Green Rock Fire Accident Investigation

Summary of Investigation Findings

1. Accident Sequence

At 14:43 hours on June 27, 2008, a fire was reported in the Buffalo Cove area of Caldwell County. Two units from Caldwell County North Carolina Division of Forest Resources (NCDFR) and the Yadkin Valley Fire Department responded. The fire was located in a saddle near Carr Mountain. Resources requested for the fire by NCDFR included:

- A scout plane
- Helicopter with helitack crew.
- Two 5 man young offenders inmate crews (BRIDGE crews) with Rugged Terrain Vehicle (RTV)
- Two additional NCDFR personnel

The Caldwell County NCDFR ranger assumed command of the fire as Incident Commander (IC) and assigned the Assistant County Ranger as Operations Section Chief (OSC). The NCDFR scout plane assisted these units in locating ground access to the fire site. Suppression action consisted of constructing a containment line to hold fire in check until the next morning (6/28/08). The fire department units were released at approximately 17:35 hours. All resources cleared the Green Rock Fire by 22:15 hours June 27, 2008.

A resource request was made for two (2) BRIDGE crews and a RTV with operator to report to staging at the Green Rock Fire at 09:30 on June 28, 2008. NCDFR pre-arranged firefighters were also contacted and advised to report to the NCDFR District 2 Headquarters in Lenoir at 08:30.

The IC met the pre-arranged crews at D2 Headquarters at approximately 08:30 on June 28th. The crews geared up for the day and traveled to the Green Rock staging area. The IC provided the crew with a briefing and they departed for the fire at approximately 09:50. The BRIDGE Crews and RTV arrived at staging at approximately 10:00. The IC briefed the 3 BRIDGE Crew Bosses (CRWB) and crewmen. The BRIDGE Crews geared up for the day and departed for the fire at approximately 10:30.

The crews hiked in and began improving control lines, followed by burn out and mop up operations. The IC was dispatched to a fire in Gamewell, NC at 12:15 and transferred command of the fire to the OSC.

Burnout and mop up operations continued without incident until the time of the lightning strike (16:37, 6/28/08).
Just prior to the lightning strike, most of the crew members took a break. Most personnel were in small groups gathered on the north end of the fire, 4 Bridge crewmembers were on the fireline on the NW side of the fire, and a NCDFR

employee was walking the line on the south side of the fire. According to BLM Lightning Data, a negative polarity strike occurred at 16:37 hours on June 28, 2008. Based on evidence from the scene, it appears a dead snag just off of the fireline was struck and lightning ran along a path in the ground passing directly under or adjacent to several groups of firefighters.

As depicted on the attached Personnel Location Map(s), the closest to the strike was BRIDGE CRWB1 who was standing next to a RTV and indications are, the lightning passed near or directly under him. The path of the lightning traveled south toward another group of firefighters to include: five crewmen and the IC/OSC. Four additional BRIDGE crew members on the fireline on the NW perimeter were struck. Two BRIDGE CRWBs were sitting in the Kubota RTV and were not injured. Nine additional firefighters were not injured by the lightning strike.

BRIDGE CRWB#1 lost feeling in his right side and collapsed on the ground. The IC/OSC was knocked down and received burns to both feet and pain in both legs and knees. Firefighter (FFT) #1 was thrown backwards and could not feel his legs for some time. He had burns on both hips and left leg. FFT#2 was thrown back and could not move for 2 – 3 minutes. FFT#3 experienced tingling in his legs and ringing ears. FFT#4 and FFT#5 suffered no effects from the strike. FFT#6 lost consciousness and when he regained consciousness; his whole body was numb except his right arm. FFT#7 felt pain on his right side and suffered memory loss. FFT#8 suffered hearing loss. FFT#9 was thrown back and suffered burns to his skin.

2. Post Accident Response

The post accident response was immediate according to witness statements. The process to assist the injured and establish accountability for all personnel began within the first minute. Although injured, the IC/OSC attempted to notify District 2 Operations Center of the incident. He was unable to make radio contact and activated a response from Caldwell County EMS and Yadkin Valley first responders.

According to witness statements, an informal triage process began immediately follow the lightning strike. The most seriously injured personnel were identified and loaded on the Kubota RTV first. These included FFT#1, CRWB#1, FFT#6, and FFT#7. These personnel were transported via the logging trail south of the fire to meet the D2 NCDFR District Ranger. They were then transferred to the District Ranger's SUV and transported a mile down a logging trail and then to a Caldwell EMS unit located at the landing zone (see Green Rock Fire map).

The RTV returned to the fire and picked up the IC, FFT#8, and FFT#9. The above process was repeated to get these personnel to Caldwell County EMS units at the landing zone.

The remaining members gathered what they could and hiked down the mountain to where their vehicles were parked. FFT#1's injuries were reported and he was directed to be evaluated by EMS and was transported.

All of the injured personnel were transported to Caldwell Memorial Hospital for treatment.

All personnel cleared the accident scene by approximately 19:05. The accident scene was left unsecured until approximately 10:30 on 6/29/08. A preliminary field investigation began at that time to locate pertinent information related to the accident.

3. **Preliminary Investigation**

A log composed of photos, video tape, and a rough sketch(s) was compiled on 6/29/08. The field session on 6/29/08 was discontinued due to thunderstorm activity in the immediate area. On 7/02/08 the state accident investigation team returned to the site. This team consisted of Greg Yates, Gerald Honeycutt, Travis Ruff, Marshall Humphries and Jeff Burns. Hunter Birckhead and representatives from the North Carolina Department of Corrections and NCOSHA were also present.

a. Damage

The only damage reported was to a Kenwood TK-280 portable radio. The radio was working prior to the strike. The radio was in a chest harness worn by BRIDGE CRWB#2. No other equipment was damaged. There were reports of some articles of clothing being burned.

b. Human Factors

1. Qualifications and Training

The IC/OSC is qualified up to Division Supervisor Trainee. He has performed Type IV IC on many occasions. All CRWBs were qualified to perform in their positions. Fifteen of the crew members were fully qualified and two were trainees.

2. Duties

The individuals involved in the incident had been assigned to the incident and were functioning in their assigned roles on 6-28-08.

The IC/OSC was in compliance with 2:1 work/rest ratio. His last day off was 6-08-08. This was an extended period of work, but no violation of Division Policy. There was no indication this had any contribution to the accident.

BRIDGE CRWB#1 had exceeded his 2:1 work/rest ratio guidelines. Plans were to mitigate this by providing him the appropriate time off at the end of shift on 6-28-08. There was no indication this had any contribution to the accident.

The remaining BRIDGE CRWBs and crewmen were in compliance with 2:1 work/rest ratio guidelines. All pre-arranged firefighters were in compliance with the 2:1 work/rest ratio guidelines.

No human contributing factor has been identified in the accident

3. Management

The fire was operating at a Type IV ICS level. The CRWBs were under direct supervision of the IC/OSC on scene. The firefighters were all assigned CRWB that they reported to. There were no break downs in the chain of command before or after the incident. Immediately after the accident, BRIDGE CRWB#1's uninjured Bridge crew members were assigned to BRIDGE CRWB#3 for supervision. No contributing factors in regard to management were noted.

4. **Review of Standard Fire Orders and 18 Situations That Shout Watch Out:**

All NC DFR personnel are expected to comply with the Standard Fire Orders and conduct fireline operations in a way that mitigates the risks identified in the 18 Situations That Shout Watch Out. This review indicated that these were met. It has been determined that none of these contributed to the accident. This was an act of God, however there are mitigation steps that need to be in all safety briefings.

Fire Orders:

1. **Keep informed on fire weather conditions and forecasts.**
   - Personnel had discussed the day's morning weather forecast, in addition they heard the radar weather updates from D-2.
   - Of all interviews, only one person claimed to have seen lightning immediately prior to incident. This individual did not share this information with anyone else on the fire.
2. **Know what your fire is doing at all times.**
   - This was generally complied with. The IC had requested a helicopter for difficulty with burn out operation.
3. **Base all actions on current and expected behavior of the fire.**
   - Actions were based on the current behavior of the fire. It is a very remote area with difficult access.
4. **Identify escape routes and safety zones, and make them known.**
   - This was complied with. There were known escape routes on the North and South end of the fire. The IC and crews were carrying a black line, burning out the

unburned fuel between the fire and the fireline, so that there was an escape route/safety zone present as the fireline construction progressed.

5. **Post lookouts when there is possible danger.**
   - This was a summer time fire visibility is minimum due to green vegetation. The lookout situation was mitigated by the use of D-2 District Ops monitoring the local weather radar. D-2 District Ops officer relayed all current weather information. CRWB#1 was monitoring NWS radio for updates. Crewmembers were briefed to be aware of storm potential
6. **Be alert. Keep calm. Think clearly. Act Decisively.**
   - This was met very effectively. Listening to all injured personnel at the critical incident debriefing, they stated that the evacuation plan and implementation was excellent.
7. **Maintain prompt communications with your forces, your supervisor and adjoining forces.**
   - This was met.
8. **Give clear instructions and ensure they are understood.**
   - There was a tailgate briefing held at the staging area. For future mitigation include thunderstorm safety briefing. With clear instruction specifically on 30/30 rule which is found on page 75 of the Incident response pocket guide and minimizing of exposure when caught in storm.
9. **Maintain control of your forces at all times.**
   - This was met. In the event that this had not been met, the results could have increased time to treatment or been fatal.
10. **Fight fire aggressively, having provided for safety first.**
    - This was met. The accident occurred on the incident while fire fighters were rehydrating and waiting for aircraft.

Watch Out Situations

1. **Fire was scouted and sized up.**
   - The fire was contained and sized up the previous night. During the time of the accident the fire was contained but not controlled. The IC made a request for a helicopter for burnout support.
2. **In country not seen in daylight.**
   - This was not applicable.
3. **Safety zones and escape routes not identified.**
   - Escape route/safety zone was known. There was adequate black to secure all fire fighters present.
4. **Unfamiliar with weather and local factors influencing fire behavior.**
   - The firefighters were updated throughout the operational period on all weather updates.
5. **Uninformed on strategy, tactics and hazards.**
   - Briefing was conducted, however according to witness statements some fire fighters were inattentive.
6. **Instructions and assignments not clear.**

- Instructions and assignment were given and understood.

7. **No communication link with crew members/supervisor.**
   - Confirmed a total of 8 handheld radios including the IC.
8. **Constructing fireline without safe anchor point.**
   - Fireline was safely anchored at the origin.
9. **Building fireline with fire below.**
   - This was not applicable.
10. **Attempting frontal assault on fire.**
    - This was not applicable.
11. **Unburned fuel between you and the fire.**
    - This is not applicable.
12. **Cannot see the main fire, not in contact with anyone who can.**
    - Personnel actively patrolling fire at all times.
13. **On a hillside where rolling material can ignite a fire below.**
    - Cup trench on all down hill portions of the fire.
14. **Weather is getting hotter and drier.**
    - D-2 Ops continued to give local weather updates. IC took on site weather periodically throughout the day.
15. **Wind increases or changes direction.**
    - Some of the firefighters that were interviewed stated that the wind began to gust just prior to lightning strike. The people interviewed stated the wind was not enough to react to or initiate any further action.
16. **Getting frequent spot fires across line.**
    - This was not applicable.
17. **Terrain and fuels make escape to safety zones difficult.**
    - Very remote area and steep terrain. 1.86 miles from the fire to the staging area.
18. **Taking a nap near the fireline.**
    - Three crewmen admitted to taking a nap on the fireline while taking a break earlier in the day. This did not contribute to the accident.

In reviewing NCDFR Policy and Procedure 4180 (fire line safety) it has been determined that there was no breach in P&P, the Ten Standard Fire Orders, or the 18 Situations that Shout Watch Out that contributed to the accident.

<u>Communications (8 Radios)</u>

The incident command channel was working on District 2 high band network (Hibriten and Deep Gap repeaters). The incident TAC frequency was D2 TAC 1. There was no reference to communication problems on the incident before, during or after the incident with the 2 exceptions:

- the initial report of the strike on D2 high band The IC transmitted while on the ground and his transmission was broken and scratchy.
- The communications link was lost, due to terrain, with the RTV for 15-20 minutes during the evacuation.

As noted earlier, one radio was destroyed during the incident. None of these factors contributed to the accident or hindered the emergency response.

Risk Management

Supporting documentation indicated two tailgate briefings were conducted at the staging area. The briefing included hazards in and around the fireline to include extended hike in, fluid, snakes, rock cliffs, weather, and thunderstorms. Additional statements indicate not all firefighters were attentive to the briefing. ****A major opportunity for improvement exists here.**** This does not seem to be a contributing factor in this accident.

Analysis – A lack of knowledge of blue lightning.

Equipment Factors
No equipment factors contributed to this accident

Environmental Factors

Weather forecasts have been reviewed for the day. Indications are thunderstorm forecast was broadcast and briefed to line crews. BLM Lightning Data captured strike that occurred. There is some evidence a small rain cloud passed south of the accident site prior to the lightning strike.

Physical Environmental

The accident occurred on Carr Mountain in the Buffalo Cove area of Caldwell County. The accident site was a narrow ridge top saddle between two higher peaks. The elevation was approximately 2200 feet. The fire was burning in duff and leaf litter at the time of the strike. Containment lines had been established using hand lines and the fire was contained, but not controlled. Access to the site from a staging area was approximately 2.5 miles up a trail. A second access for the RTV was discovered on the morning of 6-28-08 and provided a second access route of 3-3 ½ miles. A contributing factor for the accident would be working on a high ridge during thunderstorm activity. Indications are that efforts to mitigate this were in place. Written statements indicate storm patterns and locations were being monitored closely and no visible lightning was observed by or reported to the IC. The 30/30 applies when lightning is observed and there is one indication lightning was observed by a BRIDGE crew member. This member although informed of the danger did not report the strike to anyone else on the fire. No one else one the fire reported seeing any lightning. It is possible this could be a contributing factor to the accident. Information that is not shared with the rest of the group is useless in beginning mitigation measures. The witness could not provide details of distance, direction, or time from flash to sound.

5. Factors that Contributed to the Lightning Strike Accident

There has only been one possible factor that may have contributed to the accident. The one member that stated he saw lightning failed to initiate any further action. The crewmember had been briefed on lighting safety. It is not clear if the group would have had to take action or if they would have had time to react. The crewmember's information does not provide enough information to form any definitive conclusion.

Recommendations to Prevent Recurrence

Information that was addressed during the course of this accident investigation that could help prevent future accidents like this one are as follows:

1. Situation awareness, always be aware of the ever changing environmental factors. Failure to share critical information may have been a contributing factor in this incident. All information in regard to situational awareness should travel freely up and down the chain of command.

2. Ensure complete attention from all personnel when providing safety briefing. Use of an ICS 201 would be help in the documentation process.

3. Refer to incident response pocket guide , thunderstorm safety (page 75). Page 19 of the NWCG Fireline handbook for Thunderstorm Safety.

4. When thunderstorms are forecast, special precautions should be implemented when working around dead snags, regardless of height, working in green vegetation (minimum visibility), working under standing timber and working on ridge tops.

5. It is the recommendation of the investigating team, that in the event the predicted fire weather forecast (regardless of the season) predicts thunderstorm activity; the 30/30 rule and sheltering in place needs to be included in all fire line briefings. In addition all District Operations officers when transmitting morning fire weather or 1300 fire danger readings the lighting activity level (LAL) should be included in the fire weather forecast when LAL level reaches 2 or above.

6. This accident was considered a blue sky lighting strike. For more information on lighting " A Bolt Out Of The Blue WWW.SPECTRUMTHUNDERBOLT.COM

7. NCDFR should review notification process for serious injuries. There may be a need to streamline the notification process for serious injuries. The current system has many steps involving many people that could provide potential delays in the notification process to other agencies like NC Dept of Labor**.**

It is worth mentioning that the RTV was brought in through a rugged steep logging trail and was a critical resource in the evacuation process. The unit performed well and minimized the time to evacuate the injured. Incorporating this type of vehicle into the Division fleet where practical would be beneficial. The remote back country in the mountains will continue to provide these types of situations for us to deal with.

Documentation before, during, and after the incident was critical in reconstructing the incident and verifying facts surrounding the incident. Continued use of available documents and pocket guides should be continued.

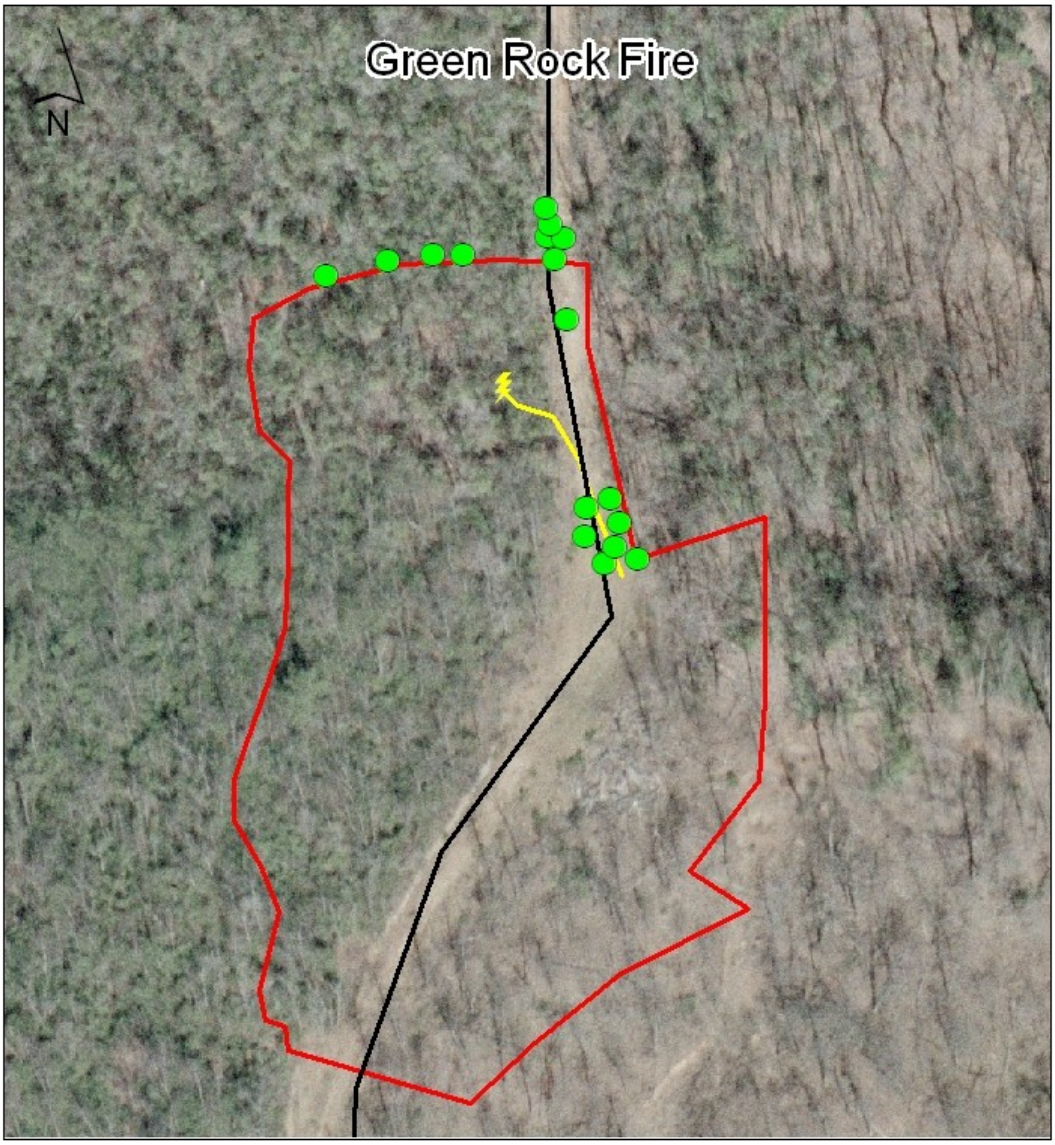
0 355 710 1,420 2,130 2,840
Feet

Green Rock Fire
Location: 36º02.31 / 81º33.19
Created on: 7/7/08
Created by: Burns & Query

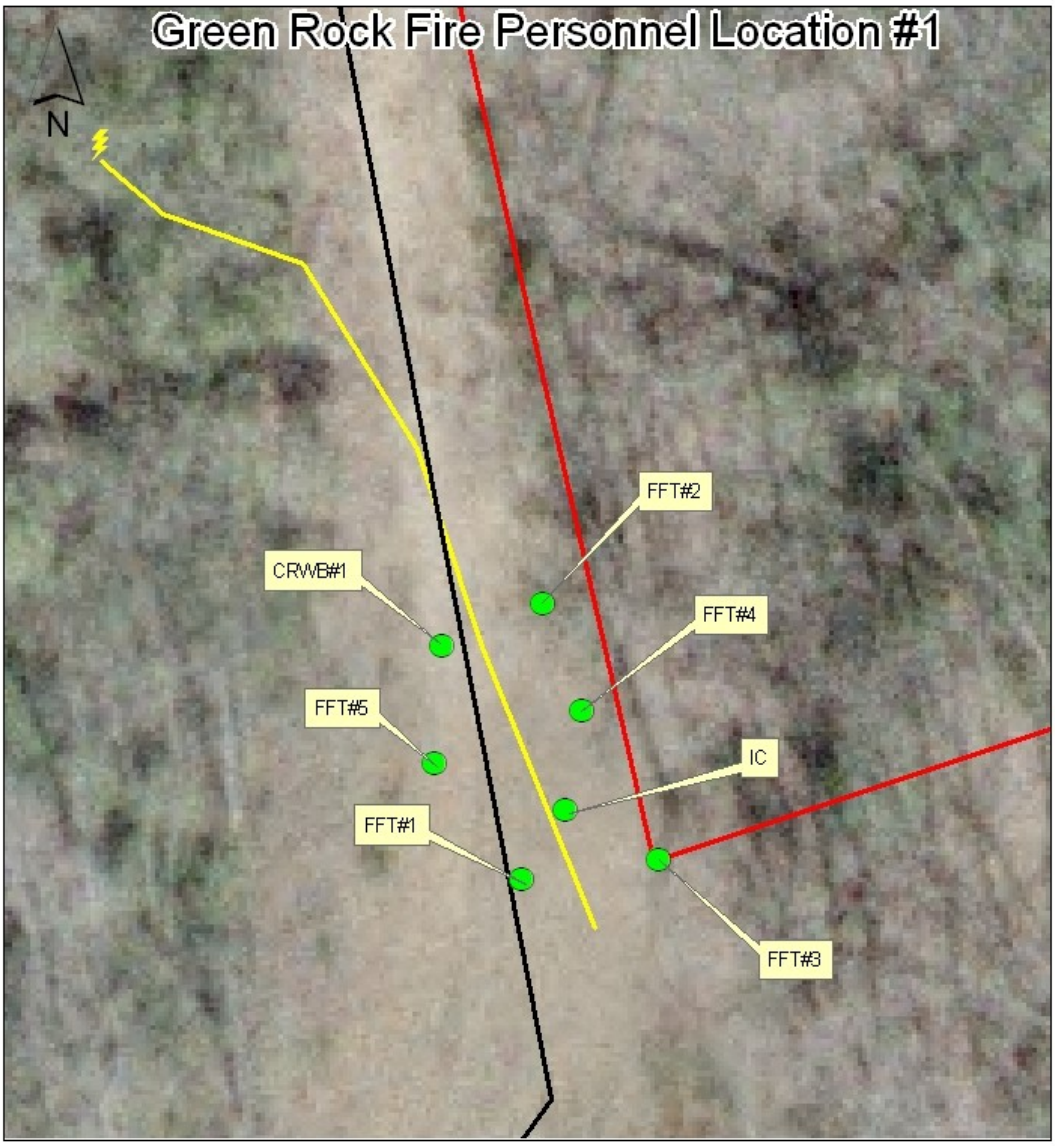
Legend

Access_trail

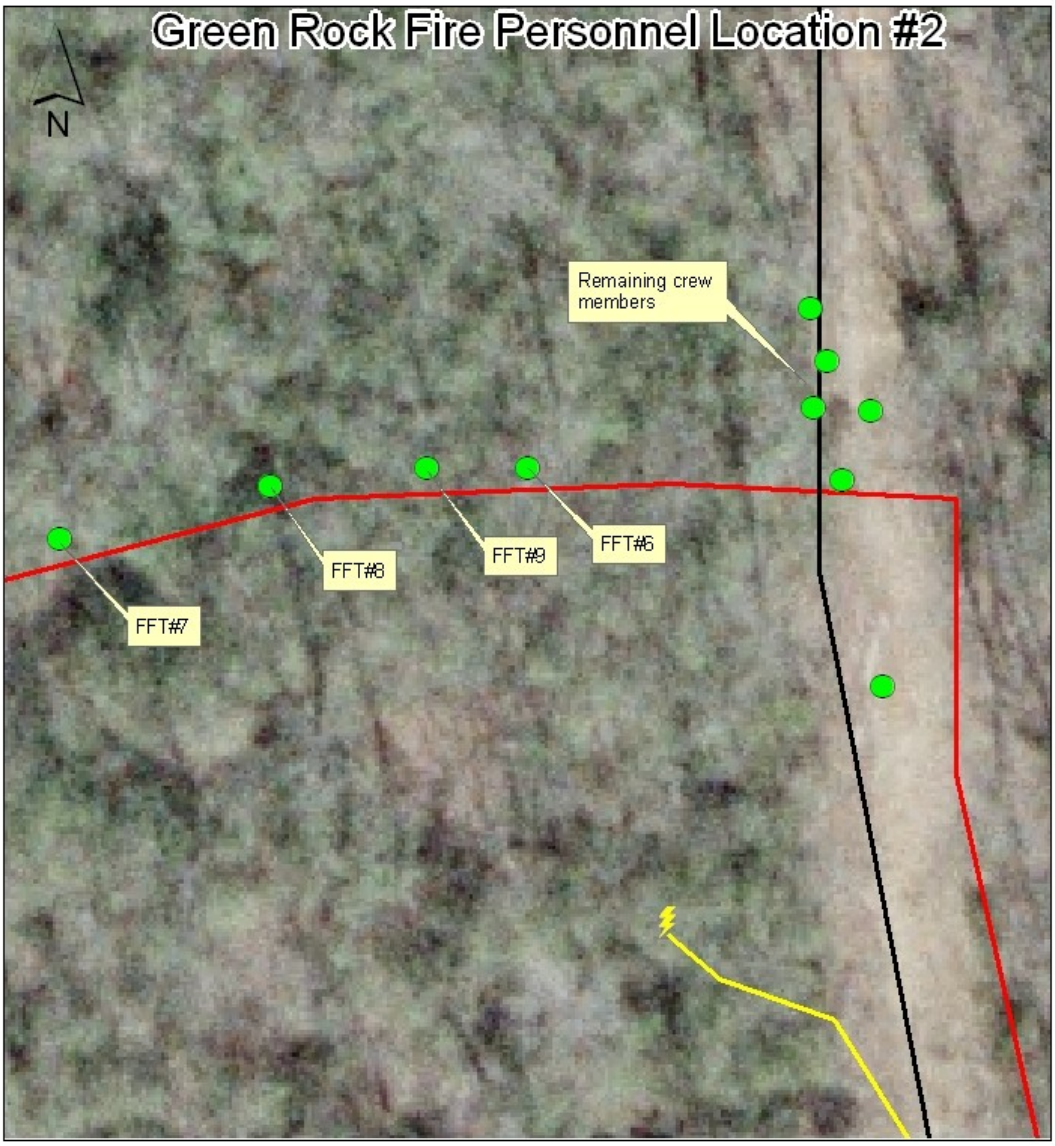
Fire_perimeter



Green Rock Fire
Location: 36º02.31 / 81º33.19
Created on: 7/7/08
Created by: Burns & Query



Green Rock Fire
Location: 36º02.31 / 81º33.19
Created on: 7/7/08
Created by: Burns & Query


Green Rock Fire Personnel Location #2
N
Remaining crew members
FFT#8
FFT#9
FFT#6
FFT#7
0 10 20 40 60 80
Feet
Green Rock Fire
Location: 36º02.31 / 81º33.19
Created on: 7/7/08
Created by: Burns & Query
Legend
Strike_tree
People_location
Access_trail
Lightning_path
Fire_perimeter