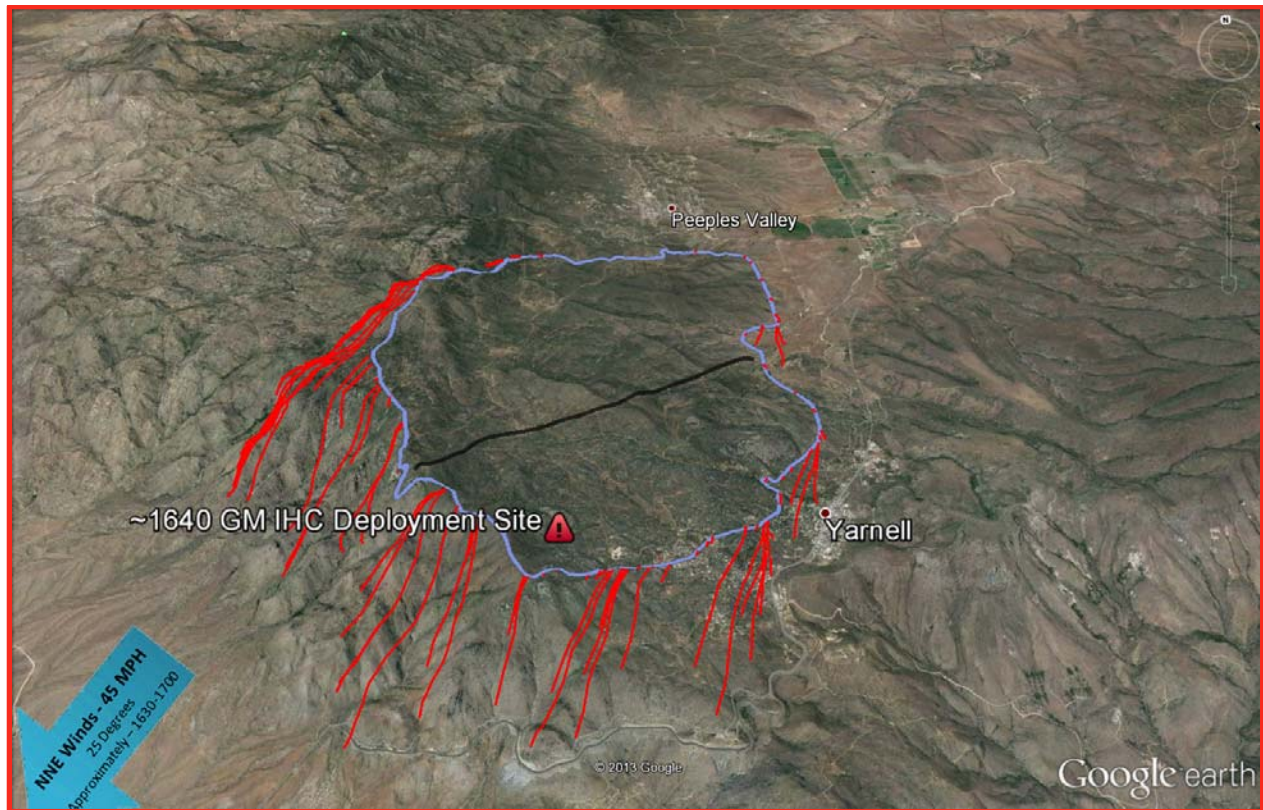


Figure 12. Yarnell Hill Fire outlined in purple. Red lines indicate fire growth and path, and the black line represents aerial suppression efforts. The deployment site is labeled and marked with a red triangle. Winds are shown from the north-northeast at 45 miles per hour. Photo courtesy of SAIT, 2013.

Oriented due north, Figure 13 shows the Wind Wizard modeling results that indicate winds speeds and directions as the fire burns through the deployment site. Wind speeds could have reached above 50 miles per hour in the area of the deployment.

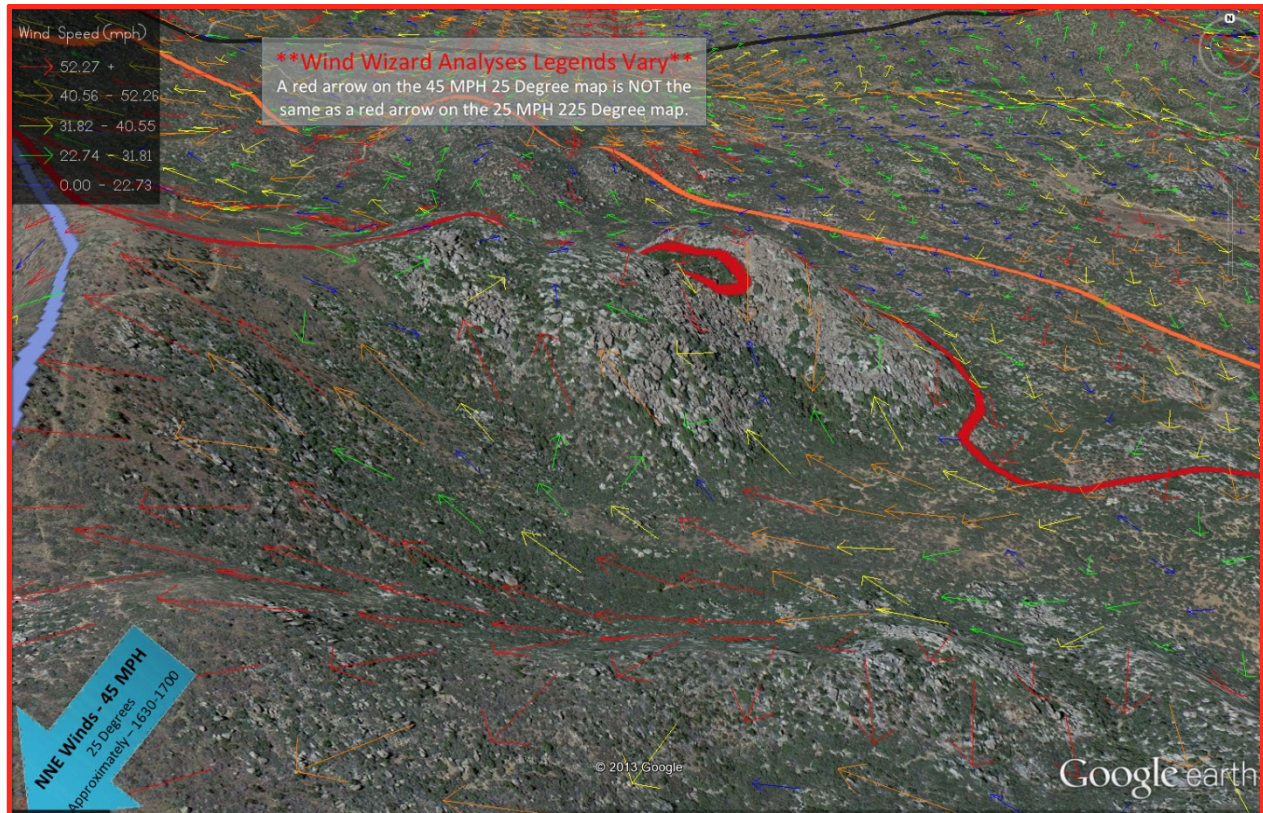


Figure 13. Deployment site at foreground, center of map. Photo courtesy of SAIT, 2013.

As modeled for the SAIT Final Report, the fire spread would have involved two flaming fronts after the frontal boundary began driving the fire to the southeast and then to the south. The first front would have moved up through the valley past the lunch spot, and over the two-track to crest on the ridge above the lunch spot and two-track area.

From a vantage point to the south at Congress, Arizona, the following two photos were taken of the Yarnell Hill Fire at approximately the time of the burnover. The first shows the outflow boundary as it crested the ridge prior to the fire running up through the deployment site to the ridge. And the second shows the outflow boundary as it continues over the ridge and the fire has run up through the deployment site and south to the ridgeline (Figures 14 and 15 on next page).





Figure 14. Yarnell Hill Fire, June 30<sup>th</sup>, 2013, approximately 1640. Photo courtesy of Matt Oss.



Figure 15. Yarnell Hill Fire, June 30<sup>th</sup>, 2013, approximately 1640. Photo courtesy of Matt Oss.



## DISCUSSION

The following discussion identifies areas of concern where difficulties existed on the Yarnell Hill Fire. Our conclusions are based upon professional experience and the industry standards for wildland fire that include the 10 Standard Firefighting Orders, 18 Watch Out Situations, Lookouts Communication Escape Routes and Safety Zones (LCES), 2013 Interagency Standards for Fire and Aviation Operations (Red Book), Incident Response Pocket Guide (IRPG), and the Wildland Fire Incident Management Field Guide (PMS 210).

The analysis of the decision making process has led to the identification of four primary areas of concern:

- ▼ ARIZONA STATE FORESTRY DIVISION
- ▼ YARNELL HILL FIRE INCIDENT MANAGEMENT
- ▼ DEPARTURE FROM STANDARD PRACTICES
- ▼ FATIGUE

Below we highlight the specific conditions and events that support why these four areas of concern resulted in the burnover.

### PRE-EXISTING CONDITIONS IN YARNELL

Yarnell, Arizona is a classic example of the wildland urban interface (WUI) situation. The structures within town are located in chaparral scrubland that had not burned in at least 40 years. The Yavapai Communities Wildfire Protection Plan approved in 2004 provides direction for hazard fuel removal on lands including the Yarnell area. The Bureau of Land Management has been working to reduce hazard fuels in Peeples Valley and Yarnell. Between 2005 and 2011, \$169,000 was spent in the Yarnell area to clear 375 acres, and \$27,500 was spent in 2007 to clear 40 acres near Peeples Valley<sup>17</sup>.

Based upon the Arizona State Forestry Division (ASFD) 2013 Season Outlook released in March 28, 2013, the state of Arizona was in a drought situation. Fine fuel moistures were approaching single digits as early as late March and the Energy Release Component was above normal and trending upward. Yavapai County had live green fuel moistures in chaparral that were below normal. Yarnell was mentioned as having chaparral with below average live fuel moisture and older chaparral stands with high dead-to-live ratio that may “prove resistant to control efforts due to the low live fuel moistures.” The dry winter and late spring precipitation had led to a delay in new seasonal fine fuel growth. The conclusion of the report is that the Yarnell area had high fire potential<sup>18</sup>.

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<sup>17</sup> AZCentral.com, Brush Clearing Saved Homes, July 17, 2013.

<sup>18</sup> 2013 Arizona Fire Season Outlook, page 10.

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## Arizona State Forestry Division

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The ASFD is responsible for fire suppression operations on 22 million acres of State Trust land and private property located outside of incorporated communities<sup>19</sup>. ASFD has employees that work on three districts and in the state office. Each District has a District Forester who, in the case of the Phoenix District, also fills the role of FMO. The Phoenix District Office maintains field offices in Prescott and Yuma, and has three fire crew coordinators throughout the District. Yarnell is part of the Phoenix District.

ASFD responds to an average of 476 wildfires annually (based upon a 10 year average, with 2006 having substantially more fires than the other nine years), which burn an average of 24,000 acres per year. ASFD supports twelve 20-person Arizona DOC fire crews, supplemental summer preparedness resources, and has cooperative agreements with 250 fire departments and federal agencies<sup>20</sup>.

ASFD had the authority for the suppression of Yarnell Hill Fire.

### INCIDENT ACTION PLAN

The Arizona Revised Statute 37-623 Section on Wildfire Suppression Strategies states that wildfire suppression operations shall be conducted to

*“minimize both suppression costs and resource losses, consistent with resource values to be protected and shall consider fire behavior, the availability of suppression resources, the values of the natural resources and property at risk, and potential cost of suppression.”*

In order to meet the intent of this statute, a comprehensive and coherent Incident Action Plan (IAP) should have been articulated. An IAP “contains objectives reflecting the overall incident strategy and specific tactical actions and supporting information for the next operational period. The plan may be oral or written.”<sup>21</sup>

Based upon incident documents and interviews, we believe that the ICT4 worked hard to develop and convey the incident strategy and tactics to resources as they arrived on the fire. However, given the complexity of the rapidly evolving fire situation, the ICT4 did not adequately brief incoming resources on June 29 or provide a written IAP for the incoming IMT2 on June 30.

Based upon our interview with ICT2, we have concluded that when ICT2 arrived at the Incident Command Post (ICP) he observed an obviously fatigued ICT4. Realizing that the fire situation was very dynamic and intensifying, ICT2 took over the fire despite the fact that certain key members of the team had not yet arrived. ICT2 provided the 0930 briefing to resources that had arrived at the ICP. Some resources were not at the 0930 briefing because they had already been assigned and working on the fireline. Based upon incident documents and interviews, ICT2 was working in a diligent and professional manner, although the situation was deteriorating.

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<sup>19</sup> Arizona State Forestry Division website (<http://www.azsf.az.gov/>, accessed on November 3, 2013).

<sup>20</sup> Arizona House of Representatives, Committee on Agriculture and Water, Minutes of Meeting, March 3, 2011.

<sup>21</sup> NWCG Glossary of Wildland Fire Terminology.

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The ultimate result was that ICT4 and ICT2 failed to convey a coherent strategic plan for suppressing the fire that was uniformly understood by ground and air resources from initial attack through the entrapment and burnover. An IAP with formalized strategies and tactics known to all resources assigned to the Yarnell Hill Fire, starting with initial attack, would have decreased the amount of confusion and miscommunication that occurred.

### EFSA AND AGENCY ADMINISTRATOR BRIEFING

The ASFD failed to give clear management direction to the incoming IMT2 because they had not completed the Escaped Fire Situation Analysis (EFSA) required by their own policy for fires escaping initial attack<sup>22</sup>. A Complexity Analysis was not completed until June 30, after the IMT2 had taken over the fire. ASFD published their Wildland Fire Situation Analysis (WFSA) decision on July 4. The ICT4, acting as Agency Administrator, provided the briefing for IMT2.

## Yarnell Hill Fire Incident Management

The following is a discussion of the decision points starting with the ignition of the Yarnell Hill Fire and ending with the entrapment and burnover. We examined the decisions that were made through the lens of the outcome and, where appropriate, suggest where different decisions could have been made based upon current policy and guidelines.

### QUALIFICATIONS

During our investigation, we reviewed the Incident Qualifications for significant personnel assigned to the Yarnell Hill Fire. We found that everyone was qualified for the positions in which they were serving.

We also examined the Type 1 Certification for the Granite Mountain Interagency Hotshot Crew (GMIHC), along with the training records for each firefighter. We have determined that GMIHC met the Type 1 Crew qualification. Each of the firefighters met the basic qualifications for the positions they held on GMIHC.

### INITIAL ATTACK

At approximately 1700 on June 28, the Yarnell Hill Fire was started by lightning. The Air Attack Group Supervisor (ATGS) for the Doce Fire was requested to fly over the Yarnell area and size up the fire. The ATGS said that the fire was in a boulder field with no vehicle access. The size-up also included that the fire was less than half an acre, only burning on one side, and did not appear to pose a threat to structures or people. A conference with the Yarnell Fire Department (YFD) personnel confirmed that the fire was inaccessible by road. The ICT4 decided not to initially attack the fire until the following morning based upon the ATGS size-up, input from YFD, and concerns about firefighter safety. The decision to defer initial attack was made without input from the District Office because the AFMO was the duty officer for the day. The ICT4 planned for initial attack the following morning.

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<sup>22</sup> Arizona State Forestry Division, Policies and Procedures, September 23, 2008. Note: The EFSA has been replaced by the Wildland Fire Decision Support System (WFDSS).



Initial attack on the morning of June 29 was delayed because a helicopter large enough to move the six-person crew safely to the site and evacuate them if needed was not available. People with local area expertise did not tell him about local trails and roads that could be used to hike in to the fire.

By mid-afternoon on June 29, the fire jumped over the two-track trail. ICT4 started ordering additional resources. The initial attack forces had clearly failed to “stop the fire and put it out in a manner consistent with firefighter and public safety and values to be protected.”<sup>23</sup> ASFD did not declare that the fire had escaped initial attack. Had they made that declaration, the decisions from that moment forward would have been proactive, rather than reactive. Based upon the Wildland Fire Incident Management Guide (PMS 210), the ICT4 would have completed a complexity analysis, implemented risk management protocols from Incident Response Pocket Guide (IRPG), determined and documented incident objectives, and reviewed the Extended Attack Safety Checklist. Based upon interviews and incident documents, we have found no evidence that this occurred.

### STRATEGIES & TACTICS

The initial strategy for the Yarnell Hill Fire was full suppression. Direct attack was made on June 29 with Single Engine Air Tankers (SEAT) dropping fire retardant by mid-morning. A Hotshot Crew arrived at the fire around 1100. The Hotshot Crew continued direct attack throughout the day. Direct attack by the SEATs was discontinued in the early afternoon. The full suppression strategy was modified to include point protection for Peeples Valley and Yarnell by the evening of June 29.

By the morning of June 30, tactics still included direct attack on the ridge at the south end of the fire by GMIHC, with aviation resources being used to slow the spread of the fire on the north and east flanks. Structure protection tactics and trigger points were established in Peeples Valley and Yarnell.

Planning OSC and DIV A decided that GMIHC would establish an anchor point using the burned area and flank using direct attack whenever possible. GMIHC was to join their line with the dozer line at the bottom of the hill and then work to the north in an effort to keep the fire out of Yarnell and Peeples Valley.

The S-336 Tactical Decision Making in Wildland Fire Course textbook contains a section on appropriate tactics in the Southwest which says that direct attack works well on small fires. However, when planning for larger fires

*“a number of items need to be considered before deciding on strategy; topography, fire behavior and intensity, rate of spread, availability of needed resources, logistics in moving and supplying firefighters and of course, probability of success... Indirect attack is also used, especially in lower elevation fuel types. Acreage is often sacrificed for lower suppression costs and higher probability of success. Direct attack on a fast moving desert or brush fire is seldom successful. Using natural barriers and roads when burning out is very common...”*

Based upon incident documents and interviews, we found no evidence that a risk assessment for the strategies and tactics were examined. We also could not find evidence that the probability of success for the chosen strategy and tactics was examined.

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<sup>23</sup> NWCG Glossary Definition of Initial Attack.

An alternative to the implemented tactics could have been to establish the anchor point as they did, burn out along the two-track trail that existed at the top of the ridge, and then burn out along the jeep trail that they used to hiked in, ending at the old grader. This tactic would entail indirect attack with burnout, and would have provided a secure line from the ridgetop to the valley floor. This tactic would have supported the strategy of point protection in Peoples Valley and the town of Yarnell. This concept is displayed in Figure 15.

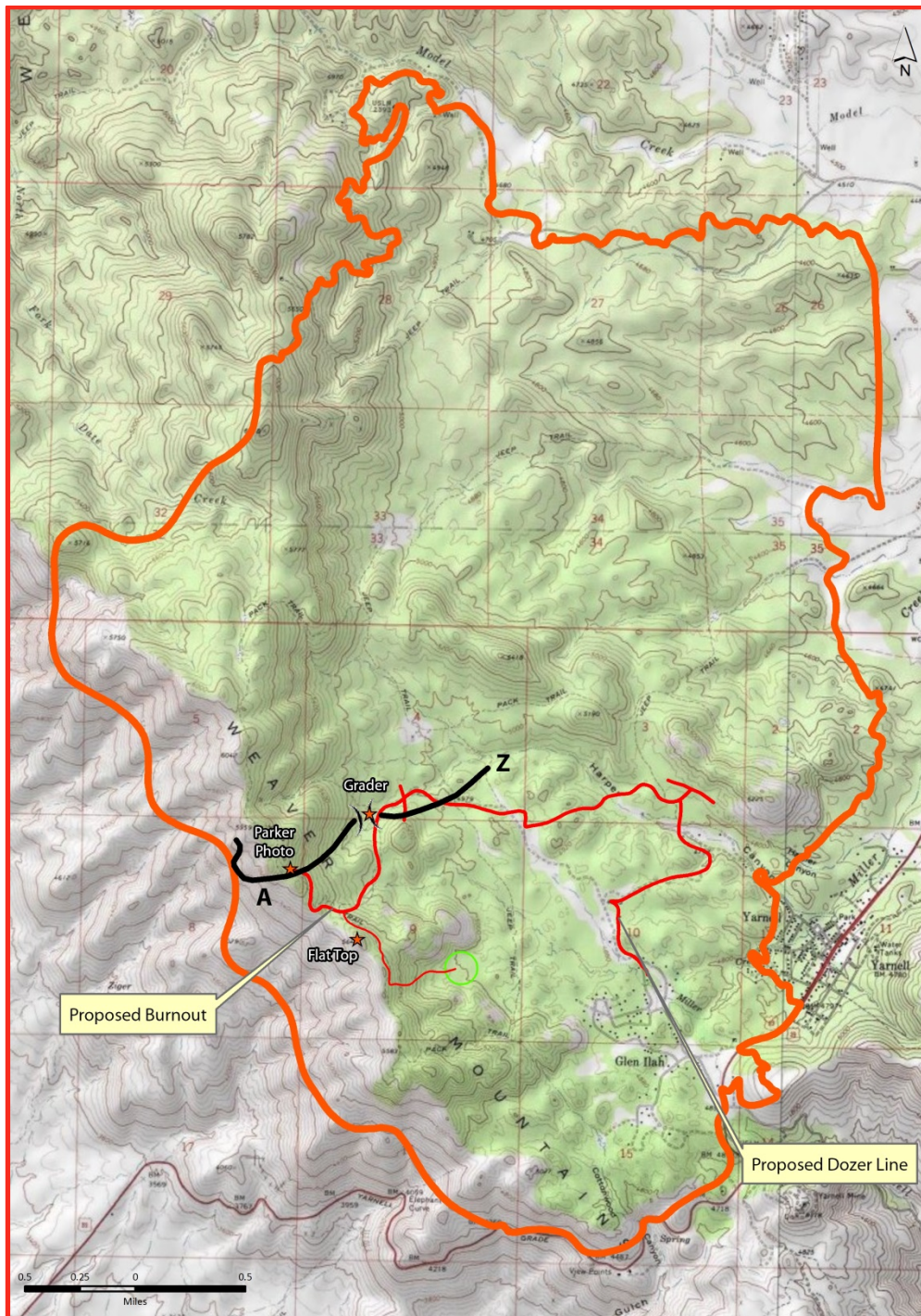


Figure 15. Yarnell Hill Fire's final outline perimeter (thick, orange outline). Topographic map showing proposed burnout and dozer line. Deployment site marked with a green circle.

Based upon interviews and incident photos, our opinion is that GMIHC was trying to ignite a test fire in anticipation of burning out indirect line along the two-track that they used to walk in when SEAT drops extinguished their burn out. GMIHC was then told by ATGS to go back to direct attack. From the interviews and incident documents, it is unclear whether the DIVS A spoke with Field OCS about the SEAT extinguishing the test fire. Also unclear is whether DIVS A spoke to Field OSC about GMIHC retreating to the burned area because the tactic of building direct line was not feasible.

## RISK MANAGEMENT

Safe implementation of the strategy and tactics requires constant reevaluation due the continual change in predicted and observed fire behavior. One of the main requirements of risk management is to identify trigger points for reevaluating strategies and tactics being applied on the fire. ICT4 initially selected a tactic of direct attack for the Yarnell Hill Fire, including the establishment of an anchor point and flanking the fire as it headed to the north and east. This tactic was not fully implemented on June 29. As a result, early in the morning of June 30, a decision to have GMIHC establish the anchor point and make a direct attack on the fire was made between Planning OSC and DIVS A during a conversation at the Yarnell Fire Station. Neither Planning OSC nor GMIHC had actually seen the fire.

The chosen tactics had the following limitations:

- ▼ THE SUSTAINED LINE PRODUCTION RATE OF A 20-PERSON CREW IN THE CHAPARRAL BRUSH TYPE IS ONLY 436 FEET AN HOUR, THE SLOWEST PRODUCTION RATE OF ANY FUEL MODEL<sup>24</sup>.
- ▼ FIREFIGHTERS USING HAND TOOLS ARE EFFECTIVE ONLY AGAINST FLAME-LENGTHS OF ABOUT 3.5 FEET BECAUSE OF THE HEAT GIVEN OFF BY THE FIRE<sup>25</sup>.
- ▼ THE RATE OF SPREAD ESTIMATES FOR THE YARNELL HILL FIRE EXCEEDED 436 FEET PER HOUR WITH FLAME LENGTHS GREATER THAN 3.5 FEET.

At the June 30 noon meeting between IMT2 Command and General Staff, they discussed current perimeter control efforts and decided to continue with existing strategy and tactics.

On June 30, the fire moved to the northeast, then to the east, and eventually to the south. The SPGS2 reported flame lengths of 40 feet with rates of speed up to 16 miles per hour occurred, yet no one seemed to recognize these signs as trigger points that should have led to a change in tactics and relocation of GMIHC. The probability of success for the chosen tactic of establishing an anchor point and flanking the fire diminished greatly each time the fire changed direction. We found no evidence that:

- ▲ GMIHC OR DIVS A SUGGESTED TO PLANNING OSC THAT THE TACTIC WOULD NOT WORK,
- ▲ THAT PLANNING OSC FOLLOWED UP WITH DIVS A OR GMIHC TO GET THEIR IMPRESSION OF THE CHANCE FOR SUCCESS,
- ▲ OR THAT IMT2 REEVALUATED THE TACTICS OR DISCUSSED MOVING GMIHC SO THAT THEY COULD REENGAGE WHERE THEY WOULD BE EFFECTIVE.

<sup>24</sup> Wildland Fire Incident Management Field Guide, 2013, PMS-210, page 109.

<sup>25</sup> 2010 Incident Response Pocket Guide (IRPG), page 79.



## ARIZONA INCIDENT MANAGEMENT TEAM

According to the 2013 Southwest Area Mobilization Guide,

*“The Arizona Divisions of Forestry and Emergency Management jointly sponsor the Arizona Incident Management Team (Arizona IMT). The team consists of employees of the Forestry Division and other areas of State government and from fire departments throughout the State. While the majority of the team’s experience is wildland fire, the team is organized with “multi-hazard” intent and is used to manage a wide range of incidents and events at the local, State, and Federal levels within Arizona as well as other areas of the country. The Arizona IMT can be configured and will respond to meet the requirements of almost any all-risk incident up to and including a Type 2 level. The team will respond as a Type 3 IMT, as a Type 2 Short IMT, as a Type 2 Long IMT, or as ordered depending on the needs and desires of the Agency Administrators responsible for the incident.”<sup>26</sup>*

The Arizona Incident Management Team, referred to as IMT2, was ordered as a “short team” and arrived without some of its key members. The following discussion outlines what happened based upon dispatch logs, interviews and daily logs. The importance of the discussion is that the team that arrived was already short-handed and had to fill in with people that were not part of the initial team order. This led to an organization that lacked the initial cohesion needed to successfully take over a complex fire.

The initial team order did not include a Safety Officer (SOF) as suggested by the Southwest Area Mobilization Guide for ordering a short Type 2 Team<sup>27</sup>. The SOF regularly assigned to the team was unavailable due to injury. Orders for two SOFs were placed on the evening of June 29 that went unfilled. They were re-ordered on the next day at 1230 with a request that they arrive by 1700. The responding SOFs arrived separately at 1455 and 1530 on the afternoon of June 30. The SOFs were assigned on the fire shortly before the entrapment and burnover. The SOF duties include “monitoring and assessing hazardous and unsafe situations, and developing measures for assessing personnel safety.”<sup>28</sup>

The individuals who filled the Operations Section Chief (OSC) positions were not originally ordered as OSCs, although they were both qualified. One individual was originally ordered as an Incident Commander Type 3, but was reassigned as Planning OSC when he arrived on the fire. Field OSC was originally ordered as a Division Supervisor, but reassigned when he arrived on the fire. The Air Support Group Supervisor (ASGS) and Air Operations Branch Director (AOBD) were ordered as part of the original team order. The rest of the Operations Section was filled with individuals who were ordered as individual resources, not as part of the formal team. This includes the individuals assigned as Structure Protection Specialists (STPS).

The Planning Section Chief (PSC) was ordered as part of the team, but did not arrive at the ICP until late afternoon. The Fire Behavior Analyst (FBAN) was also part of the initial team order and arrived in time for the 1000 briefing. A GIS Specialist was ordered as part of the team; however this position is not listed in the final organization chart of those assigned to the fire.

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<sup>26</sup> 2013 Southwest Area Mobilization Guide, page 60-10.

<sup>27</sup> 2013 Southwest Area Mobilization Guide, page 60-7.

<sup>28</sup> NWCG Glossary of Terms.

The initial team order did not request a Logistics Section Chief (LSC), but the person who filled that role was ordered as a Based Camp Manager (BCMG) in the initial team order. The initial team order did request an Ordering Manager (ORDM), a Supply Unit Leader (SPUL) and a Communications Unit Leader (COML). The COML did not arrive until after the 1000 briefing.

The Finance Section Chief (FSC) was originally ordered as the Cost Unit Leader (COST). A Time Unit Leader (TIME) was on the original order.

The results of IMT2 initially missing key people or having them arrive after the morning briefing led to the following deficiencies as the team took the fire over from IMT4.

- ▼ THE PSC WOULD HAVE BEEN ABLE TO BRING FOCUS AND COHERENCE TO THE 1000 BRIEFING AND DISTRIBUTE MAPS TO ALL RESOURCES.
- ▼ AN SOF ON-SITE THE MORNING OF JUNE 30 WOULD HAVE VIEWED THE FIRE AND FIRELINE ASSIGNMENTS STRICTLY FROM A SAFETY VIEWPOINT, NOT THE TASK-ORIENTED VIEWPOINT OF AN OSC.
- ▼ COML WOULD HAVE BEEN ABLE TO HELP THE TEAM TO ESTABLISH CONSISTENT COMMUNICATIONS WITH GROUND AND AIR RESOURCES BEFORE THEY LEFT THE ICP.
- ▼ ICT2 HAD TO ASSUME ALL THE MISSING FUNCTIONAL DUTIES WHICH WAS A SIGNIFICANT WORKLOAD.
- ▼ THE TEAM THAT WAS ASSIGNED TO THE FIRE LACKED THE COHESIVENESS THAT IS EXPECTED WHEN A TEAM IS ORDERED.

As soon as the ICT2 saw the scope and potential of the fire, he started seeking the closest qualified resources, including a SOF, through every channel available to him. The ICT2 called resources directly and bypassed the Resource Ordering Status System (ROSS) to ensure that people with the necessary skills were in place as soon as possible to assist fighting the fast moving chaparral fire. The ICT2 had little choice but to accept the fire on the morning of June 30, however the job was made more difficult based upon the way the team was ordered. They did not arrive as a cohesive and functioning unit and spent the day trying to bring order to a very chaotic situation.

Communications on the Yarnell Hill Fire were inadequate from the time IMT2 arrived because the COML arrived late. COML was not available to clone radios at the morning briefing. Tone guards were also a problem. Lack of communication is a significant safety problem.

An additional problem with the way the team arrived is that without a PSC, maps are not readily available to resources going to the fireline. GMIHC was not provided with a map or aerial photo by ICT4 when they arrived on the fire. A map would have helped the crew estimate how far the Boulder Springs ranch site was away from the lunch spot and evaluate alternative escape routes including the two-track road to Boulder Springs Ranch. Visually, the ranch looks close from the top of the ridge where GMIHC initiated their descent into the canyon. The heavy brush in the canyon, combined with the rocky nature of the area, made travel difficult and slow. They may have underestimated the speed with which the fire was moving.

## BRIEFINGS

On June 30, the IMT2 morning briefing at 0930 lacked necessary effectiveness because many Command and General Staff members had not arrived at the fire. The ICT2 had to present many parts of the briefing that should have been presented by other Command and General Staff positions because the PSC, SOF, COML and one of their usual OSC's had not arrived at the ICP by the time of the briefing. ICT4 was present to assist with the briefing as needed.

Based upon incident documents and interviews, it appears that most of the information flow for GMIHC occurred through informal conversations prior to departing to the fireline at 0800. GMIHC and DIVS A were not at the 0930 briefing.

A good example of the lack of communication from the briefing that occurred on June 30 was the test fire that GMIHC was igniting. During the morning at the top of the ridge, GMIHC was planning to burnout a small section of line to create the fire perimeter down to a two-track road. While they were igniting the test fire, two SEAT retardant drops extinguished their test fire between 1130 and 1145. The Air Tactical Group Supervisor (ATGS) did not know the purpose of the burning and dropped retardant on it, forcing GMIHC to go to direct attack on the fires perimeter. Planning OSC failed to inform ATGS of the tactics for the fire. During our interview with the ATGS on ASM1, he stated that they did not have a firm understanding of where the division breaks were. He stated that they could see the dozer, but did not understand its mission. The dozer was constructing a contingency line from west to east, which when complete, would allow a firing operation to be conducted when conditions were favorable. If ATGS had known this, they could have reinforced the dozer line with retardant instead of picking a location just to the north.

## UNCLEAR DIVISION BOUNDARIES

Neither DIVS A nor DIVS Z was at the 0930 briefing at the ICP. At different times, Field OSC instructed DIVS A and DIVS Z to establish the division boundary. DIVS A thought that DIVS Z wanted to establish the Division break somewhere near the top of the hill, which would leave Division A with only the top of the ridge heading north. DIVS Z could not figure out how to establish the Division break with DIVS A and traveled back to ICP to seek clarification. DIVS Z also was unclear as to how to initiate effective suppression actions. During an interview, DIVS Z stated that "there was just no good ways to connect any dots at that time. It was just really difficult to see anyway to connect a piece of line."

ATGS of ASM1 believed that Division A was on the western edge of the fire along the ridgeline heading north from the heel of the fire. Planning OSC thought that Division A was working from the anchor point to the East, down-slope to the valley floor. Planning OSC also thought that the western edge of the fire perimeter was not a major concern because the fire could not move to the west over the ridge without encountering a change in aspect, vegetation types and prevailing wind direction.

## OPERATIONAL OVERSIGHT

The Blue Ridge Interagency Hotshot Crew (BRIHC) spent part of their time waiting for an assignment and part of their time working on improving the dozer line. The dozer encountered a locked gate and "No Trespassing" sign which stopped line production. The objective for the dozer was to construct line from the old grader to the east to anchor into a physical feature that would allow for a burnout to protect



Yarnell. This objective was established by STPS1, and it is unclear as to whether Field OSC and Planning OSC were aware of this plan.

DIVS A did not feel that GMIHC needed the help from BRIHC. However, GMIHC made little progress in establishing an anchor point. With limited resources available, Planning OSC could have used both GMIHC and BRIHC in Division A to establish the anchor point and connect with the dozer line. Assigning both GMIHC and BRIHC to work together would have used the concept of mass action. The crews would have been able to burnout from the top of the ridge to the dozer line fairly quickly. Giving the crews separate assignments appears to be a result of poor communication, which led to poor coordination.

### COMMUNICATION BETWEEN DIVS A AND OPERATIONS

The fire situation deteriorated throughout the day of June 30. The incoming IMT2 personnel had to orient themselves to the current fire behavior, the resources currently on the fire and plan for the impending wind shift. There had to be a coherent flow of information between Field OSC and ATGS, and between Field OSC and DIVS A. The Field OSC was limited by the lack of a PSC who would translate the conceptual plan into an actual plan to be implemented on the ground. Based upon our interviews, we believe that none of the following items were intentional, but a function of an overwhelming and understaffed situation.

Planning OSC stated that “since we had not developed a plan...as we got...things going we would just assign them out.”

The decision to establish the anchor point and flank the fire was made between Planning OSC and DIVS A during a conversation that occurred while standing in the Yarnell Fire Station early in the morning of June 30. Neither OCS Plans nor DIVS A had actually seen the on-the-ground fire situation. Once GMIHC had arrived at their work area, Planning OSC should have asked if the burned area was an adequate safety zone in the event of extreme fire behavior. If GMIHC did not consider the safety zone adequate for an extreme fire behavior situation, then their assignment would have been changed to one that would be in a safer area.

Once the SEAT drops had extinguished the test fire that GMIHC was igniting, the crew tried to build direct handline, which subsequently failed. We found no evidence that DIVS A notified Planning OSC that the tactic of going direct had failed. Such a notification should trigger a reassessment of both strategy and tactics.

Planning OSC did make efforts to check on the crew with helicopter flyovers and radio calls in the morning and early afternoon. During an interview, Planning OSC said that he believed that GMIHC was safe because they were located in over 200 acres of previously burned landscape, some of which had been cold for 24-36 hours. By 1540, the first trigger point in Yarnell was breached and STPS1 called for an evacuation of the town. A short time later, the fire reached the second established trigger point and was breached which called for all structure protection personnel to retreat to their pre-identified safety zones. Planning OSC was standing with STPS1 when these commands were made.

GMIHC did not stay in the burned area safety zone. They moved toward a previously identified safety zone at Boulder Springs Ranch. Planning OSC did overhear a radio transmission from GMIHC saying

to someone that they were using their predetermined route to the structures. Although Planning OSC believed as long as the crew had one foot in the burned area they would be safe, earlier in the day, he should have discussed with GMIHC whether the burned area was an acceptable safety zone.

Some Incident Management Teams require Division or Group Supervisors to call back to the ICP by a specified time to confirm that the requirements of LCES have been put in place. This protocol was not in place on the Yarnell Hill Fire.

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## Departure from Standard Practices

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In determining the standards that guide professionals in the field of wildland fire management, we identified the 2013 Interagency Standards for Fire and Fire Aviation Operations (Red Book) and Wildland Fire Incident Management Field Guide (PMS 210) as established industry standards. We also referred to Arizona Revised Statutes and City of Prescott guiding documents as needed. In addition to these resources, we also used the 10 Standard Firefighting Orders and LCES. Through our interview process, a clear picture emerged that ground-level firefighters treat the 10 Standard Firefighting Orders and LCES as rules and upper level managers tend to treat the Orders as guidelines. As a result of our observations, we have chosen to treat the 10 Standard Firefighting Orders and LCES as rules because they should have guided the actions of GMIHC on June 30.

### 10 STANDARD FIREFIGHTING ORDERS

We have applied the 10 Standard Firefighting Orders to the Yarnell Hill Fire:

1. *Keep informed on fire-weather conditions and forecasts.*

Planning OSC briefed GMIHC on fire weather conditions and forecasts at the Yarnell Fire Department during the morning of June 30. The crew was later informed twice over the radio about weather warnings from the National Weather Service concerning approaching thunderstorms with associated strong winds.

2. *Know what your fire is doing at all times.*

GMIHC was positioned on a ridgeline that had an unobstructed view of the fire movement and

The 10 Standard Firefighting Orders were developed by a Task Force in 1957. The expectation was that firefighters would memorize them and use them to keep themselves safe.

The project was undertaken after the Inaja Fire in California where 11 firefighters died. The effort to develop the 10 Standard Firefighting Orders also led to the development of the fire shelter and Nomex clothing for wildland firefighters, and a call for improved training especially in the area of fire behavior. The Inaja Fire of 1956 was viewed by some as the final straw in a series of fire fatalities:

1943 Hauser Creek, CA, 11 fatalities

1949 Mann Gulch, MT, 13 fatalities

1953 Rattlesnake, CA, 15 fatalities

1956 Inaja, CA, 11 fatalities

The 10 Standard Firefighting Orders were written in an attempt to provide rules that would be able to stop the increasing number of fire fatalities.

intensity. The crew had a lookout posted for much of the day. Their lookout eventually had to move because the fire reached pre-established trigger points that meant that he was in danger from the fire. GMIHC no longer had a lookout after their lookout evacuated his position. ATGS was in the air above the fire when GMIHC decided to change locations; however the crew did not ask ATGS to serve as their lookout.

3. *Base all actions on current and expected behavior of the fire.*

GMIHC based their actions on the fire behavior they had observed for several hours.

4. *Identify escape routes and safety zones, and make them known.*

GMIHC had identified their vehicles and the Boulder Springs Ranch as good safety zones. The Ranch site was large and well-constructed, with wildfire in mind. The site withstood the flames of the Yarnell Hill Fire as it burned around the Ranch. The buildings sustained very little damage and the owners stayed in the main house as the flaming front passed. Granite Mountain had several escape routes to select from. We could find no evidence that they timed or improved the escape route to Boulder Springs Ranch.

5. *Post lookouts whenever there is possible danger.*

GMIHC posted a lookout when they were building direct handline. However, GMIHC did not have a lookout posted during their descent to the safety zone. The lookout had left his post because trigger points used to ensure his safety had been breached. During the critical period when GMIHC was traveling to the safety zone, the lookout was moving the crew vehicles to a safer location as requested by his supervisor. Based on interviews, we found no evidence that GMIHC requested that ATGS or anyone else in a position to see the crew's location, watch the fire for them as they traveled to Boulder Springs Ranch.

6. *Be alert. Keep calm. Think clearly. Act decisively.*

Evidence shows that even up to and including their last radio transmission, DIVS A and GMIHC were alert, unimaginably calm, thinking clearly, and taking decisive actions.

7. *Maintain prompt communications with your forces, your supervisor, and adjoining forces.*

GMIHC maintained communications with everyone on their crew and division. DIVS A had some difficulty maintaining communication with Planning OSC. GMIHC did not notify their supervisor that they planned to move to an alternate safety zone.

Planning OSC ineffectively communicated the tactics to be used for the day with all of his forces. There is evidence that the aerial resources did not understand tactics being used by forces on the ground. There is also evidence that DIVS A and DIVS Z could not agree where the division break should be placed.



8. *Give clear instructions and insure that they are understood.*

ASFD failed to:

- ▼ PROVIDE A WFSA OR WFDSS DOCUMENT AND RATIONALE FOR SELECTING ITS SUPPRESSION ALTERNATIVE TO THE IMT2;
- ▼ PROVIDE THE IMT2 WITH CLEAR WRITTEN DIRECTION IN THE FORM OF A DELEGATION OF AUTHORITY LETTER, WHICH IS CONSIDERED TO BE MARCHING ORDERS BY INCIDENT COMMANDERS;
- ▼ THE PLANNING OSC DID NOT GET AVIATION RESOURCES AND GROUND RESOURCES ON THE SAME TACTICAL PLAN. GMIHC WAS ATTEMPTING TO BURN OUT FIRELINE AND ATGS ORDERS TWO RETARDANT DROPS ON THEIR BURNOUT. SIMILARLY, THE STRUCTURE PROTECTION GROUP WAS USING A DOZER TO CONSTRUCT CONTINGENCY LINE NEAR YARNELL, BUT THE AVIATION RESOURCES CHOOSE TO DROP RETARDANT ON A SIMILAR VECTOR CLOSE TO THE DOZER LINE. AIR RESOURCES MISSED THE OPPORTUNITY TO REINFORCE THE DOZER LINE WITH RETARDANT BECAUSE THEY WERE NOT PROPERLY COORDINATED WITH THE STRUCTURE PROTECTION GROUP.

9. *Maintain control of your forces at all times.*

GMIHC died together in a very small space. No one ran. This is a testament to the exceptional leadership abilities of GMIHC Superintendent and Captain.

10. *Fight Fire Aggressively, having provided for Safety First*

ASFD had a strategy of full suppression using the tactic of direct attack. When the tactic failed, the managers of the fire did not reassess the strategy or tactics. A reassessment should have resulted in GMIHC moving to an area of the fire where they would have been safe and could be used effectively.

Although GMIHC successfully followed most of the 10 Standard Firefighting Orders and LCES, this section discusses the errors that were made by the crew.

The LCES checklist suggests that more than one escape route be available and that escape time and safety zone size requirements will change as fire behavior changes. GMIHC initially had multiple escape routes, including the ability to walk back to their vehicles (an option that was closed off when the vehicles were moved to safety). A second escape route was to travel south along the ridge towards the Boulder Springs Ranch and turn east at the descent point. However, this escape route had not been scouted, timed, marked or improved. At the descent point, they had a third option of turning to the west, escaping over the ridge and down to Highway 89 on the Congress side of the mountain. A fourth option would have been to continue along the two-track road to the south and east to the Boulder Springs Ranch. There is no evidence that GMIHC had scouted and timed alternative escape routes or checked

LCES was designed to be a simple way to ensure that fireline resources have identified their Lookout, Communication, Escape Route and Safety Zone. LCES reinforces the 10 Standard Firefighting Orders and 18 Watch Out Situations.

the escape route they used for loose soils, rocks or excessive vegetation. There is also no evidence that the crew had evaluated the escape time versus the potential rate of spread based upon the afternoon weather forecast.

A second error made by GMIHC is that they did not have a lookout when they made the descent to Boulder Springs Ranch. GMIHC did a very good job of having a lookout posted while they established the anchor point and constructed line. Based upon interviews and incident documents, we could find no evidence that they requested a lookout as they traveled towards Boulder Springs Ranch.

Finally, GMIHC had an obligation to notify their supervisor where they were moving and what route they would be traveling. The confusion that surrounded the search for the crew after the entrapment and burnover illustrates the importance of notifying the supervisor.

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## Fatigue

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Based upon interviews, fatigue appears to be a factor in the decisions that were made by ICT4 during the Yarnell Hill Fire. Timesheet records indicate that he had worked 28 days straight as of June 28. ICT4 sized the fire up on the evening of June 28 before returning home for the night. The following morning, he arrived in Yarnell and started a shift that would last for over 30 hours. The Incidence Response Pocket Guide states that going 24 hours without sleep affects your decision-making ability the same way a blood-alcohol-content of 0.10 would<sup>29</sup>. This level of exhaustion could impair decision-making ability and situational awareness.

Fatigue may have been a factor for GMIHC as well. Their work records indicate that they had worked 28 out of 30 days during the month of June. The crew had worked 13 of a 14-day tour. Although technically not a violation of the work-rest guidelines, cumulative fatigue resulting from working 28 out of 30 days may have been a factor in their decision making process.

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<sup>29</sup> IRPG, PMS 461, January 2010.

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## CONCLUSIONS

We have determined that the following factors directly contributed to the entrapment and burnover:

- ▲ FIRE BEHAVIOR WAS EXTREME AND EXACERBATED BY THE OUTFLOW BOUNDARY ASSOCIATED WITH THE THUNDERSTORM. THE YARNELL HILL FIRE CONTINUALLY EXCEEDED THE EXPECTATIONS OF FIRE AND INCIDENT MANAGERS, AS WELL AS THE FIREFIGHTERS.
  - ▲ ARIZONA STATE FORESTRY DIVISION FAILED TO IMPLEMENT THEIR OWN EXTENDED ATTACK GUIDELINES AND PROCEDURES INCLUDING AN EXTENDED ATTACK SAFETY CHECKLIST AND WILDLAND FIRE DECISION SUPPORT SYSTEM WITH A COMPLEXITY ANALYSIS.
  - ▲ THE INCIDENT MANAGEMENT DECISION PROCESS FAILED TO RECOGNIZE THAT THE AVAILABLE RESOURCES AND CHOSEN ADMINISTRATIVE STRATEGY OF FULL SUPPRESSION AND ASSOCIATED OPERATIONAL TACTICS COULD NOT SUCCEED. THIS ALSO REMAINED THE CASE WHEN THE STRATEGY CHANGED FROM FULL SUPPRESSION TO A COMBINATION OF POINT PROTECTION AND FULL SUPPRESSION.
  - ▲ RISK MANAGEMENT WEIGHS THE RISK ASSOCIATED WITH SUCCESS AGAINST THE PROBABILITY AND SEVERITY OF FAILURE. ASFD FAILED TO ADEQUATELY UPDATE THEIR RISK ASSESSMENT WHEN THE FIRE ESCAPED INITIAL ATTACK LEADING TO THE FAILURE OF THEIR STRATEGIES AND TACTICS THAT RESULTED IN A LIFE-THREATENING EVENT.
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## APPENDIX A – Curricula Vitae

**DAN O'BRIEN, B.S.**

**SENIOR CONSULTANT**

Mr. O'Brien is an expert in fire and aviation with over 40 years with the National Park Service. Mr. O'Brien has held the positions of Smokejumper, Hotshot Crew Supervisor and Air Attack Supervisor. He has served as Chief of Fire and Aviation Management in three regions in the National Park Service. Mr. O'Brien has been Fire and Aviation Management Officer in several parks, and Assistant Fire and Aviation Management Officer for Glacier National Park.

Mr. O'Brien served on various Regional Coordinating Groups from 1991 to 2000, and served as Multi-Area Group Coordinator for the Rocky Mountain Region. He has held several positions in the Incident Command System including Incident Commander Type II, Fire Use Manager Type I, National Park Service Agency Liaison to Area Command Team and Incident Commander II on multiple type II fire incidents over a 10-year period. He has also consulted for four law firms concerning wildland fire cases.

**ELIZABETH ANDERSON, M.S.**

**SENIOR CONSULTANT**

Ms. Anderson is an expert in fire ecology and is the Chief Operating Officer for Wildland Fire Associates. She started her federal career working on a helitack crew and in natural resources management with the National Park Service. Her career includes eight years working for the USDA Forest Service in prescribed fire and fuels management, and as a District Fire Management Officer. Ms. Anderson has over 12 years of providing consulting services to federal land management agencies that include environmental planning, fire management planning, fire staff recruitment services, and fire ecology expertise. She has specialized in providing scientific fire ecology information and research to assist fire managers make prescribed fire and fuels treatment decisions.

Ms. Anderson served for over four years as a member of the Fire Monitoring Steering Committee for the National Park Service. The committee provided the direction and oversight for the national fire ecology and fire effects monitoring program. She spent over four years establishing a regional fire ecology program and implementing a fire effects monitoring program to measure the short and long-term effects of prescribed fire on natural and cultural resources. She was also a member of a team that developed a comprehensive fire management and ecology brochure for the National Park Service.

**WILLIAM BARRY HICKS, B.S.**

**SENIOR CONSULTANT**

Mr. Hicks is an expert in Aviation Management on wildfires. Mr. Hicks has served as Aviation Coordinator on National Area Command Team from 1994-2003 and on complex fires throughout US and numerous hurricane assignments. He served as a fire expert advisor to a consortium of ranchers in Mexico in 2010 on perhaps largest wildfires Mexico has experienced. He also served on Chief's Principal Representative Team in Oregon & Washington in 2007 for fires in excess of \$10,000,000. He was requested to advise on the use of the Evergreen 747 dropping retardant on these fires and as a Team participant on Interagency Smokejumper Delivery System study 2004-2005. Mr. Hicks was an

advisor to the US Coast Guard for aviation on BP Oil Spill in 2009 and worked a Special Assignment to Columbia Shuttle Disaster recovery efforts.

Mr. Hicks began his career with the U.S. Forest Service in positions such as smoke jumper, engine crew and working on a hotshot crew. He became a smoke jumper squad leader and a base manager before becoming a Fire Management Officer, District Ranger, and then a Regional Aviation Officer.

**DAVE LARSEN, B.S.**  
**SENIOR CONSULTANT**

Mr. Larsen is an expert in fire management and the tactical application of resources in fire suppression. Mr. Larsen has held the positions of Incident Commander Type I, Deputy Incident Commander Type I, Incident Commander Type II, Prescribed Burn Boss Type I, Prescribed Fire Manager Type I, and Fire Use Manager Type I.

Mr. Larsen's fire management experience includes work as a fire lookout, district engine foreman and crewmember, district trail crewmember, district brush disposal crew and a hot shot crew supervisor. Mr. Larsen was a District Fire Management Officer as well as a Forest Fire Management Officer for the Helena National Forest. Mr. Larsen's expertise includes All-Risk Incident Commander including Hurricanes Katrina and Rita Operation Section Chief, Type II, and Fire Behavior Analyst, Type II. Additionally, Mr. Larsen has Instructed S290, S390, S490, S339, S330, I400 and other ICS courses.

**DARRELL SCHULTE, B.S.**  
**SENIOR CONSULTANT**

Mr. Schulte's expertise is in analyzing and predicting fire behavior. Mr. Schulte has 22 years of experience working on Incident Management Teams nationally as a Fire Behavior analyst, including 18 years of experience as a Long Term Fire Behavior Analyst. His career includes serving as Assistant Forest Fire Management Officer, District Fire Manager officer, hotshot crew supervisor, Assistant District Fire Management Officer supervising a 20-person brush disposal crew, and supervising district engine and fire crews. He is an expert user of Firefamily Plus, FlamMap, Farsite, as well as an Analyst and User for WFDSS.

Mr. Schulte has worked on interdisciplinary teams and NEPA planning efforts for over 33 years specializing in fire and fuels management. Mr. Schulte participated in the 1995 Interagency Management Review for the South Canyon Fire by analyzing the availability and use of Fire Behavior Analysts during the 1994 fire season. He has served as an expert witness and fire behavior consultant for legal firms. Additionally, Mr. Schulte has instructed S130, S190, S230, S231, S390, S490, S590, and RX 590 classes, as well as other ICS classes, nationally.

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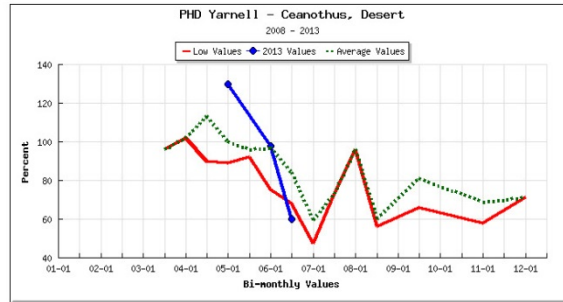
# APPENDIX B - Fire Behavior and Weather Supporting Graphics

## National Fuel Moisture Database

### PHD Yarnell (Bi-monthly Data)

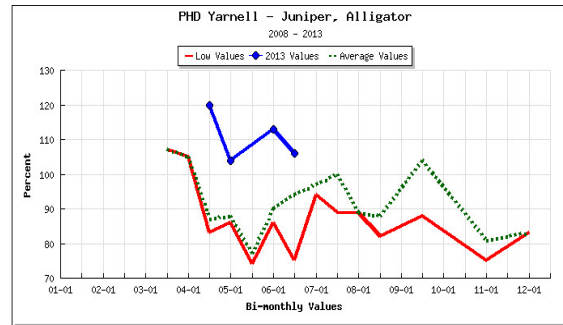
[Site Information](#) | [Stanton RAWs](#) | [Close the Report](#)

Gray background indicates that no current year data is available



PHD Yarnell - Ceanothus, Desert

	01-01	01-15	02-01	02-15	03-01	03-15	04-01	04-15	05-01	05-15	06-01	06-15	07-01	07-15	08-01	08-15	09-01	09-15	10-01	10-15	11-01	11-15	12-01	12-15
2013									130		98	60												
Avg							96	102	113	100	96	97	84	59	73	96	60		81			69		71
Low							96	102	90	89	92	75	68	47	73	96	56		66			58		71

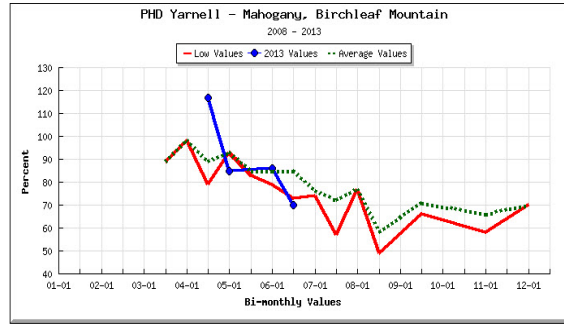


PHD Yarnell - Juniper, Alligator

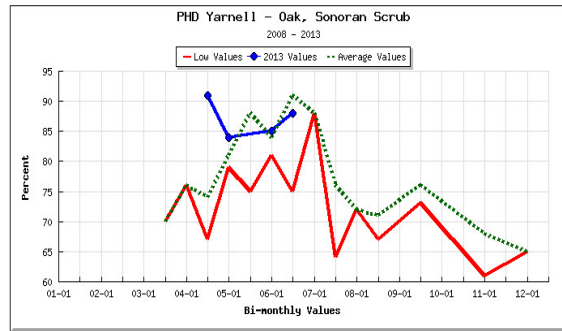
	01-01	01-15	02-01	02-15	03-01	03-15	04-01	04-15	05-01	05-15	06-01	06-15	07-01	07-15	08-01	08-15	09-01	09-15	10-01	10-15	11-01	11-15	12-01	12-15
2013									120		113	106												
Avg							107	105	87	88	77	90	94	97	100	89	88		104			81		83
Low							107	105	83	86	74	86	75	94	89	89	82		88			75		83

Figure B-1. National Live Fuel Moisture Database for Yarnell, 2008 – 2013 (continued on next page).





PHD Yarnell - Mahogany, Birchleaf Mountain																								
	01-01	01-15	02-01	02-15	03-01	03-15	04-01	04-15	05-01	05-15	06-01	06-15	07-01	07-15	08-01	08-15	09-01	09-15	10-01	10-15	11-01	11-15	12-01	12-15
2013								117	85		86	70												
Avg						89	98	89	93	85	85	85	76	72	77	58		71				66		70
Low						89	98	79	93	83	79	73	74	57	77	49		66				58		70



PHD Yarnell - Oak, Sonoran Scrub																								
	01-01	01-15	02-01	02-15	03-01	03-15	04-01	04-15	05-01	05-15	06-01	06-15	07-01	07-15	08-01	08-15	09-01	09-15	10-01	10-15	11-01	11-15	12-01	12-15
2013								91	84		85	88												
Avg						70	76	74	81	88	84	91	88	76	72	71		76				68		65
Low						70	76	67	79	75	81	75	88	64	72	67		73				61		65

Figure B-1. National Live Fuel Moisture Database for Yarnell, 2008 – 2013.

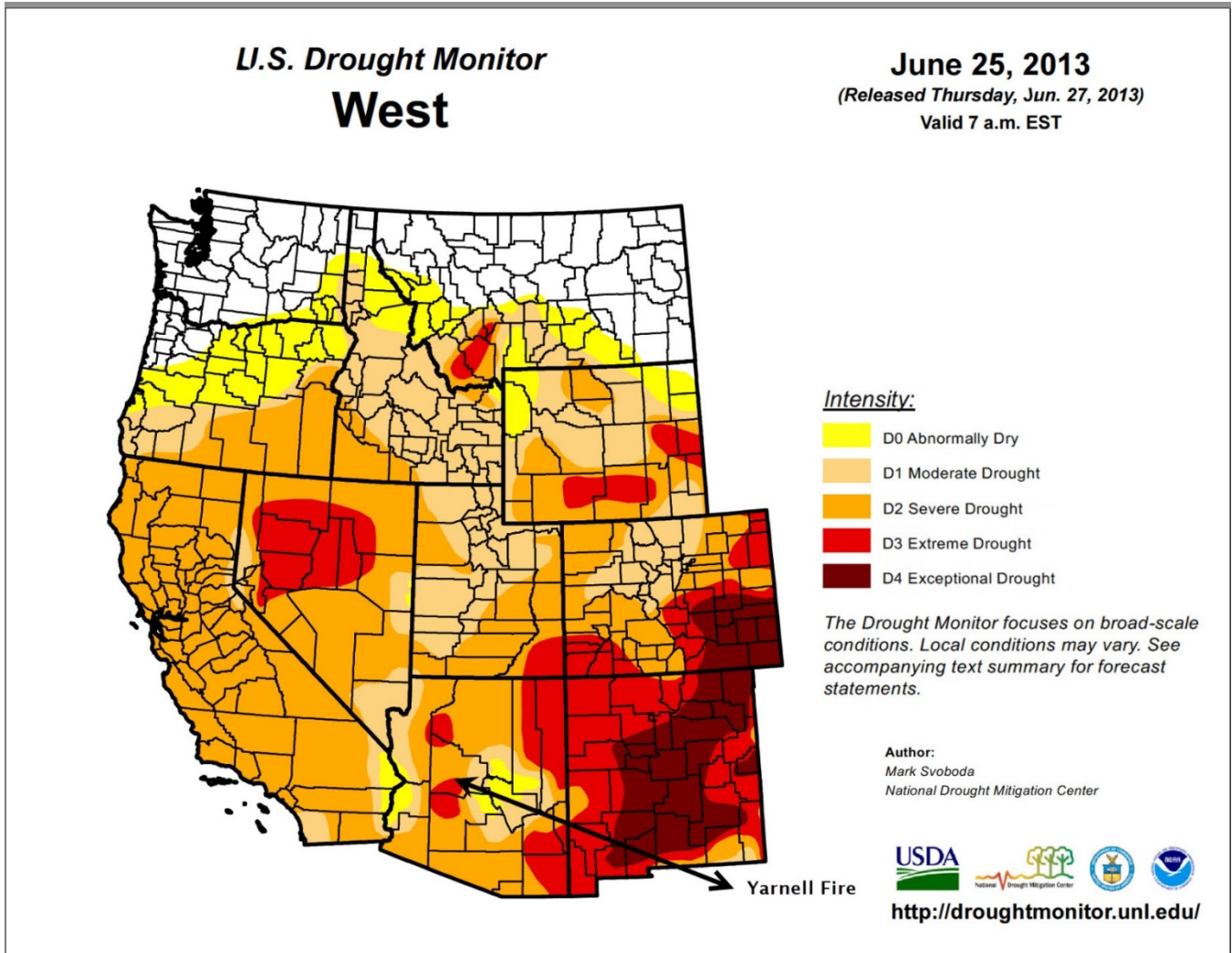


Figure B-2. U.S. Drought Monitor for the western United States for June 25, 2013.





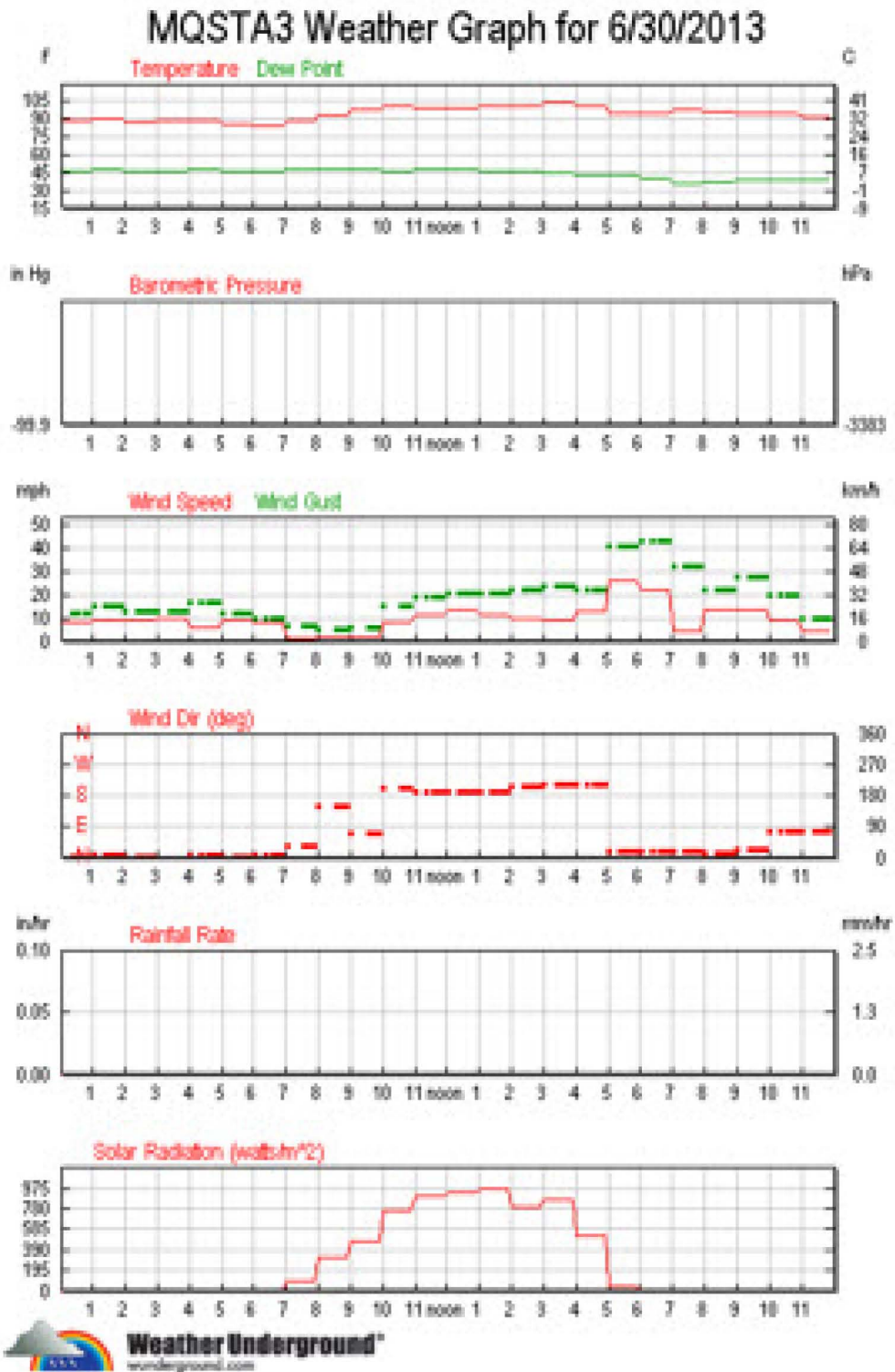


Figure B-4. MQSTA3 Weather Graph showing temperature, wind speed, wind direction, and solar radiation for June 30, 2013.

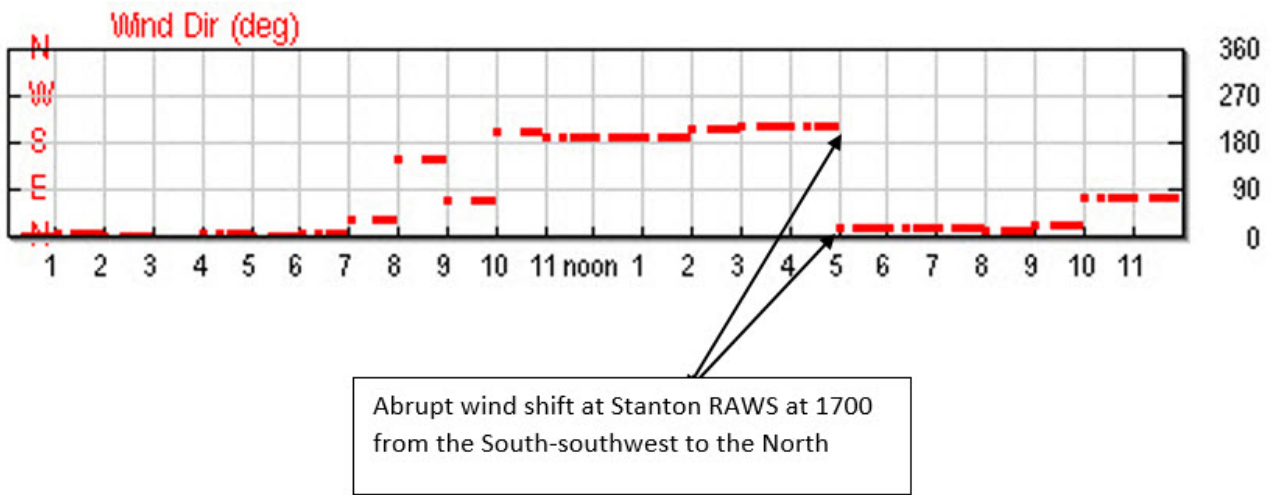


Figure B-5. Weather data graph detail showing wind direction shift on June 30, 2013.

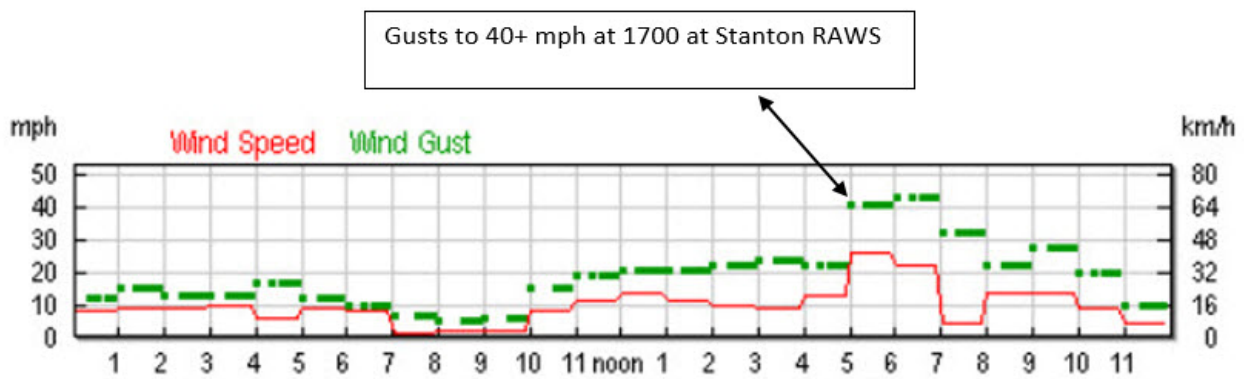


Figure B-6. Weather data graph detail showing wind speed increase on June 30, 2013.

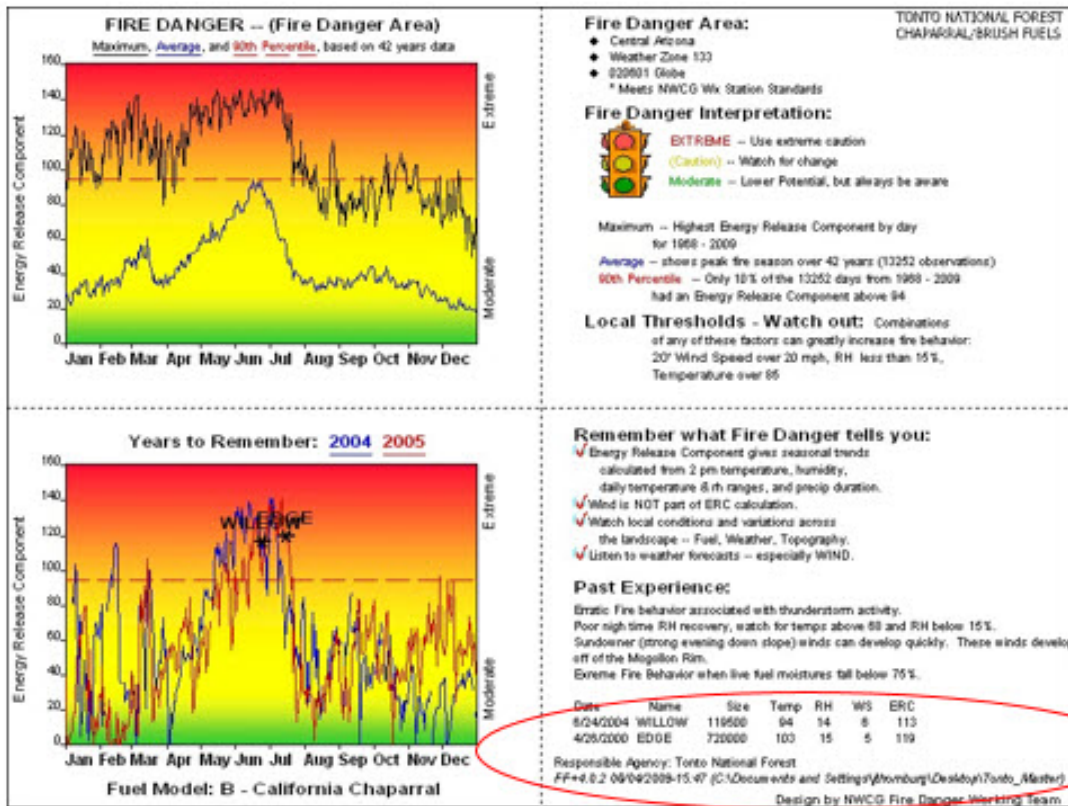


Figure B-7. Tonto National Forest, Chaparral/Brush Fuels Fire Danger pocket card.



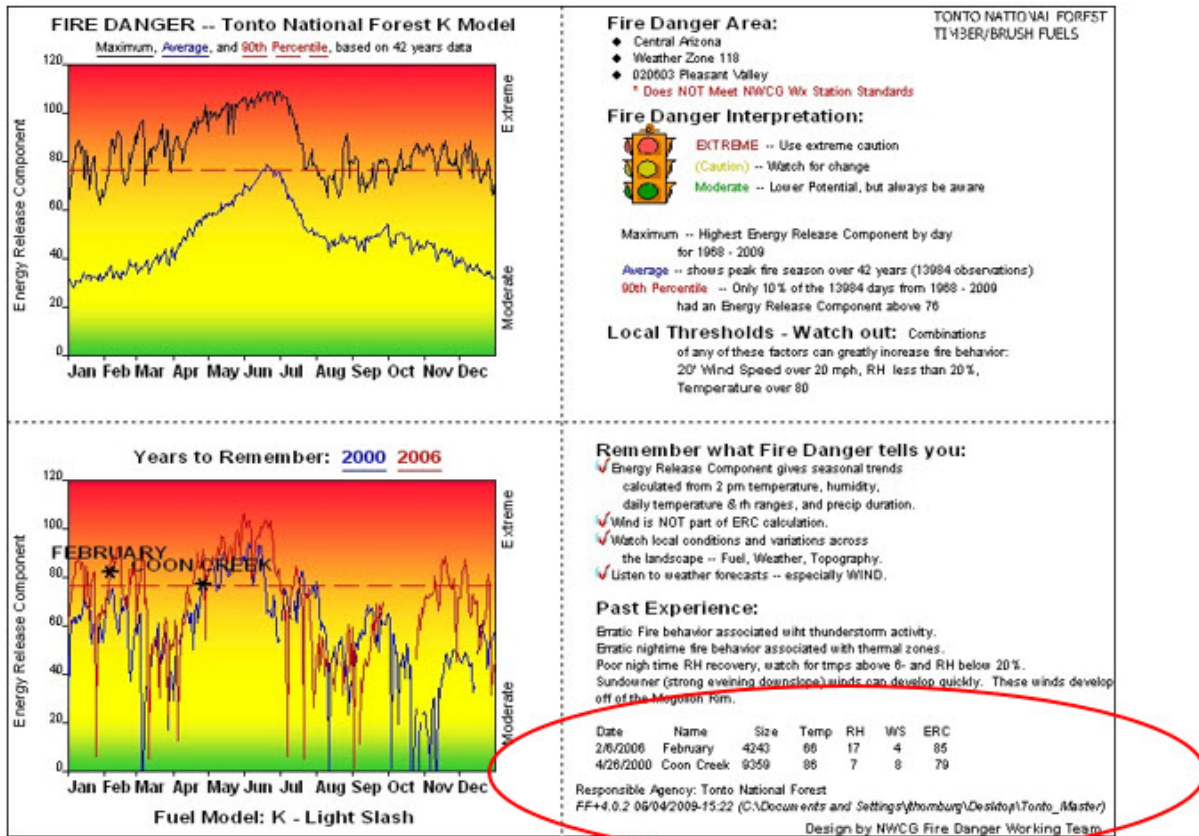


Figure B-8. Tonto National Forest, Timber/Brush Fuels Fire Danger pocket card.

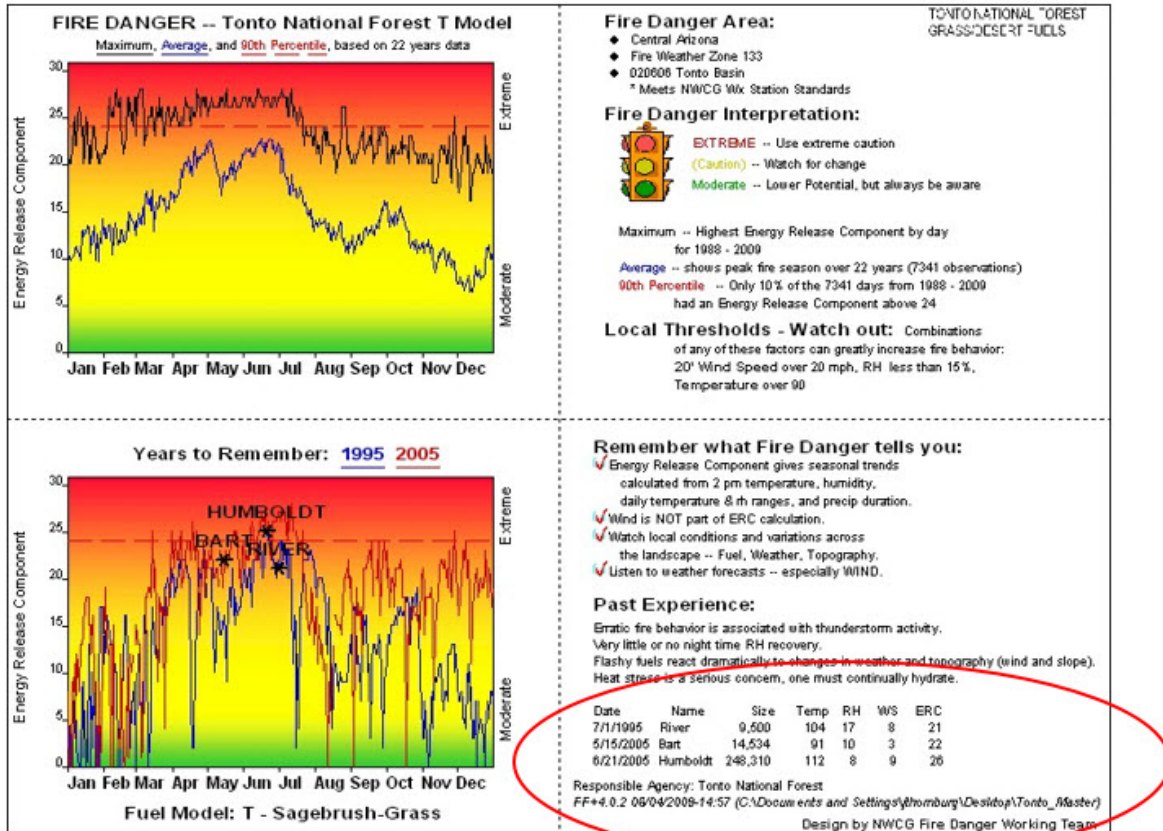


Figure B-9. Tonto National Forest, Grass/Desert Fuels Fire Danger pocket card.

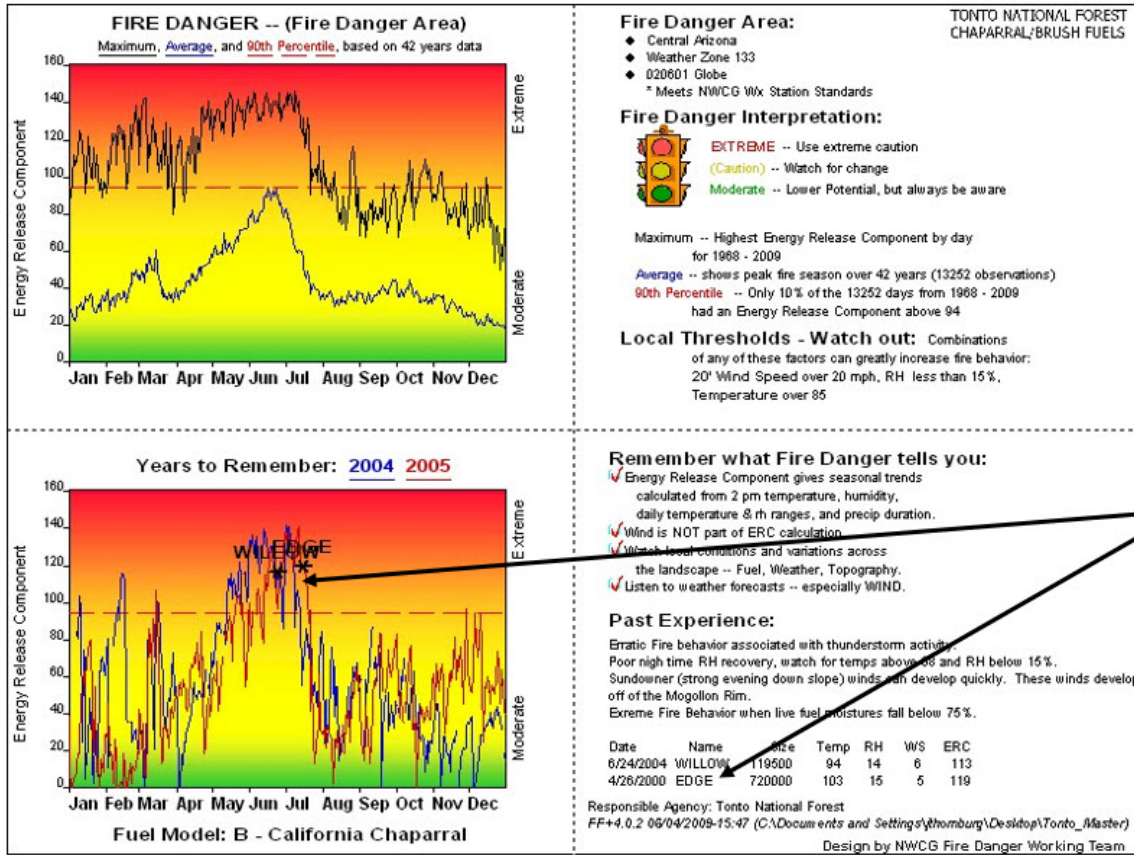


Figure B-10. Tonto National Forest, Chaparral/Brush Fuels Fire Danger pocket card showing past fire events with an ERC above 100.

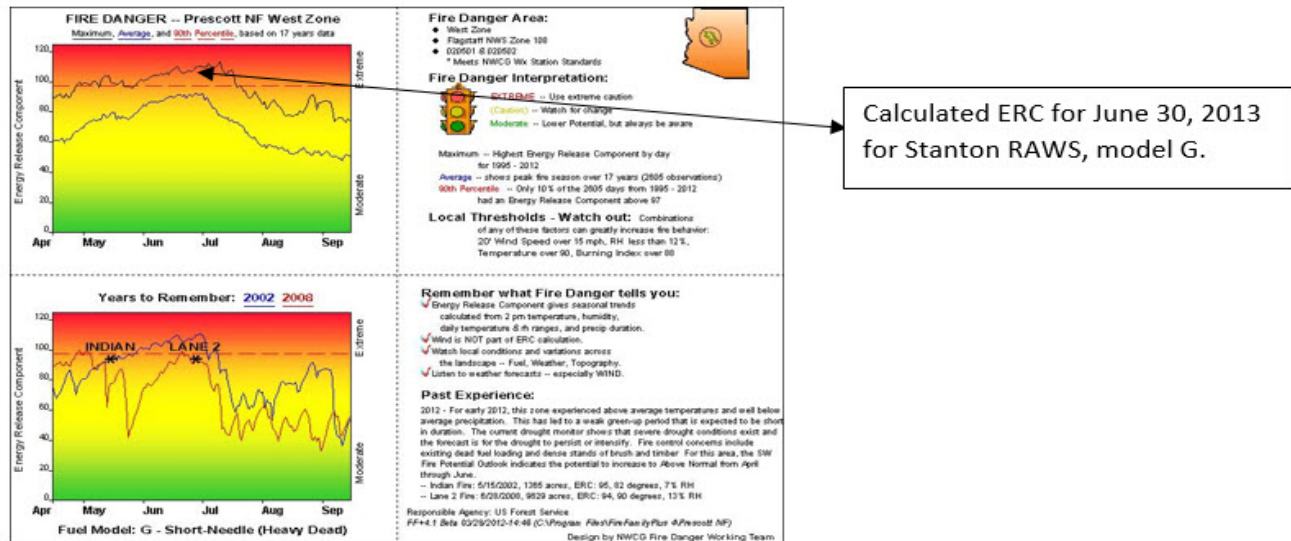


Figure B-11. Prescott NF West Zone, Short Needle Fuels Fire Danger pocket card showing the calculated ERC above 100 for June 30, 2013.



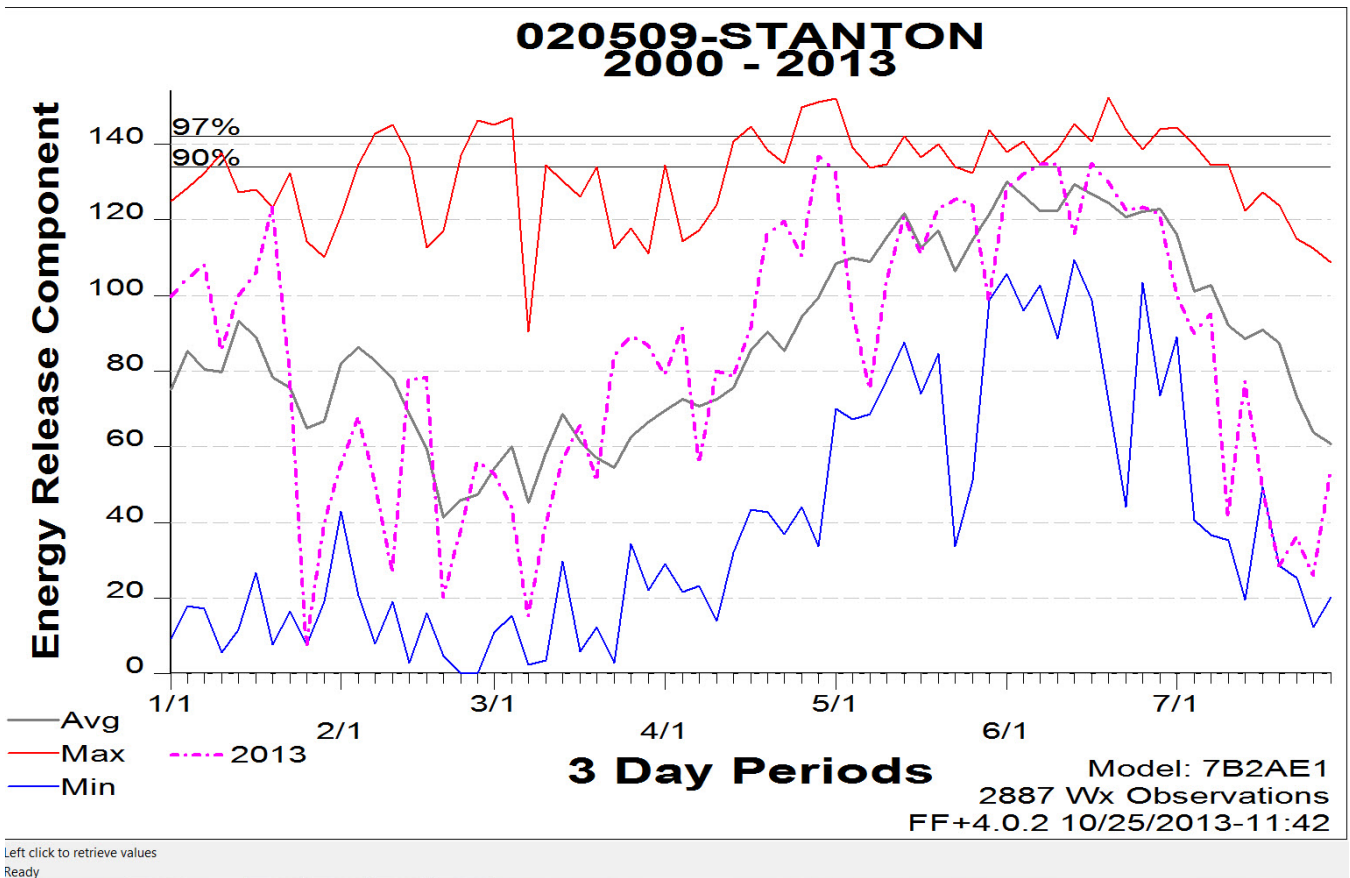


Figure B-12. Fire Family Plus ERC output graph for the Stanton RAWS weather station.

## APPENDIX C – Glossary

**Acceptable Fire Risk** - The potential fire loss a community is willing to accept rather than provide resources to reduce such losses.

**Action Plan** - Any tactical plan developed by any element of ICS in support of the incident action plan.  
Also: Incident Action Plan

**Assigned Resources** - Resources checked in and assigned work tasks on an incident.

**Advancing Fire** - That portion of the fire with rapid fire spread with higher intensity which is normally burning with the wind and/or up slope. Also called: forward fire, or a run. Synonym: **Head Fire**

**Aerial Detection** - A system for, or the act of discovering, locating, and reporting fires from aircraft.

**Aerial Observer** - A person specifically assigned to discover, locate, and report wildland fires from an aircraft and to observe and describe conditions at the fire scene.

**Aerial Reconnaissance** - Use of aircraft for detecting and observing fire behavior, values-at-risk, suppression activity, and other critical factors to facilitate command decisions on strategy and tactics needed for fire suppression.

**After Action Review (AAR)** - A professional discussion of an event, focused on performance standards, that enables Agency Administrators and firefighters to discover for themselves what happened, why it happened, and how to sustain strengths and improve on weaknesses. An After Action Review is a tool incident command personnel and units can use to get maximum benefit from every incident. It provides a daily review of the day's actions: - Identify and discuss effective and non-effective performance. Candid insights into specific firefighter, leader, and unit strengths and weaknesses from various perspectives. - Feedback and insight critical to actions that were not standard operating procedures, or those that presented safety problems. - Lessons learned and how to apply them in the future.

**Agency Administrator** - Managing officer of an agency, division thereof, or jurisdiction having statutory responsibility for incident mitigation and management. Examples: NPS Park Superintendent, BIA Agency Superintendent, USFS Forest Supervisor, BLM District Manager, FWS Refuge Manager, State Forest Officer, Fire Chief, Police Chief. Also: Line Officer

**Agency Certification** - The process whereby the employing agency or contractor documents that the individual is fully qualified to perform duties and responsibilities for a specified position.

**Agency Dispatch** - The agency or jurisdictional facility from which resources are allocated to incidents.

**Agency Dispatcher** - A person working within an agency organization who processes resources to and from incidents. Also: Dispatcher

**Agency Representative (AREP)** - This ICS position serves as the point of contact for an assisting or cooperating agency which has been delegated authority to make decisions on matters affecting that agency's participation at the incident and reports to the Liaison Officer.

**Agency/Area Coordination Center** - A facility which serves as a central point for one or more agencies to use in processing information and resource requests. It may also serve as a dispatch center for one of the agencies.

**Agency** - An agency is a division of government with a specific function, or a non-governmental organization (e.g., private contractor, business, etc.) that offers a particular kind of assistance. In ICS, agencies are defined as jurisdictional (having statutory responsibility for incident mitigation), or assisting and/or cooperating (providing resources and/or assistance).

**Air Attack Base** - Permanent facility at which aircraft are stationed for use in air attack operations.

**Air Attack** - The deployment of fixed-wing or rotary aircraft on a wildland fire, to drop retardant or extinguishing agents, shuttle and deploy crews and supplies, or perform aerial reconnaissance of the overall fire situation.

**Air Tactical Group Supervisor (ATGS)** - This ICS position is responsible for directing and coordinating airborne aircraft operations and management of an incident's airspace and reports to the Air Operations Branch Director.

**Air Tanker** - Fixed-wing aircraft certified by FAA as being capable of transport and delivery of fire retardant solutions.

**All Terrain Vehicle (ATV)** - Any motorized vehicle designed for or capable of cross-country travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other terrain. Synonym: Off-road Vehicle

**Anchor Point** - An advantageous location, usually a barrier to fire spread, from which to start constructing a fireline. The anchor point is used to minimize the chance of being flanked by the fire while the line is being constructed.

**Appropriate Management Response (AMR)** - Any specific action suitable to meet Fire Management Unit (FMU) objectives. Typically, the AMR ranges across a spectrum of tactical options (from monitoring to intensive management actions). The AMR is developed by using Fire Management Unit strategies and objectives identified in the Fire Management Plan.

**Aspect** - Cardinal direction toward which a slope faces.

**Assigned Resources** - Resources checked in and assigned work tasks on an incident.

**Assignments** - Tasks given to resources to perform within a given operational period, based upon tactical objectives in the incident action plan.

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**Assistant** - Term used as a title for subordinates of the command staff positions. In some cases, assistants are also assigned to unit leader positions in the planning, logistics, and finance/administration sections. Qualifications, technical capability, and responsibility of assistants are normally less than those of the person holding the primary position.

**Assisting Agency** - An agency directly contributing tactical or service resources to another agency. Also: Cooperating Agency, Supporting Agency

**Attack a Fire** - Limit the spread of fire by any appropriate means.

**Attack Time** - The starting date, hour, and minute of the first suppression work on a fire.

**Attack Unit Response** - The response of one attack unit to a fire or other emergency with no regard for the number of return trips to that same fire or emergency.

**Average Annual Precipitation** - The expected amount of annual rainfall. Average annual precipitation is an important component to determining the Keech-Bryam Drought Index (KBDI).

**Average Relative Humidity** - Part of the National Fire Danger Rating System (NFDRS). The mathematical average of the maximum and minimum relative humidities measured at a fire weather station from one basic observation time to the next.

**Awareness** - The continual process of collecting, analyzing, and disseminating intelligence, information, and knowledge to allow organizations and individuals to anticipate requirements and to react effectively and safely.

**Backing Fire** - Fire spreading, or ignited to spread, into (against) the wind or downslope. A fire spreading on level ground in the absence of wind is a backing fire. That portion of the fire with slower rates of fire spread and lower intensity normally moving into the wind and/or down slope. Also called: heel fire.

**Barrier** - Any obstruction to the spread of fire. Typically an area or strip devoid of combustible fuel.

**Base Manager (BCMG)** - This ICS position is responsible for ensuring that appropriate sanitation, security, and facilities management services are provided at the Incident Base and reports to the Facilities Unit Leader.

**Base** - The location at which primary logistics functions for an incident are coordinated and administered. There is only one base per incident. (Incident name or other designator will be added to the term "base.") The incident command post may be collocated with the base. The location of initial attack forces. Also: Camp

**Brush Fire** - A fire burning in vegetation that is predominantly shrubs, brush, and scrub growth.

**Brush** - A collective term that refers to stands of vegetation dominated by shrubby, woody plants, or low growing trees, usually of a type undesirable for livestock or timber management.

**Burn** - An area burned over by wildland fire. To consume fuel during rapid combustion. A fire in progress or under investigation.

**Burning Conditions** - The state of the combined factors of the environment that affect fire behavior in a specified fuel type.

**Burning Out** - Setting fire inside a control line to consume fuel located between the edge of the fire and the control line.

**Burning** - Decomposition of material by the application of heat and oxidation.

**Burnover** - An event in which a fire moves through a location or overtakes personnel or equipment where there is no opportunity to utilize escape routes and safety zones, often resulting in personal injury or equipment damage.

**Camp** - A geographical site(s), within the general incident area, separate from the incident base, equipped and staffed to provide sleeping, food, water, and sanitary services to incident personnel.

**Chain of Command** - A series of management positions in order of authority.

**Check-in** - The process whereby resources first report to an incident. Check-in locations include incident command post (ICP), base or camps, staging areas, helibases, or direct to a tactical assignment. Also: Reporting Locations

**Chief** - The ICS title for individuals responsible for command of functional sections: Operations, Planning, Logistics, and Finance/Administration.

**Class of Fire** - As to kind of fire for purpose of using a proper extinguisher: Class A - Fires involving ordinary combustible materials (such as wood, cloth, paper, rubber, and many plastics) requiring the heat absorbing (cooling) effects of water, water solutions, or the coating effects of certain dry chemicals, which retard combustion. Class B - Fires involving flammable or combustible liquids, flammable gases, greases, and similar materials where extinguishment is most readily secured by excluding air (oxygen), inhibiting the release of combustible vapors, or interrupting the combustion chain reaction. Class C - Fires involving live electrical equipment where safety to the operator requires the use of electrically nonconductive extinguishing agents. Class D - Fires involving certain combustible metals (such as magnesium, titanium, zirconium, sodium, potassium, etc.) requiring a heat absorbing extinguishing medium not reactive with burning metals. Also: Size Class of Fire

**Command** - The act of directing, and/or controlling resources by virtue of explicit legal, agency, or delegated authority.

**Communications Unit Leader (COML)** - The ICS position responsible for supervising the Communications Unit. Reports to the Service Branch Director or Logistics Section Chief.

**Communications Unit** - An organizational unit in the Logistics Section responsible for providing and maintaining communication services at an incident. May also be a facility (e.g., a trailer or mobile van) used to provide the major part of an incident communications center.

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**Cooperating Agency** - An agency supplying assistance including but not limited to direct tactical or support functions or resources to the incident control effort (e.g. Red Cross, law enforcement agency, telephone company, etc.).

**Coordination** - The process of systematically analyzing a situation, developing relevant information, and informing appropriate command authority of viable alternatives for selection of the most effective combination of available resources to meet specific objectives. The coordination process (which can be either intra- or interagency) does not involve dispatch actions. However, personnel responsible for coordination may perform command or dispatch functions within limits established by specific agency delegations, procedures, legal authority, etc.

**Crew** - An organized group of firefighters under the leadership of a crew boss or other designated official.

**Dead Fuels** - Fuels with no living tissue in which moisture content is governed almost entirely by absorption or evaporation of atmospheric moisture (relative humidity and precipitation).

**Delegation of Authority** - A statement provided to the incident commander by the agency executive delegating authority and assigning responsibility. The delegation of authority can include objectives, priorities, expectations, constraints and other considerations or guidelines as needed. Many agencies require written delegation of authority to be given to incident commanders prior to their assuming command on larger incidents.

**Detection** - The act or system of discovering and locating fires.

**Direct Attack** - Any treatment applied directly to burning fuel such as wetting, smothering, or chemically quenching the fire or by physically separating the burning from unburned fuel.

**Direct Line** - Any treatment applied directly to burning fuel such as wetting, smothering, or chemically quenching the fire or by physically separating the burning from unburned fuel.

**Discovery Time** - Elapsed time from start of fire (known or estimated) until the time of the first discovery that results directly in fire suppression action.

**Discovery** - Determination that a fire exists. Location and reporting of a fire is not required as is with detection.

**Dispatch Center** - A facility from which resources are assigned to an incident.

**Dispatch** - The implementation of a command decision to move a resource or resources from one place to another.

**Division Supervisor (DIVS)** - The ICS position responsible for supervising equipment and personnel assigned to a division. Reports to a Branch Director or Operations Section Chief.

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**Division** - The ICS organization level between the branch and the task force/strike team. Divisions are used to divide an incident into geographical areas of operation. Divisions are established when the number of resources exceeds the span-of-control of the operations chief.

**Dozer** - Any tracked vehicle with a front mounted blade used for exposing mineral soil.

**Drought Index** - A number representing the net effect of evaporation, transpiration and precipitation in producing cumulative moisture depletion in deep duff or upper soil layers.

**Duty Week** - Regular number of hours worked per week by a full-time firefighter, excluding overtime.

**Energy Release Component (ERC)** - The computed total heat release per unit area (British thermal units per square foot) within the flaming front at the head of a moving fire.

**Entrapment Avoidance** - A process used to improve the safety of personnel on the fireline, which emphasizes tools and tactics available to prevent being trapped in a burnover situation. This process includes appropriate decision making through risk management, application of LCES, use of pre-established trigger points, and recognition of suitable escape routes and safety zones.

**Entrapment** - A situation where personnel are unexpectedly caught in a fire behavior-related, life-threatening position where planned escape routes or safety zones are absent, inadequate, or compromised. An entrapment may or may not include deployment of a fire shelter for its intended purpose. These situations may or may not result in injury. They include "near misses."

**Escape Route** - A preplanned and understood route firefighters take to move to a safety zone or other low-risk area. When escape routes deviate from a defined physical path, they should be clearly marked (flagged).

**Evacuation** - An organized, phased, and supervised withdrawal, dispersal, or removal of civilians from dangerous or potentially dangerous areas, and their reception and care in a safe area.

**Extended Attack** - Suppression activity for a wildfire that has not been contained or controlled by initial attack or contingency forces and for which more firefighting resources are arriving, en route, or being ordered by the initial attack incident commander.

**Extreme Fire Behavior** - "Extreme" implies a level of fire behavior characteristics that ordinarily precludes methods of direct control action. One or more of the following is usually involved: high rate of spread, prolific crowning and/or spotting, presence of fire whirls, strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.

**Fine Fuel Moisture** - The probable moisture content of fast-drying fuels which have a timelag constant of 1 hour or less; such as, grass, leaves, ferns, tree moss, pine needles, and small twigs (0-1/4").

**Fine Fuels** - Fast-drying dead or live fuels, generally characterized by a comparatively high surface area-to-volume ratio, which are less than 1/4-inch in diameter and have a timelag of one hour or less. These fuels (grass, leaves, needles, etc.) ignite readily and are consumed rapidly by fire when dry.

**Fire Agency** - Official group or organization compelled and authorized under statutes or law to control fires within a designated area or upon designated lands.

**Fire Behavior Analyst (FBAN)** - Person responsible to the planning section chief for establishing a weather data collection system and for developing fire behavior predictions based on fire history, fuel, weather, and topography.

**Fire Behavior** - The manner in which a fire reacts to the influences of fuel, weather, and topography.

**Fire Crew** - General term for two or more firefighters organized to work as a unit.

**Fire Danger Rating PocketCard for Firefighter Safety** - A communication aid designed to help firefighters develop an awareness of the local fire situation by providing a visual reference to fire danger rating.

**Fire Death** - Fire casualty which is fatal or becomes fatal within one year of the fire.

**Fire Detection** - Act or system of discovering and locating fires.

**Fire Duty** - Actual physical engagement in firefighting service as distinguished from staff work at headquarters or maintenance division; work at an individual fire done by an individual firefighter or by a company.

**Fire Perimeter** - The entire outer edge or boundary of a fire.

**Fire Qualifications** - Computerized interagency summary of fire suppression qualifications of listed personnel. Available information includes fire training record, fire experience record, and physical fitness testing score for each individual.

**Fire Shelter** - An aluminized tent offering protection by means of reflecting radiant heat and providing a volume of breathable air in a fire entrapment situation. Fire shelters should only be used in life threatening situations, as a last resort.

**Fire Suppression** - All work and activities connected with control and fire-extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

**Fire Weather Forecast** - A weather prediction specially prepared for use in wildland fire operations and prescribed fire.

**Fire Weather Station** - A meteorological station specially equipped to measure weather elements that have an important effect on fire behavior.

**Fire** - Rapid oxidation, usually with the evolution of heat and light; heat fuel, oxygen and interaction of the three.

**Firebreak** - A natural or constructed barrier used to stop or check fires that may occur, or to provide a control line from which to work.

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**Firefighter** - Person whose principal function is fire suppression.

**Fireline Intensity** - The product of the available heat of combustion per unit of ground and the rate of spread of the fire, interpreted as the heat released per unit of time for each unit length of fire edge. The primary unit is Btu per second per foot (Btu/sec/ft) of fire front. The rate of heat release per unit time per unit length of fire front. Numerically, it is the product of the heat yield, the quantity of fuel consumed in the fire front, and the rate of spread.

**Fireline** - The part of a containment or control line that is scraped or dug to mineral soil.

**Flame Height** - The average maximum vertical extension of flames at the leading edge of the fire front. Occasional flashes that rise above the general level of flames are not considered. This distance is less than the flame length if flames are tilted due to wind or slope.

**Flame Length** - The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface), an indicator of fire intensity.

**Flame** - A mass of gas undergoing rapid combustion, generally accompanied by evolution of sensible heat and incandescence.

**Flank Fire** - A firing technique consisting of treating an area with lines of fire set into the wind which burn outward at right angles to the wind.

**Flanking Fire Suppression** - Attacking a fire by working along the flanks either simultaneously or successively from a less active or anchor point and endeavoring to connect two lines at the head.

**Fuel Class** - Part of the National Fire Danger Rating System (NFDRS). Group of fuels possessing common characteristics. Dead fuels are grouped according to 1-, 10-, 100-, and 1000-hour timelag, and living fuels are grouped as herbaceous (annual or perennial) or woody.

**Fuel Model** - Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

**Fuel Moisture Content** - The quantity of moisture in fuel expressed as a percentage of the weight when thoroughly dried at 212°F.

**Fuel Type** - An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause a predictable rate of spread or resistance to control under specified weather conditions.

**Fuel** - Any combustible material, especially petroleum-based products and wildland fuels.

**General Fire Weather Forecast** - A forecast, issued daily during the regular fire season to resource management agencies, that is intended for planning of daily fire management activities, including daily staffing levels, prevention programs, and initial attack on wildfires. Also called presuppression forecast.

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**General Staff** - The group of incident management personnel reporting to the Incident Commander. They may each have a deputy, as needed. The General Staff consists of: Operations Section Chief, Planning Section Chief, Logistics Section Chief, and Finance/Administration Section Chief.

**Geographic Information System Specialist (GISS)** - The incident support position responsible for collecting and maintaining geospatial data and providing geospatial analysis and producing products (maps, etc.) in support of wildland fire incident planning. GISS is utilized in support of incident management, assigned to an ICS organization's Situation Unit.

**Global Positioning System (GPS)** - A system of navigational satellites operated by the U.S. Department of Defense and available for civilian use. The system can track objects anywhere in the world with an accuracy of approximately 40 feet.

**Green-up** - Green-up for the 1978 version of NFDRS model is defined as the beginning of a new cycle of plant growth. Green-up usually occurs once a year, except in desert areas where rainy periods can produce a flush of new growth more than once a year. Green-up may be signaled at different dates for different fuel models. Green-up should not be started when the first flush of green occurs in the area. Instead, the vegetation that will be the fire problem (represented by the NFDRS fuel model associated with the weather station) when it matures and cures should be identified. Green-up should start when the majority of this vegetation starts to grow.

**Hotshot Crew** - A number of individuals that have been organized and trained and are supervised principally for operational assignments on an incident.

**Handline** - Fireline constructed with hand tools.

**Head Fire** - A fire spreading or set to spread with the wind.

**Head of a Fire** - The most rapidly spreading portion of a fire's perimeter, usually to the leeward or up slope.

**Hotshot Crew** - Intensively trained fire crew used primarily in hand line construction (Type-1).

**Humidity** - General term referring to the moisture content of the atmosphere.

**Incident Action Plan (IAP)** - Contains objectives reflecting the overall incident strategy and specific tactical actions and supporting information for the next operational period. The plan may be oral or written. When written, the plan may have a number of attachments, including: incident objectives, organization assignment list, division assignment, incident radio communication plan, medical plan, traffic plan, safety plan, and incident map. Formerly called shift plan.

**Incident Base** - Location at the incident where the primary logistics functions are coordinated and administered. (Incident name or other designator will be added to the term Base.) The incident command post may be collocated with the base. There is only one Base per incident.

**Incident Command Post (ICP)** - Location at which primary command functions are executed. The ICP may be collocated with the incident base or other incident facilities.

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**Incident Command System (ICS)** - A standardized on-scene emergency management concept specifically designed to allow its user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.

**Incident Commander (ICT1, ICT2, ICT3, ICT4, or ICT5)** - This ICS position is responsible for overall management of the incident and reports to the Agency Administrator for the agency having incident jurisdiction. This position may have one or more deputies assigned from the same agency or from an assisting agency(s).

**Incident Management Team** - The incident commander and appropriate general and command staff personnel assigned to an incident.

**Incident Objectives** - Statements of guidance and direction necessary for the selection of appropriate strategy(s), and the tactical direction of resources. Incident objectives are based upon agency administrators direction and constraints. Incident objectives must be achievable and measurable, yet flexible enough to allow for strategic and tactical alternatives.

**Incident Organization** - Resources, together with a complement of overhead personnel, calculated to be sufficient to provide fire efficient incident management.

**Incident Overhead** - All supervisory positions described in the Incident Command System.

**Incident** - An occurrence either human-caused or natural phenomenon, that requires action or support by emergency service personnel to prevent or minimize loss of life or damage to property and/or natural resources.

**Indirect Attack** - A method of suppression in which the control line is located some considerable distance away from the fire's active edge. Generally done in the case of a fast-spreading or high-intensity fire and to utilize natural or constructed firebreaks or fuelbreaks and favorable breaks in the topography. The intervening fuel is usually backfired; but occasionally the main fire is allowed to burn to the line, depending on conditions.

**Initial Action** - The actions taken by the first resources to arrive at a wildfire or wildland fire use incident. Initial actions may be size up, patrolling, monitoring, holding action or aggressive initial attack.

**Initial Attack Crew** - Specially trained and equipped fire crew for initial attack on a fire.

**Initial Attack (IA)** - A planned response to a wildfire given the wildfire's potential fire behavior. The objective of initial attack is to stop the fire and put it out in a manner consistent with firefighter and public safety and values to be protected.

**Inmate Crew** - Any fire crew composed of prison inmates or wards.

**Leader** - The ICS title for an individual responsible for a task force, strike team, or functional unit.

**Lightning Fire** - Wildfire caused directly or indirectly by lightning.

**Live Fuel Moisture Content** - Ratio of the amount of water to the amount of dry plant material in living plants.

**Live Fuels** - Living plants, such as trees, grasses, and shrubs, in which the seasonal moisture content cycle is controlled largely by internal physiological mechanisms, rather than by external weather influences.

**Live Woody Moisture Content** - Ratio of the amount of water to the amount of dry plant material in shrubs.

**Local Agency** - Any agency having jurisdictional responsibility for all or part of an incident.

**Logistics Section Chief (LSC1 or LSC2)** - This ICS position is responsible for supervising the Logistic Section. Reports to the Incident Commander and is a member of the General Staff. This position may have one or more deputies assigned.

**Logistics Section** - The ICS section responsible for providing facilities, services, and supplies in support of an incident.

**Lookout** - A person designated to detect and report fires from a vantage point. A fire crewmember assigned to observe the fire and warn the crew when there is danger of becoming trapped.

**Major Disaster/Catastrophe** - Any natural catastrophe or, regardless of cause, any fire, flood, or explosion, in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance.

**Management Action Points/Trigger Points** - Geographic points on the ground or specific points in time where an escalation or alternative of management actions is warranted. These points are defined and the management actions to be taken are clearly described in an approved Wildland Fire Implementation Plan (WFIP) or Prescribed Fire Plan. Timely implementation of the actions when the fire reaches the action point is generally critical to successful accomplishment of the objectives. Also called **Trigger Points**.

**Mid-Flame Windspeed** - The speed of the wind measured at the midpoint of the flames, considered to be most representative of the speed of the wind that is affecting fire behavior.

**Military Time** - The 24-hour clock system where midnight is 2400, one minute after midnight is 0001 and progresses to 2400 daily.

**Mobile Radio** - A two way radio unit on mobile apparatus (instead of base stations), usually semi-permanently attached to the apparatus.

**Multi-Agency Incident** - An incident where one or more agencies assist a jurisdictional agency or agencies. May be single or unified command.

**Mutual Aid Agreement** - Written agreement between agencies and/or jurisdictions in which they agree to assist one another upon request, by furnishing personnel and equipment.

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**Mutual Aid** - Assistance in firefighting or investigation by fire agencies, without regard for jurisdictional boundaries.

**National Fire Danger Rating System (NFDRS)** - A uniform fire danger rating system that focuses on the environmental factors that control the moisture content of fuels.

**National Wildfire Coordinating Group (NWCG)** - A group formed under the direction of the Secretaries of the Interior and Agriculture to improve the coordination and effectiveness of wildland fire activities and provide a forum to discuss, recommend appropriate action, or resolve issues and problems of substantive nature.

**Natural Barrier** - Any area where lack of flammable material obstructs the spread of wildfires.

**NWCG Standard** - A defined behavior, action, process, or equipment type, agreed upon by the National Wildfire Coordinating Group for wildland fire performance, and is necessary to meet consistent, interagency fire management activities.

**Objective** - A description of a desired condition; quantified and measured, and where possible, with established time frames for achievement. Specific, achievable, measurable, time-limited results to be achieved through land management practices, either through a description of a desired condition or the degree of desired change in an attribute.

**One-hour Timelag Fuel Moisture (1-h TL FM)** - Moisture content of one-hour timelag fuels.

**One-hour Timelag Fuels** - Fuels consisting of dead herbaceous plants and roundwood less than about one-fourth inch (6.4 mm) in diameter. Also included is the uppermost layer of needles or leaves on the forest floor.

**One-hundred Hour Timelag Fuel Moisture (100-h TL FM)** - The moisture content of the 100-hour timelag fuels.

**One-hundred Hour Timelag Fuels** - Dead fuels consisting of roundwood in the size range of 1 to 3 inches (2.5 to 7.6 cm) in diameter and very roughly the layer of litter extending from approximately three-fourths of an inch (1.9 cm) to 4 inches (10 cm) below the surface.

**One-thousand Hour Timelag Fuel Moisture (1,000-h TL FM)** - The moisture content of the 1,000-hour timelag fuels.

**One-thousand Hour Timelag Fuels** - Dead fuels consisting of roundwood 3-8 inches in diameter and the layer of the forest floor more than about 4 inches below the surface.

**Operational Control** - The exercise of authority over initiating, conducting, or terminating any operation. Often associated with aviation operations.

**Operational Period** - The period of time scheduled for execution of a given set of tactical actions as specified in the Incident Action Plan. Operational Periods can be of various lengths, although usually not over 24 hours.

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**Operations Section Chief (OSC1 or OSC2)** - This ICS position is responsible for supervising the Operations Section. Reports to the Incident Commander and is a member of the General Staff. This position may have one or more deputies assigned.

**Operations Section** - The section responsible for all tactical operations at the incident. Includes branches, divisions and/or groups, task forces, strike teams, single resources and staging areas

**Overhead** - Personnel assigned to supervisory positions, including incident commander, command staff, general staff, branch directors, supervisors, unit leaders, managers and staff.

**Plan of Attack** - The selected course of action and organization of personnel and equipment in fire suppression, as applied to a particular fire or to all fires of a specific type.

**Planning Meeting** - A meeting held regularly throughout the duration of an incident, to select specific strategies and tactics for incident control operations and to plan for needed service and support. On larger incidents, the planning meeting is a major element in the development of the Incident Action Plan.

**Planning Section Chief (PSC1 or PSC2)** - This ICS position is responsible for supervising the Planning Section. Reports to the Incident Commander and is a member of the General Staff. This position may have one or more deputies assigned.

**Planning Section** - Responsible for the collection, evaluation, and dissemination of tactical information related to the incident, and for the preparation and documentation of incident action plans. The section also maintains information on the current and forecasted situation, and on the status of resources assigned to the incident. Includes the situation, resource, documentation, and demobilization units, as well as technical specialists.

**Point of Origin** - The location where a competent ignition source came into contact with the material first ignited and sustained combustion occurred.

**Protection Area** - That area for which a particular fire protection organization has the primary responsibility for attacking an uncontrolled fire and for directing the suppression action. Such responsibility may develop through law, contract, or personal interest of the firefighting agent (e.g., a lumber operator). Several agencies or entities may have some basic responsibilities (e.g., private owner) without being known as the fire organization having direct protection responsibility.

**Qualifications and Certification** - This subsystem of NIIMS provides recommended qualification and certification for those personnel responding to an incident regionally or nationally, allowing for the development of local minimum standards to meet local needs. Standards typically include training, experience, and physical fitness.

**Rate of Spread** - The relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area, depending on the intended use of the information. Usually it is expressed in chains or acres per hour for a specific period in the fire's history.

**Relative Humidity (RH)** - The ratio of the amount of moisture in the air, to the maximum amount of moisture that air would contain if it were saturated. The ratio of the actual vapor pressure to the saturated vapor pressure.

**Required Experience** - Documented, satisfactory performance in a specified position needed to qualify for another (usually higher level) position. Required experience cannot be challenged.

**Required Training** - A course or courses that must be completed prior to initiating a position task book. Training which has been identified as required cannot be challenged; an agency equivalent course may be used as a substitute when the course meets or exceeds a required course's learning and performance objectives.

**Resource Order** - The form used by dispatchers, service personnel, and logistics coordinators to document the request, ordering or release of resources, and the tracking of those resources on an incident.

**Resource Ordering and Status System (ROSS)** - A national system that provides automated support to interagency and agency dispatch and coordination offices. The system will provide current status of resources available to support all-risk activities; enable dispatch offices to exchange and track resource ordering information electronically; enable dispatch offices to rapidly and reliably exchange mission-critical emergency electronic messages.

**Response** - Movement of an individual firefighting resource from its assigned standby location to another location or to an incident in reaction to dispatch orders or to a reported alarm. Activities that address the short-term, direct effect of an incident, including immediate actions to save lives, protect property, and meet basic human needs. Also includes the execution of emergency operations plans as well as mitigation activities designed to limit the loss of life, personal injury, property damage, and other unfavorable outcomes.

**Responsible Fire Agency** - Agency with primary responsibility for fire suppression on any particular land area.

**Retardant Base** - Ground facilities for mixing, storing, and loading fire retardant into air tankers.

**Retardant Drop** - Fire retardant cascaded from an air tanker or helitanker.

**Retardant** - A substance or chemical agent which reduces the flammability of combustibles.

**Risk** - The chance of fire starting as determined by the presence and activity of causative agents. A chance of suffering harm or loss.

**Saddle** - Depression or pass in a ridgeline.

**Safety Briefing** - A safety briefing emphasizes key safety concerns on the incident and is presented at each briefing session. The safety briefing should contain information to alert incident personnel of potential risk/hazard considered to be most critical.

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**Safety Officer** - A member of the command staff responsible to the incident commander for monitoring and assessing hazardous and unsafe situations, and developing measures for assessing personnel safety.

**Serious Accident Investigation Team (SAIT)** - A formal investigation team that is organized with the purpose of conducting an accident investigation for an occurred serious accident. The team is given full authorization to conduct the investigation from involved agencies through letter of delegation.

**Shrub** - A woody perennial plant differing from a perennial herb by its persistent and woody stem; and from a tree by its low stature and habit of branching from the base.

**Single Resource** - An individual, a piece of equipment and its personnel complement, or a crew or team of individuals with an identified work supervisor that can be used on an incident.

**Situation Analysis** - Analysis of factors which influence suppression of an escaped fire from which a plan of attack will be developed; includes development of alternative strategies of fire suppression and net effect of each.

**Sizeup** - The evaluation of the fire to determine a course of action for suppression.

**Smoke** - Small particles of carbon, tarry and water vapor resulting from the incomplete combustion of carbonaceous materials such as wood, coal or oil.

**State Forest** - Forests owned and administered by a state, and not by a federal government.

**Structural Fire Protection** - The protection of homes or other structures from wildland fire.

**Strategy** - The general plan or direction selected to accomplish incident objectives.

**Structure Protection Plan** - A plan developed by the Structure Protection Specialist that provides operational guidelines to suppression resources responsible for providing wildland fire structure protection.

**Structure Protection Specialist (STPS)** - An individual responsible for developing an incident's structure protection plan, providing tactical direction and recommendations to incident planning and operations on efficient and safe utilization of resources assigned to provide wildland fire structure protection.

**Structure** - A constructed object, usually a free-standing building above ground.

**Supervisor** - The ICS title for individuals responsible for command of a division or group.

**Supply Unit Leader (SPUL)** - The ICS position responsible for supervising the Supply Unit. Reports to the Support Branch Director or Logistics Section Chief.

**Suppression** - All the work of extinguishing or confining a fire beginning with its discovery.

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**Survival Zone** - A natural or cleared area of sufficient size and location to protect fire personnel from known hazards while inside a fire shelter. Examples include rock slides, road beds, clearings, knobs, wide ridges, benches, dozer lines, wet areas, cleared areas in light fuels, and previously burned areas. These are all areas where you expect no flame contact or prolonged heat and smoke.

**Tactics** - Deploying and directing resources on an incident to accomplish the objectives designated by strategy.

**Ten-hour Timelag Fuel Moisture (10-h TL FM)** - The moisture content of the 10-hour timelag roundwood fuels.

**Thunderstorm** - Localized storm characterized by one or more electrical discharge(s).

**Timelag (TL)** - Time needed under specified conditions for a fuel particle to lose about 63 percent of the difference between its initial moisture content and its equilibrium moisture content. If conditions remain unchanged, a fuel will reach 95 percent of its equilibrium moisture content after 4 timelag periods.

**Transfer of Command** - The ICS management process in which the on-scene incident commander at a specified time hands off command responsibilities to the incident commander that will be taking over incident command.

**Two-Way Radio** – Radio equipment with transmitters in mobile units on the same frequency as the base station, permitting conversation in two directions using the same frequency in turn.

**Type** - Refers to resource capability. A Type 1 resource provides a greater overall capability due to power, size, capacity, etc., than would be found in a Type 2 resource. Resource typing provides managers with additional information in selecting the best resource for the task.

**Uncontrolled Fire** - Any fire which threatens to destroy life, property, or natural resources, and (a) is not burning within the confines of firebreaks, or (b) is burning with such intensity that it could not be readily extinguished with ordinary tools commonly available.

**Values To Be Protected** - Include property, structures, physical improvements, natural and culture resources, community infrastructure, and economic, environmental, and social values.

**Wildfire Suppression** - An appropriate management response to wildfire, escaped wildland fire use or prescribed fire that results in curtailment of fire spread and eliminates all identified threats from the particular fire.

**Wildfire** - An unplanned, unwanted wildland fire including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.

**Wildland Fire Serious Accident** - Any accident where one or more fatalities occur and/or three or more personnel are inpatient hospitalized as a direct result, or in support of wildland fire suppression or

prescribed fire operations. Accident may result in substantial property or equipment damage of \$250,000 or more.

**Wildland Fire Situation Analysis (WFSA)** - A decision-making process that evaluates alternative wildfire suppression strategies against selected environmental, social, political, and economic criteria, and provides a record of those decisions.

**Wildland Fire** - Any non-structure fire that occurs in the wildland. Three distinct types of wildland fire have been defined and include wildfire, wildland fire use, and prescribed fire.

**Wildland Urban Interface (WUI)** - The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

**Wind Direction** - Compass direction from which wind is blowing.

**Wind Shift** - For ground observation purposes, a change of at least 45° in the direction of a significant wind, which occurs in a relatively short time frame.

**Wind Speed** - Wind, in miles per hour, measured at 20 feet above open, level ground or as adjusted to meet this standard to compensate for height of ground cover, uneven ground, and nearby obstructions.

**Wind** - The horizontal movement of air relative to the surface of the earth.

**Wind-driven Wildland Fire** - A wildland fire that is controlled by a strong consistent wind.

**Woody Fuel Moisture** - In NFDRS, a calculated value representing the approximate moisture content of the live woody vegetation in the rating area expressed as a percentage of the oven dry weight of the sample.

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