FIRE COMMAND 2E

Approved by the Statewide Training and Education Advisory Committee

Adopted by the State Board of Fire Services

STUDENT SUPPLEMENT

October 2004

California Department of Forestry and Fire Protection

State Fire Training

FIRE COMMAND 2E

WILDLAND FIRE-FIGHTING TACTICS

STUDENT SUPPLEMENT

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State Fire Training

Mission Statement

The mission of State Fire Training is to enable the California fire service to safely protect life and property through education, training, and certification.

California Fire Service Training and Education System

The California Fire Service Training and Education System (CFSTES) was established to provide a single statewide focus for fire service training in California. CFSTES is a composite of all the elements that contribute to the development, delivery, and administration of training for the California Fire Service. The authority for the central coordination of this effort is vested in the Training Division of the California State Fire Marshal's Office with oversight provided by the State Board of Fire Services.

The role of CFSTES is one of facilitating, coordinating, and assisting in the development and implementation of standards and certification for the California fire service. CFSTES manages the California Fire Academy System by providing standardized curriculum and tests; accredited courses leading to certification; approved standardized training programs for local and regional delivery; administering the certification system; and publishing Career Development Guides, Instructors Guides, Student Manuals, Student Supplements, and other related support materials.

This system is as successful and effective as the people involved in it are. It is a fire service system developed by the fire service, for the fire service, and we believe it is the best one in the country.

Acknowledgments

The State Fire Training Curriculum Development Division coordinated the development of the material contained in this guide. Before its publication, the Statewide Training and Education Advisory Committee (STEAC) and the State Board of Fire Services (SBFS) approved this guide. This guide is appropriate for fire service personnel and for personnel in related occupations that are pursuing State Fire Training certification.

Dale Geldert Director of CDF	**Ruben Grijalva** State Fire Marshal
David B. Ebert CDF Training and Education Chief	**Art Cota** Chief of State Fire Training

Special acknowledgement and thanks are extended to the following members of CDF/State Fire Training Curriculum Development Division for their diligent efforts and contributions that made the final publication of this document possible.

Alicia Hamilton
Fire Service Training Specialist

The material contained in this document was compiled and organized through the cooperative effort of numerous professionals within, and associated with, the California fire service. We gratefully acknowledge these individuals who served as principal developers for this document.

Steve Brown
Chico Fire Department

Bill Clayton
CDF/San Diego

John Hawkins
CDF/Riverside

James McFadden
CDF/Retired

"We gratefully acknowledge the hard work and accomplishments of those before us who built the solid foundation on which this program continues to grow."

Course Outline

Course Objectives: To provide the student with…

a) Information about the command responsibilities pertinent to emergency operations involving wildland fires.

b) Information on the principles and methods for planned suppression of wildland fires.

c) Information on the tactics and strategies common to wildland fires.

d) Information on the resources specifically designed for wildland fire control.

e) Information on the specific applications of the Incident Command System used in wildland fires and emergencies.

f) The tools and techniques relative to reading maps and assessing topography that can be utilized in their own agency to improve pre-emergency planning and resource deployment.

g) The opportunity to gain experience in a controlled environment through simulations.

h) Information to manage a wildland fire incident.

Course Content **40:00**

1. The Wildland Fire Problem and Protection Responsibilities 2:00
2. Firefighter Safety and Survival 4:00
3. Strategy and Tactics for Wildland Operations 5:00
4. Command Responsibilities – ICS 201 ..... 1:00
5. Pre-emergency Planning 1:00
6. Wildland Fire Behavior 6:00
7. Wildland Incident Command Systems 2:00
8. Unified Command – Report on Conditions 1:00
9. Map Reading and Usage 1:00
10. Problems #1-#5 ..... 8:00
11. Simulations 4:00
12. Quizzes 3:00

Review and Certification Exam **2:00**

Texts and References

- ICS 420-1 Field Operations Guide, FIRESCOPE, 2004 Edition
- Incident Response Pocket Guide, NWCG (NFES 1077), 2004 Edition
- Introduction to Wildland Fire Behavior S-190 Student Workbook with Unit/Final Tests (Appendix B), NWCG (NFES 1860), 1994 Edition
- Wildland Firefighting for Structural Firefighters, IFSTA, 2003 Edition

Calendar of Events

DAY	TOPIC	TITLE	TIME	ACTIVITY	EVALUATION
Day 1		Fire Problem and Protection Responsibilities	2:00		
			1:00	Problem #1	
		Fire Fighter Safety and Survival	1:00		
		Wildland Strategy and Tactics	3:00		
		Command Responsibility – ICS 201	1:00		
		Day 1 Total	**8:00**		
Day 2			1:00		**Quiz 1**
			1:00	Problem #2	
			2:00	Problem #3	
		Fire Fighter Safety and Survival	1:00		
			2:00	Problem #4	
		Fire Fighter Safety and Survival	1:00		
		Day 2 Total	**8:00**		
Day 3			1:00		**Quiz 2**
		Pre-emergency Planning	1:00		
		I-Zone Strategy and Tactics	2:00		
			2:00	Problem #5	
		Wildland Fire Behavior – NFDRS	2:00		
		Day 3 Total	**8:00**		
Day 4			1:00		**Quiz 3**
		Wildland Incident Command Systems	2:00		
		Unified Command – Report on Conditions	1:00		
		Simulations	4:00		
		Day 4 Total	**8:00**		
Day 5		Map Reading and Usage	1:00		
		Fire Fighter Safety and Survival	1:00		
		Wildland Fire Behavior – S190	4:00		
			2:00	Review and Certification Exam	
		Day 5 Total	**8:00**		
		Course Total	**40:00**		

Introductions

Name: _____

Department: _____

Rank/Position: _____

Totals Years in the Fire Service: _____

Present Assignment: _____

Please list previous job assignments: (e.g., Training Officer, Alarm Center, Company Officer, etc.)

_____

_____

_____

_____

Please list previous wildland assignments: (e.g., Strike Team Leader, Division Supervisor, etc.)

_____

_____

_____

_____

_____

Content

- ❒ Introduction
  - Purpose and objectives
  - Requirements for successful completion
  - Homework and reading assignments
  - Belt weather kit
  - ICS-201
- ❒ Statutory Responsibilities for Wildland Fire Protection, Mutual Aid, and California's Wildland Fire Protection Problem
- ❒ Resource Capabilities
  - Dozers
  - Engines, hose lays
  - Hand crews
  - Aircraft
- ❒ Structure Protection in the I-Zone
- ❒ Fire Behavior
  - Topography
  - Weather
  - Fuel
  - Fire danger rating system
  - Rate of spread guidelines
- ❒ Map Reading
  - Topographic map familiarization
  - Slope calculation
  - Acreage estimation
- ❒ Simulations
  - Plan
  - Organize - ICS
  - Direct

- Control

❒ Safety
- 10 standard orders
- 18 Situations that Shout "Watch Out"
- Common denominators of fatal and near miss fires
- Fire fighter survival
- LCES
- Downhill fire-fighting guidelines

❒ Student Evaluations
- Homework
- Periodic tests
- Certification exam

❒ Course Evaluations

Course Purpose and Objectives

By the end of this class, we will expect you to demonstrate your ability to apply basic management principles to the unique requirements of wildland fire command. Strategy, tactics, resource capability, and knowledge of wildland fire behavior will be interwoven with the concepts of planning, organizing, directing, and controlling. Additional emphasis will be placed on clear, concise communication, and effective organizational structure, and the many aspects of wildland fire safety.

Throughout the course, you will have the opportunity to constantly interact with the instructors and each other. Shared experiences and mutual problem solving will allow you to participate in the learning process.

Our purpose is for you to leave this week of instruction feeling confident in your ability as Chief Officers to effectively command wildland fire incidents. We want you to meld your years of experience and fire service training together with what you have learned here. This combination will give you the broadest base possible for a successful career. The specific objectives you will be required to meet are:

The STUDENT will be able to define and list four basic elements of management, plus:

- Define a plan and list the key elements of a planning process.
- Define four key principles of an organization.
- List the key elements of a good directive.
- List three methods of controlling and why they are necessary.

The STUDENT will be able to interpret topographic maps, including:

- Identification of map symbols.
- Estimation of slope and distance.

The STUDENT will be able to:

- Describe the California Mutual Aid System and the Forestry Assistance Agreement as used for wildland fires.
- Describe the statutory responsibility for wildland fire protection of their own agency, CDF, and federal fire agencies.
- Identify direct and indirect attack and the advantages and disadvantages of each.
- Describe tactics of flanking, envelopment, tandem, and hot spotting.
- List safety considerations when working near dozers.
- List the average fireline production capability of a fire service dozer.
- List factors that limit dozer capabilities.
- List two types of wildland hose lays and two rules-of-thumb describing their deployment.

- List the minimum retardant capacity of ICS Type 1, 2, and 3 air tankers.
- Describe safety procedures to be taken in an aircraft drop zone.
- Describe uses of helicopters on wildland fire.
- Describe air and ground safety procedures relating to the use of helicopters.
- Describe basic structure protection considerations.
- List critical engine company safety practices used when protecting structures on a wildland fire.
- List the three key components of fire behavior and their specific effects on wildland fire.
- List and define three key components of the National Fire Danger Rating System.
- Demonstrate the basic ability to predict wildland fire behavior and spread.
- Demonstrate the ability to organize an incident using proper ICS terminology and organization.
- Demonstrate the ability to make a systematic size-up and orally deliver a concise report on conditions.
- List the four common denominators of fatal and near miss fires.
- Explain the components and the significance of LCES.

Your ability to meet these objectives will be evaluated by your homework, the use of short quizzes, and a final written examination. An overall score of at least 80% must be achieved to successfully complete the course. A score of at least 70% must be achieved on the certifying examination to receive a State Fire Training course completion certificate.

California's Wildland Fire Problem and Statutory Responsibilities of Various Agencies

Major Factors Contributing to the State's Increasing Wildland Fire Problem

- ❒ Rapidly increasing population in wildland interface areas.
- ❒ New homes and rural residential developments extremely vulnerable to fire.
- ❒ New residents are causing more fire starts in rural areas.
- ❒ Inadequate land use, planning, and fire-safe measures.
- ❒ Highly flammable wildland fuel is accumulating faster than fire and other methods are removing it.
- ❒ Wildland fires are burning with greater intensity and are more difficult to control.
- ❒ Wildland fires are immediately threatening human life and property.
- ❒ State and local government financial resources to combat fires are not increasing in proportion to the fire problem.
- ❒ Damages to downstream areas from fire caused floods, mudslides, and sedimentation are increasing.

Federal Responsibility Area (47% of Land in California)

- ❒ U.S. Forest Service (Department of Agriculture) - All wildland fires on National Forests in California.
- ❒ National Park Service (Department of Interior) - All wildland fires in National Parks System lands in California.
- ❒ Bureau of Land Management (Department of Interior) - All wildland fires on public domain lands in California.
- ❒ Bureau of Reclamation, Bureau of Indian Affairs, Fish and Wildlife Service, and other Department of Interior agencies (most protection contracted to other agencies)
- ❒ Military (Department of Defense) - All wildland fires on all federal military bases in California, including the U.S. Army Corp of Engineers.

State Responsibility Area (33% of Land in California)

California Department of Forestry and Fire Protection (CDF Fire) - All wildland fires on timber, brush, and grass covered watershed land specifically designated as State Responsibility Area (SRA) by the Board of Forestry. Nearly all of this is private land. The State of California owns less than 2% of the land in California.

Local Responsibility Area (20% of Land in California)

Cities, counties, fire protection districts, or other special districts - All wildland fires on lands ***not*** designated as the responsibility of the state or owned by the federal government. Primarily incorporated cities, irrigated agricultural lands, desert, or densely populated unincorporated areas. Under federal and state law, virtually all government agencies are authorized and encouraged to contract with each other for fire protection services when this makes economic or operational sense.

State Fire and Rescue Mutual Aid Plan

Each county has an Area Fire and Rescue Coordinator elected by the Fire Chiefs in the county. This person coordinates mutual aid within the county, requests outside aid, and may provide aid to other areas or regions. Los Angeles County has multiple mutual aid areas.

Counties are grouped into Fire and Rescue Regions. The Region Fire and Rescue Coordinator is elected by the Area Coordinators. If an operational area has insufficient fire resources, they request additional from the Region coordinator. The Chief of the OES Fire and Rescue Branch serves as the State Fire and Rescue Coordinator. If a Region has insufficient resources, it requests additional from the State Coordinator. The State Coordinator gets the resources from one or more of the other regions. Some costs for these resources may be covered by the "5-Party Agreement" when requested by one of the state or federal wildland agencies.

Problem #1

TITLE:	Plan
TIME FRAME:	1:00
MATERIALS NEEDED:	• Pen or pencil
INTRODUCTION:	This activity provides you the opportunity to assess a wildland situation for key errors.
DIRECTIONS:	1. Read the scenario below. 2. Answer the questions at the end. 3. You have 15 minutes to complete this activity. 4. Be prepared to discuss your answers with the class.

At 1145 hours, Battalion Chief Doe is dispatched to a grass fire reported by a fire lookout as starting along a state highway. The lookout states that the fire appears to be headed into a brushy canyon that has scattered homes in it.

The weather is:

Temperature:	97°
Relative Humidity:	21%
Wind:	North, 5-8 mph

Dispatch advised Chief Doe that the responding first alarm is: one Chief Officer (Doe), five engines, one Type 2 dozer (D6-C), two Type 3 (S-2) air tankers, one Air Tactical Group Supervisor, and two hand crews.

At 1205, the first engine arrives and gives the following report on conditions:

> The fire is 10-12 acres; rate of spread is rapid and just beginning to hit medium brush. Air tankers have just dropped on the head of the fire and have slowed it down. With a little luck, we can stop the fire with three or four more engines, but it will be touch and go.

The area involved has a history of severe fires. Chief Doe (who is still responding) hears the report on conditions and advises dispatch to "keep the first alarm coming, have the air tankers reload and return, but hold up on dispatching further resources until I get there."

At 1220, 15 minutes later, Chief Doe arrives at scene. The fire has burned through the airdrops and a second fire head is forming. At 1223, one hand crew, two engines, and the dozer arrive, call Doe on the

radio, and ask him where he wants them to start work. Doe begins to feel that the whole situation is going to pot rapidly.

Doe tells the dozer and the two engines to attack the fire head, and the hand crew to stand by until he determines where they can be used.

At 1235, the dispatcher advised Doe that several residents in the brushy canyon are reporting spot fires near their homes. Doe advises that everything has gone to pot. Doe advises dispatch, "You better pull the pin and send everything you have."

QUESTIONS

1. List Chief Doe's major problems.

2. What could Chief Doe have done better?

3. How would you have planned this fire situation?

Plans

Plans are the means by which objectives are ultimately achieved. Planning, as the term is generally understood, is carried out daily by almost every human being. In our personal life, we think of certain things we must do for today, for this week, for this month. We do not randomly make decisions for our next actions after we have just completed our current activity. In general, human beings seek goals and objectives within some conceived time limits, not by random motions, but usually by thinking in advance of acting. We plan our personal activities and affairs most often in an informal way without usually documenting the plan.

In wildland fire control, planning is more complex and, while often as informal as personal planning, it is important to realize that you -- the Incident Commander -- must plan. Too often, a fire organization merely grows. I am sure you have all been involved in situations in which the Incident Commander lets things happen and then reacts to them instead of formulating a plan to cover happenings before they occur.

To get back to definitions, a PLAN is an ordered sequence of events over a specified period of time to accomplish a specific objective.

To apply this definition to the extended attack fire situation, the objective is clear - and extended attack fire is one in which the first dispatched fire equipment must be substantially augmented. In addition, the fire must be contained and/or controlled within the time parameters described by your department. In wildland terminology, the term "contained" indicates that the forward rate of spread has been halted as opposed to controlled, which means the fire has no further chance of escape. The foregoing includes both the objective and the time portions of the definition, leaving only the ordered sequence of events for you to arrange. Here you apply your thought process along with your knowledge and experience to the facts as you can gather them and come up with a course of action.

Planning Process

The planning process contains three separate subsections:

1. An information gathering system.
2. An information evaluation and prediction system.
3. An information re-evaluation system.

In the extended attack situation, your information gathering system may consist of dispatch, air attack, helicopters, air tankers, operational personnel, lookouts, field observers, and your personal observations.

The information evaluation and prediction system is you -- the Incident Commander. The re-evaluation system is a never-ending process with a good manager, and is often as important and sometimes more important to be able to change a plan when new facts and information become available than to be able

to formulate an original plan. This does not mean not making a decision while awaiting new information. It means making intelligent use of new facts that may alter the original strategy.

Ideally, plans, especially fire control operational plans, should be based on facts alone. Actually, however, experience sometimes alters facts. What one sees and hears are influenced by their experience or lack of it, their attitudes, their prejudices and their values, and therefore does not always emerge as facts. As we know, two people usually view the same set of "facts" differently.

To get back to extended attack fire planning, we must think of a plan of action as a necessary first step before anything else can be accomplished. Base the plan as much as possible on facts. Do not allow beliefs, attitudes and prejudices to alter facts to the point false premises are used as a basis for your plan. Experience, intelligence, and thoughts are all necessary to accomplish the planning process which, to reiterate, contains the following:

Components of a Plan

- ❒ Objective
- ❒ Time Schedule
- ❒ Ordered sequence of events

Wildland Fire Strategy and Tactics

Three Basic Types of Wildland Fires

- ❒ Surface fire
  - A fire which burns away the low area fuels and ground litter
- ❒ Crown fire
  - A fire that burns through the treetops (can occur in brush)
- ❒ Subsurface fire
  - This type of fire burns below ground level. It burns partially decomposed organic materials such as decomposed leaves, muck, and peat

Definitions

- ❒ Fire edge
  - Actual fire flaming front
- ❒ Fireline
  - Direct or indirect control line such as with progressive hose lay, dozer line, hand line or natural and/or person-made barrier
- ❒ On a direct attack, fire edge and fireline are the same
- ❒ On an indirect attack, fireline is removed some distance from fire edge
- ❒ It is important not to commingle the terms
  - May lead to confusion and a significant safety risk

Direct Attack

- ❒ Conditions when used
  - Small fires
  - Light fuels
  - Subsurface fires (duff, peat)
  - Flanks and rear of larger fires
  - Where burning intensity, heat, smoke and terrain will allow
- ❒ Standards of line construction
  - To a depth of mineral soil (soil not containing combustible or organic material)

- Width of fireline will vary depending on
  - Slope and aspect
    - Direction that the slope faces, (i.e., N, S, E, W)
  - Fuels
  - Topography
  - Weather conditions
  - Parts of fire (head, flank, rear, etc.)
  - Size and intensity of fire
  - Equipment and personnel available
- Throw all unburned material to the outside of the fire perimeter and burned materials well into the fire perimeter
- Lines are constructed directly on the edge of the fire

❒ Pros

- Limits chance for fire to gain momentum or size
- Eliminates the uncertain elements in backfiring
- Reduces danger of fire crowning
- If necessary, crew can escape into burned area
- Takes advantage of burned out areas along the control line

❒ Cons

- Personnel work in heat and smoke
- More mop-up and closer patrol required
- More danger of slop over and spot fires
- Control line generally follows fire edge; is longer and irregular
- Does not take advantage of existing fire barriers (natural or fabricated)

❒ Do

- Take advantage of wind lulls
- Time attack to coincide with fire entering lighter fuels, if possible
- Conserve water (back pumps) by using to cool flames so hand tool personnel can get in close
- Scatter heavy fuels inside the burn
- Fell snags adjacent to the control line

- ❒ Do not
  - ■ Attack head on fast moving-hot fires
  - ■ Waste water
  - ■ Risk safety of personnel and equipment

Indirect Attack

- ❒ Conditions when used
  - ■ Where the burning intensity, rate of spread and working conditions (heat, smoke, terrain) are too extreme
  - ■ Good natural fire barrier available
  - ■ Fast spreading and/or hot fires
  - ■ To straighten fire fines (across pockets)
- ❒ Standards of line construction
  - ■ To a depth of mineral soil (soil not containing combustible organic material)
  - ■ Width of fireline will vary with
    - Slope and aspect
    - Fuels
    - Topography
    - Weather Conditions
    - Parts of fire (head, flanks, rear, etc.)
    - Size and intensity of fire
    - Equipment and personnel available
    - Width - rules of thumb
      - ◆ Fast moving fires in light fuels
        - ⮝ Head - at least twice as wide as brush height
        - ⮝ Flank as wide as brush is high
      - ◆ Creeping - light fuels
        - ⮝ Head - 3 to 4 feet
        - ⮝ Flank - 6 to 8 inches to mineral soil

- ❒ Pros
  - ■ Personnel are not working in the heat and smoke
  - ■ Takes advantage of changes in fuel types
  - ■ Eliminates irregularity of control lines
  - ■ Less danger of slop-over
  - ■ Permits taking advantage of
    - ● Tops of ridges
    - ● Benches
    - ● Bottom of slopes
    - ● Natural barriers
      - ◆ Roads
      - ◆ Trails
      - ◆ Streams
      - ◆ Old burns
    - ● Permits precision teamwork
- ❒ Cons
  - ■ Sacrifices acreage
  - ■ Crew may be flanked by fire
  - ■ Backfire may go out of control
  - ■ Fuel between fire and fire fighters
  - ■ Fire may change direction suddenly
  - ■ Personnel must be held in readiness if fire is intended to burn out by itself
- ❒ Do
  - ■ Establish lines in lighter fuels if possible
  - ■ Make lines as straight as possible
  - ■ Try to keep downed logs and dead snags on the outside of your lines
  - ■ Make use of natural barriers
  - ■ Clean line down to mineral soil
  - ■ Maintain patrol of established lines
  - ■ Set backfires when needed
  - ■ Establish periodic rest period for crew

- ❒ Do not
  - Overwork crews
  - Set unwatched backfires
  - Construct control line adjacent to tall fuels
  - Take unnecessary chances with personnel and equipment

Fire Control Actions

- ❒ Envelopment
  - Attacking the fire from multiple anchor points around the fire
- ❒ Flanking
  - Pincer
    - Attacking the fire along the flanks from secure anchor points at the origin with the intent of cutting off the head
  - Tandem
    - Pairing suppression resources (engines, dozers, crews, aircraft) to speed their effectiveness
- ❒ Hot spotting
  - Slowing the fast moving portions of the fire edge
- ❒ Parallel
  - Constructing line parallel to the fire edge in easiest fuel and backfiring as you go
- ❒ Backfiring
  - An offensive suppression action of starting a fire that is intended to be drawn into the main fire thus creating a burned out area between the fireline and the main fire
- ❒ Burning out
  - A defensive action of burning out unburned areas within the fireline with no intent of being influenced by the main fire

Individual Activity

TITLE:	Contemporary Issues
TIME FRAME:	Homework
MATERIALS NEEDED:	• Paper • Pen or pencil
INTRODUCTION:	This activity provides you the opportunity to have contemporary issues discussed by the instructors and other class members.
DIRECTIONS:	1. Describe two problems that you or your department frequently encounter on wildland fire incidents, either within your jurisdiction or when assisting others. 2. Due: Morning of Day 4. 3. Be prepared to discuss your response with the class.

1.

2.

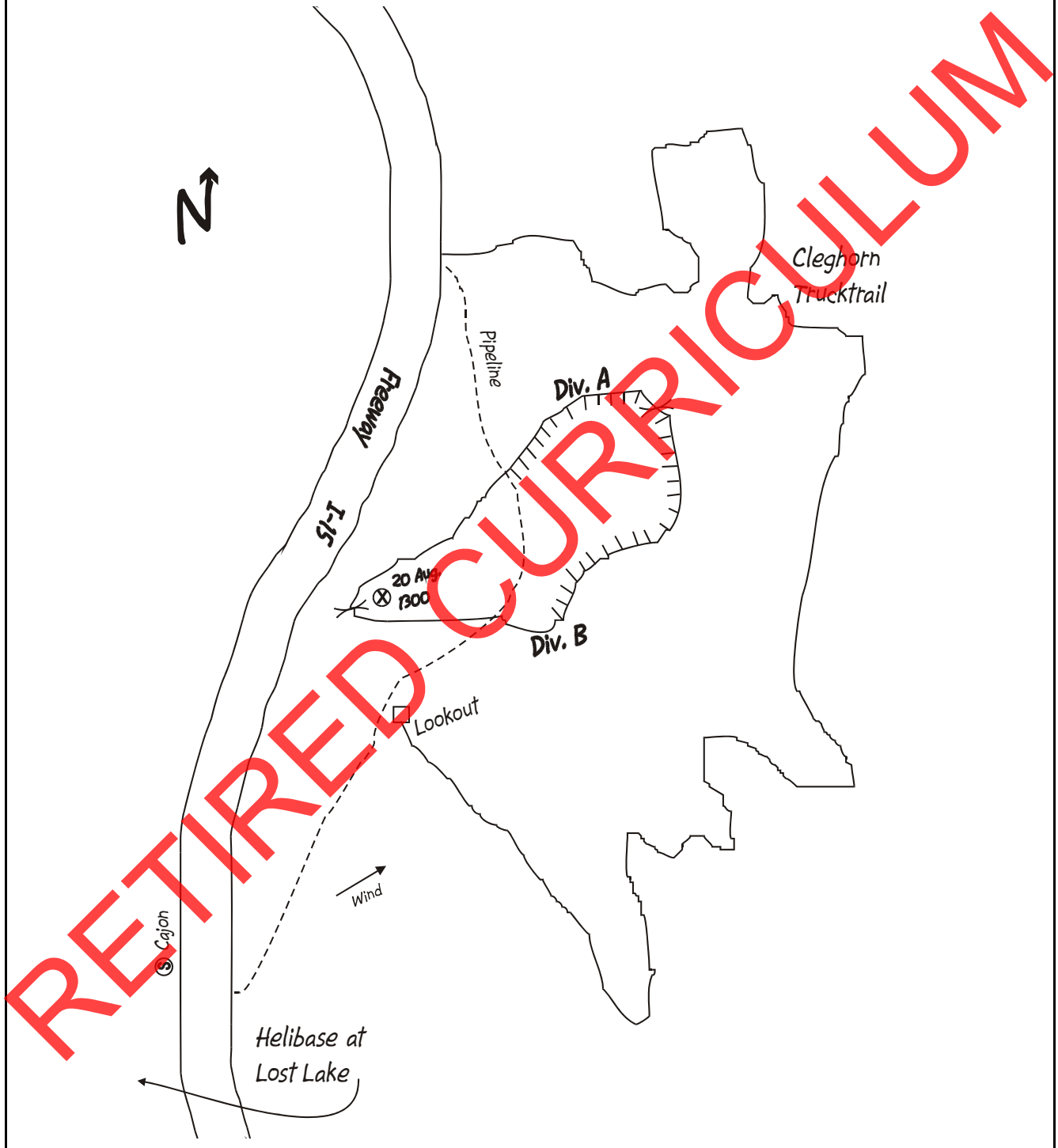
Completing the Incident Briefing (ICS FORM 201)

ITEM	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned the incident.
2.	Date Prepared	Enter the date prepared (month, day, year).
3.	Time Prepared	Enter the time prepared (24-hour clock).
4.	Map Sketch	Show perimeter and control lines, resources, assignments, incident facilities, and other special information on a sketch map or attached to a topographic or orthophoto map.
5.	Resource Summary	Enter the following information about the resources allocated to the incident.
	Resources Ordered	Enter the number and type of resources ordered.
	Resource Identification	Enter the agency's three-letter designator, S/T, kind/type, and resource designator.
	ETA/On-scene	Enter the estimated arrival time and place the arrival time or a checkmark in the "on-scene" column upon arrival.
	Location/Assignment	Enter the assigned location of the resource and/or the actual assignment.
6.	Current Organization	Enter on the organization chart the names of the individuals assigned to each position. Modify the chart as necessary.
7.	Summary of Current Action	Enter the strategy and tactics used on the incident and note any specific problem areas.
8.	Prepared By	Enter the name and position of the person completing the form.

NOTE: Additional pages may be added to Form 201 if needed.

INCIDENT BRIEFING	1. INCIDENT NAME	2. DATE PREPARED	3. TIME PREPARED
	Cleghorn	Today	Now

4. MAP SKETCH



ICS 201 5-94	PAGE 1	8. PREPARED BY (Name and Position)
		Incident Commander

7. SUMMARY OF CURRENT OBJECTIVES AND ACTIONS

CURRENT OBJECTIVES:

1300 Initial attack: 2 Acres Running North - Pincer Attack

1415 Request extended attack resources

Objective: Contain fire south of Cleghorn Truck Trail

1630 Terrain above pipeline too steep for dozers

Div. A: Direct attack holding on left flank from origin to pipeline

BDU 6314C en route to Cleghorn T.T. for indirect attack; fire and hold.

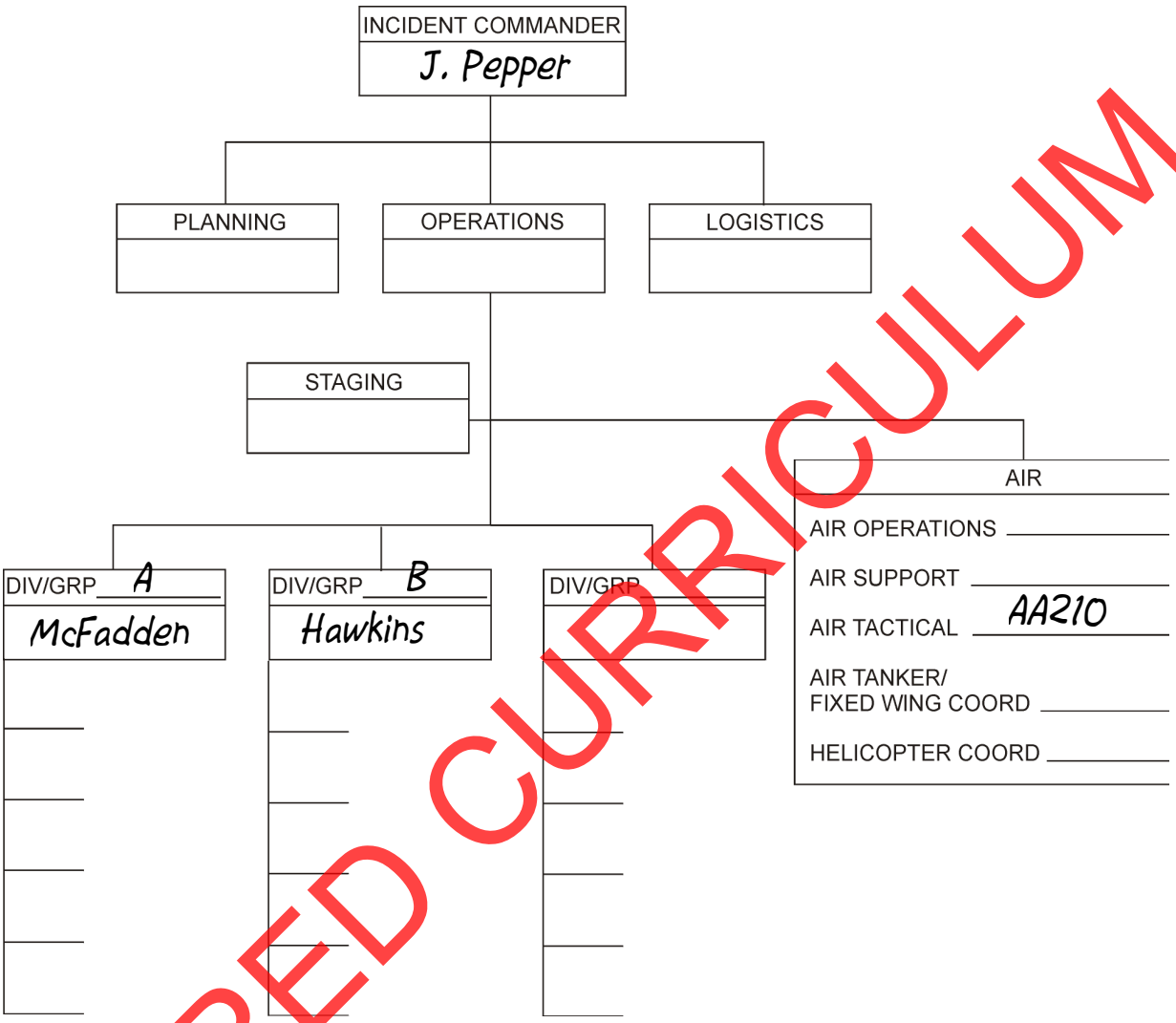
Div. B: Direct attack holding from origin to just above pipeline.

WTH @ 1330: T:90, R.H.: 28

W: SW @ 20, F.M.: 4.0

CURRENT ACTIONS:

6. CURRENT ORGANIZATION



7. RESOURCES SUMMARY				
RESOURCES ORDERED	RESOURCE IDENTIFICATION	ETA	ON SCENE ✔	LOCATION/ASSIGNMENT
Ext. Att.	6314-C	1730		
	E-6301			
	"-6302			
	"-6303			
	"-6304			
	"-6305			
	6315-C	1800		
	E-6306			
	"-6307			
	"-6308			
	"-6309			
	"-6310			
52 G S/T	6344 G	1800		
	PR 1			
	Pr 4			
	Pr 5			
	1170 G	1800		
	19-1			
	19-2			
	19-3			
LSC	BDF 304	1730		
	BDF 305	1730		
4 W.T.	BDF 327	1700		
	BDU 6312	1700		
Initial Attack	BDF E-307		✓	I/C
	" E-395		✓	Div. A Sup.
	" E-397		✓	Div. B Sup.
	" E-333		✓	" A
	" E-323		✓	" B
	BDU D-6562		✓	" B
	BDU D-6585		✓	" A
	AA 210		✓	
	AT 72		✓	
	BDU C PR-2		✓	
Extended Attack				
2 C S/T	BDU 6314-C		1730	

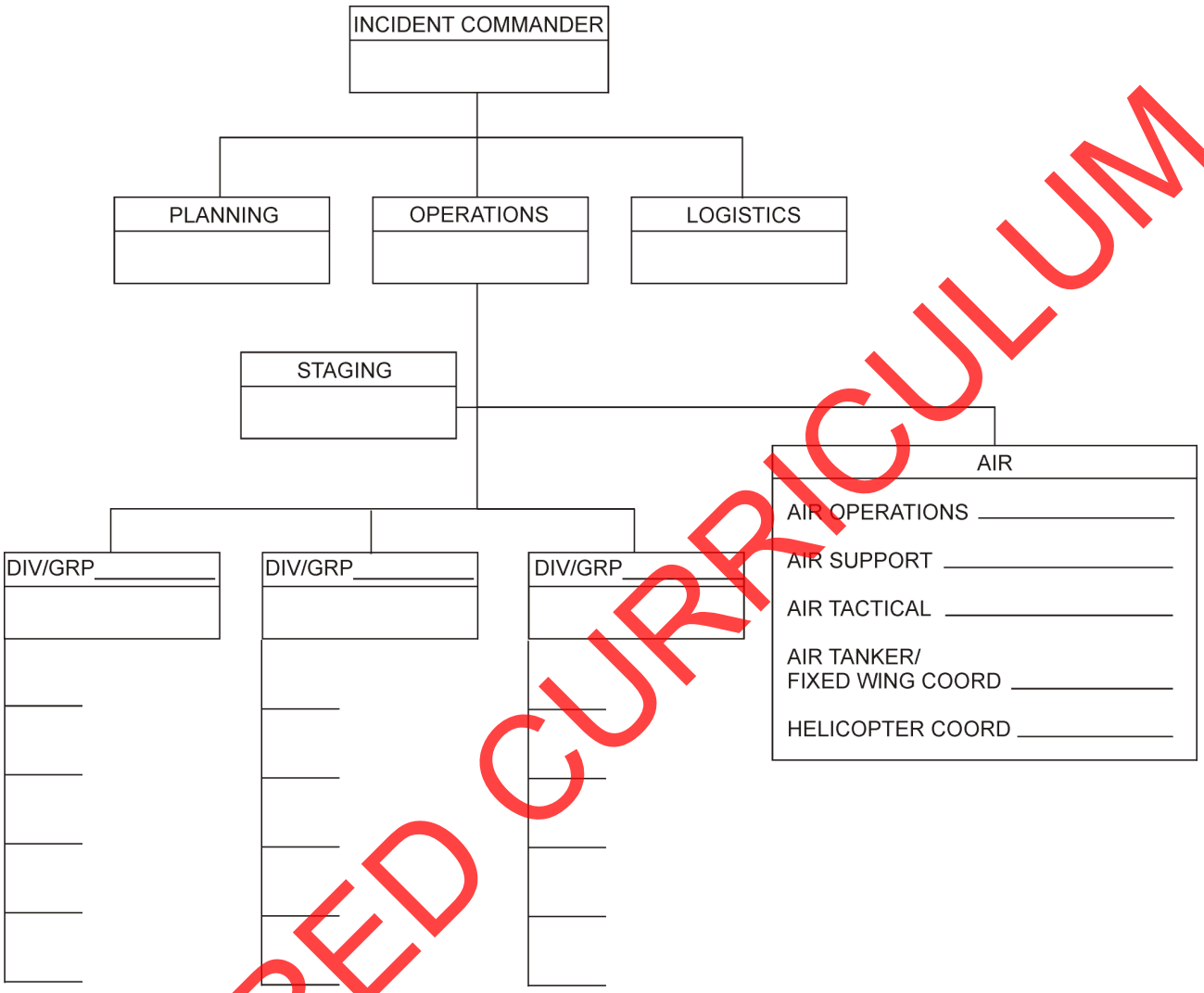
INCIDENT BRIEFING	1. INCIDENT NAME	2. DATE PREPARED	3. TIME PREPARED

4. MAP SKETCH

ICS 201 5-94	PAGE 1	8. PREPARED BY (Name and Position)

7. SUMMARY OF CURRENT OBJECTIVES AND ACTIONS		
CURRENT OBJECTIVES:		
CURRENT ACTIONS:		
ICS 201 5-94	PAGE 2	

6. CURRENT ORGANIZATION



7. RESOURCES SUMMARY

RESOURCES ORDERED	RESOURCE IDENTIFICATION	ETA	ON SCENE ✔	LOCATION/ASSIGNMENT

UNIT/ACTIVITY LOG **ICS 214** **5/94**	1. INCIDENT NAME	2. DATE PREPARED	3. TIME PREPARED
4. ORGANIZATION POSITION	5. LEADER NAME	6. OPERATIONAL PERIOD	

7. PERSONNEL ROSTER ASSIGNED

NAME	ICS POSITION	HOME BASE

8. ACTIVITY LOG (CONTINUE ON REVERSE)

TIME	MAJOR EVENTS

TIME	MAJOR EVENTS
	9. PREPARED BY (NAME AND POSITION)

Problem #2

TITLE:	Suppression Resources #1
TIME FRAME:	1:00
MATERIALS NEEDED:	• ICS Form 201 • Pen or pencil
INTRODUCTION:	This activity provides you the opportunity to identify problems occurring in a realistic scenario.
DIRECTIONS:	1. Read the scenario below. 2. Answer the questions at the end and complete an ICS 201. 3. You have 15 minutes to complete this activity. 4. Be prepared to discuss your answers with the class.

It is 1500 hours and Battalion Chief Lumfitzer is at scene on a 20-acre fire along Metcalf Canyon Road. The fire started along the road and is burning up a 30 percent slope in medium brush towards the ridge top. The rate of spread is 72 feet per minute, temperature 94, humidity 24%; wind is light and variable at 4 mph up canyon but is having little effect on the fire. Dispatch advises Chief Lumfitzer that an Air Tactical Group Supervisor (Air Tac) and two additional air tankers have been dispatched, ETA fifteen minutes, also one type 2 (D6-C) dozer, ETA five minutes. A type 3 (D-4) dozer has arrived at the same time as Chief Lumfitzer and is unloading at the point of origin. Two tankers are working the fire, four type 3 engines, and one type 1 Hand Crew are regrouping, having lost the initial attack. An additional hand crew has arrived and is tooling up.

Chief Lumfitzer advises the Type 3 dozer to start from the point of origin and flank the fire up the left flank, trying to cut off the head before it reaches the ridge top. He instructs the hand crew to hold the dozer line. At 1505, the Type 2 dozer arrives and Chief Lumfitzer advises him to build a flanking line on the other side of the fire, and to also open up and old road so that four-wheel drive engines can make it to the top of the fire.

Air Tac advises that the head of the fire has burned through the drops and is making a run towards the ridge top; if it slops over the ridge, it will go into the next drainage. Air Tac also advises that the dozer is about 300 yards from the head of the fire and the fire has about 300 yards to go before it reaches the ridge top. Chief Lumfitzer advises no problem. The Type 3 dozer will make it to the ridge top in about one hour, but keep the air tankers working on the head of the fire. Chief Lumfitzer advises dispatch he would like another hand crew and two more Type 3 engines, and that they should be able to pick up the fire in about an hour.

At about 1600 hours, the fire has reached the ridge top and there is no containment on the head. It is apparent that the fire will be going into the next drainage and that control is not going as anticipated.

QUESTIONS

1. What are the major problems?

2. Who was at fault?

3. How could these problems have been solved?

Dozers

ICS Dozer Typing

- ❒ Three types
  - ■ Type 1 (heavy dozers – D8, etc.)
  - ■ Type 2 (medium dozers – D6, etc.)
  - ■ Type 3 (light dozers – D4, etc.)
- ❒ Larger dozers generally capable of cutting wider line faster
- ❒ Dozer Strike Team
  - ■ Two dozers of same type
  - ■ One Dozer Tender
  - ■ One Strike Team Leader

Line Construction Capability

- ❒ Most effective when working in tandem with two dozers
- ❒ Rule of thumb
  - ■ A Type 2 dozer in medium fuel on a moderate slope can construct about 900 yards or one-half mile of single blade wide fireline per hour
- ❒ If in doubt about capability, ask the dozer operator

Dozer Safety and Limitations

- ❒ Maximum slope a dozer can typically operate is 75%
- ❒ Dozers used at night must have lights
- ❒ Beware of heavy rolling materials below operating dozers
- ❒ Approach dozer only when the operator signals
- ❒ Be aware of operator fatigue over extended work periods
- ❒ Remember that dozers must be fueled and serviced periodically
- ❒ Limit environmental damage caused by dozers
- ❒ Hired dozers must be supervised by qualified personnel
- ❒ Safety zones should be installed by dozers as they work the fire
- ❒ Be aware of adverse damage claims from dozer access and operations

Problem #3

TITLE:	Suppression Resources #1
TIME FRAME:	2:00
MATERIALS NEEDED:	• ICS Form 201 • Pen or pencil
INTRODUCTION:	This activity provides you the opportunity to identify problems occurring in a realistic scenario in real time.
DIRECTIONS:	1. Working in pairs, copy as much information as you can onto the ICS Form 201 while listening to the cassette tape played by the instructor. 2. Answer the following questions. 3. You have 10 minutes to complete this activity. 4. Be prepared to discuss your answers with the class.

QUESTIONS

1. What are the major problems?

2. Who was at fault?

3. What was the most significant miscalculation?

4. How would you resolve these situations?

Wildland Hose Lays and Apparatus

Wildland Hose Lays

Two Basic Types of Wildland Hose Lays

- ❒ Simple supply
  - Laid point to point dry then charged when completed
  - Typically used as a supply line
  - No protection for crew when being laid
- ❒ Progressive
  - Each length is charged as it is added
  - Normally put in on fire perimeter; fire is suppressed as the hose lay progresses
  - When needed, 1" lateral lines with tees are added every 200 feet to be used for subsequent mop-up or flare-ups

Equipment Used

- ❒ Hoses
  - Normally 1" and 1½" single jacket hose or lightweight hose with light alloy couplings in 100-foot lengths
  - Rolled single or double doughnut with brass and hose clamps, or in special hose packs
- ❒ Nozzles, clamps, tees
  - Nozzles 1" or 1½" combination
  - Forester hose clamp used for 1" and 1½" hose
  - Tees with shut-offs used to lateral 1" lines off 1½" lines
- ❒ Class A foam should be used if available

Rules of Thumb

- ❒ Under average conditions assign at least 3 engines with a total of at least 9 personnel per hose lay
- ❒ Select the pumping engine based on tank capacity and pump pressure capability
  - Head pressure can be critical in wildland hose lays
  - Relay pumping might be required
  - Ideally, the engine should be able to pump 450 psi

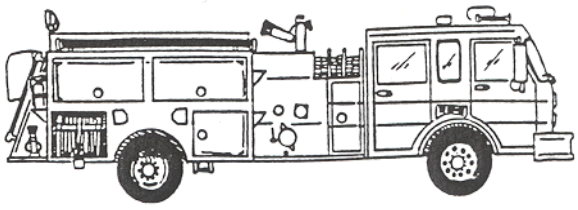
- ❒ Allow sufficient engines or water tenders and sufficient travel time to provide a constant supply of water
- ❒ Allow 4-5 minutes per 100-feet of hose for a progressive hose lay
  - This includes suppression and holding time
  - Remember that steep terrain, thick fuel, lack of daylight, and personnel fatigue can reduce this production rate
- ❒ Based on their minimum required hose complements, ICS Type 3 engines are normally most suitable for this type hose lay
- ❒ Hand crews are a valuable resource in making extended hose lays
- ❒ 1" lateral lines should normally be installed every 200 feet for mop-up and defense of the main hoseline from flare-ups

Hose Lay Safety

- ❒ Avoid using booster lines or other 1" lines on extended hose lays because friction loss is too great and there will be an inadequate volume of water to protect the nozzle operator in case of a dangerous intensification of the fire
- ❒ Combination nozzles providing a full particulate fog pattern and a minimum of 50 gpm should always be used because they add an extra measure of safety
- ❒ Straight stream tips may be used under specific conditions
- ❒ Always provide communications between the nozzle operator and the pumping engine
- ❒ Always have an anchor point for your hose lay. Avoid the danger and embarrassment of an outflanked line and burned hose
- ❒ Always adhere to downhill fire-fighting guidelines

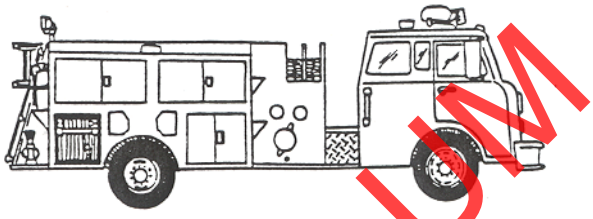
Apparatus

- ❒ Type 1 Engine Company
  - 1,000 gpm
  - 400-gallon tank
  - 1,200 feet of 2½" hoseline or larger
  - 400 feet of 1½" or 1¾" hoseline
  - 200 feet of 1" hoseline
  - 20'-24' extension ladder
  - 500 gpm heavy stream
  - 4 personnel



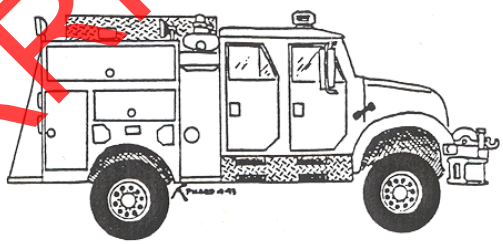
❒ Type 2 Engine Company

- 500 gpm
- 400-gallon tank
- 1,000 feet of 2½" hoseline or larger
- 500 feet of 1½" or 1¾" hoseline
- 300 feet of 1" hoseline
- 3 personnel



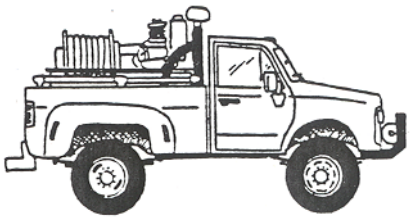
❒ Type 3 Engine Company

- 120 gpm
- 300-gallon tank
- 1,000 feet of 1½" hoseline
- 800 feet of 1" hoseline
- 3 personnel



❒ Type 4 Engine Company

- 50 gpm
- 200-gallon tank
- 300 feet of 1½" hoseline
- 300 feet of 1" hoseline
- 3 personnel



Recommended Wildland Fire Fighting Equipment for Type 1 and Type 2 Engines During Declared Wildland Fire Season

- ❒ 600-feet of single jacket 1½" wildland hoseline carried in two 200-feet hose packs
- ❒ 200-feet of single jacket 1" wildland hoseline carried in one 200-foot hose pack
- ❒ 1½" x 1" gated hose tees (2)
- ❒ 1½" combination nozzle with detachable bale shut-off (1)
  - Capable of at least 50 gpm flow
- ❒ 1" combination nozzles (2)
  - Capable of at least 15 gpm flow
- ❒ Wildland hose clamps (2)
- ❒ Small spanner wrench (1)
- ❒ 1½" NH female x 1" IP male reducer (1)
- ❒ Back pump (1)
  - Rigid or bladder style
- ❒ Drip torch with fuel (1)
- ❒ Backfire fusees (9)
- ❒ Shovel (1)
  - Short handle
  - Round pointed
- ❒ McLeod tool (1)
- ❒ Pulaski tool (1)
- ❒ Nonperishable rations (3)
- ❒ Gallon water containers (3)
- ❒ Headlamps (3)
  - Hands free
  - Extra set of batteries
- ❒ Extra fire shelter (1)
  - To be kept in the cab

Hand Crew Capabilities

Hand Crews

As with any other suppression resources, hand crew effectiveness is controlled by many factors:

- ❒ Leadership
- ❒ Amount of experience
- ❒ Degree of training
- ❒ Crew member turnover
- ❒ Crew morale
- ❒ Crew fatigue
- ❒ Fuel, weather, topography and time of day
- ❒ Fire behavior

Numerous studies on hand crew production rates have been conducted. For the purpose of the line construction studies, fuels were divided into four types based on the average width line required:

Grass	3-foot wide line
Medium brush	6-foot wide line
Heavy brush	9-foot wide line
Very heavy brush or timber slash	12-foot wide line (minimum)

The studies indicate that one crewmember can cut an average of 20 square yards of line per hour. A 15-member crew could then cut 300 square yards (15 x 20 square yards = 300 square yards). This provides the Incident Commander with the following rules of thumb for a 15-member crew:

Grass	900 fph for a 3-foot wide line
Medium brush	450 fph for a 6-foot wide line
Heavy brush	300 fph for a 9-foot wide line
Very heavy brush or timber slash	225 fph for a 12-foot wide line

Another way of visualizing this is that a 15-member crew should be able to put a 3-foot line around a one-acre grass fire in one hour (one acre of land 4 (sides) x 200 feet – 832 lineal feet). When in doubt, ask the crew leader how much line the crew can put in for you.

The above standards are for a top line production crew for the first or second hour of line construction. Production rates will decrease considerably thereafter.

ICS Crew Typing and Crew Strike Teams

See ICS 420-1 Field Operations Guide, FIRESCOPE, 2004 Edition, pages 11-3 and 11-7.

Crews Available by Agency

Federal Agencies

U.S. Forest Service (USFS)

- ❒ Hot Shot - normally 20 members (Type 1)
- ❒ Helishot crews (Type 1)
- ❒ USFS regular crews, trail or timber crews (Type 2)
- ❒ Blue card USFS certified pick up crews (Type 2)

Department of Interior (DOI)

- ❒ Bureau of Indian Affairs
- ❒ Bureau of Land Management
- ❒ National Park Service

National Interagency Fire Center (NIFC) – Boise, Idaho

- ❒ May provide crews from other states throughout the nation
- ❒ Coordinates acquisition of out-of-state resources

Department of Defense (DOD)

- ❒ Organized crews such as Vandenberg AFB
- ❒ Military personnel assembled for fire fighting

State of California - Department of Forestry and Fire Protection

- ❒ Maintains conservation camps and fire centers throughout the state
- ❒ Approximately 185 fire crews
- ❒ Crewmembers are provided by the California Department of Corrections (CDC) and California Youth Authority (CYA)
- ❒ Generally 15-17 persons supervised by a CDF Captain

Local Government

- ❒ Various county and city fire departments operate organized fire crews, with the greatest concentration in Southern California

❒ At various times, other volunteer and paid crews are available through colleges, volunteer departments, or private providers

Custodial and Logistical Aspects

Since nearly 4,000 hand crewmembers in California are in the custody of various correctional agencies, certain precautions must be taken. The CDC, CYA, and county inmates must not be mixed, particularly in camps or incident bases. The Crew Technical Specialist will handle these problems for you. CCC crews, which are composed of free people including many women, should not be mixed with inmates and wards.

Items such as medicine, weapons, and other valuables should be kept away from these crews and secured. Report any problems with individual crewmembers to the crew leader or appropriate custodial agency representative immediately.

When working in heavily populated areas, a correctional officer or youth counselor will be assigned to work directly with the crew to provide additional custody.

The inmate crews are very well trained, physically fit, and motivated. They take the same and quite often higher risks than others on the fire. Treat them with respect and dignity and remember their leaders are also brother or sister Chief Officers. Food and water to a hand crew are no different from fuel and oil to an engine. Support equals production. If a crew does an outstanding job for you, tell them so; next time they will work even harder.

Safety

Always comply with the Downhill Fire-fighting Rules. Remember that hand crews do not normally have hoselines to protect themselves.

Downhill Fire-fighting Rules

1. A competent fire fighter must make the decision to implement the downhill operation.
2. Do not build a fireline downhill in steep terrain and fast burning fuels unless there is no suitable alternative for controlling the fire.
3. Factor the current and expected fuel, weather, and topography into the current and expected fire behavior.
4. Establish a dedicated lookout.
5. Do not work in or adjacent to a chimney or chute that could burnout while the crew is in the vicinity.
6. Maintain immediate communications with crew, dedicated lookout, overhead, and adjoining forces.
7. Establish a solid anchor point prior to starting the operation.

8 Establish safety zones so that the crew can rapidly reach a zone of safety from any point along the line if the fire unexpectedly crosses below them.

9 Use direct attack whenever possible. If direct attack is not possible, secure the downhill operation by using a firing operation from an anchor point.

10 Support downhill hose lays with fire crews and dozers.

11 Maintain full compliance with the 10 Standard Fire Fighting Orders and 18 Watch Out Situations.

Problem #4

TITLE:	Suppression Resources #3
TIME FRAME:	2:00
MATERIALS NEEDED:	• ICS Form 201 • Pen or pencil
INTRODUCTION:	This activity provides you the opportunity to identify problems occurring in a realistic wildland fire scenario.
DIRECTIONS:	1. As a group, read the scenario below. 2. As a group, answer the questions at the end and prepare an ICS 201. 3. You have 15 minutes to complete this activity. 4. Be prepared to discuss your answers with the class.

You are the Incident Commander on a 100-acre fire burning grassy woodland and light brush. At scene you have: five Type 3 engines, three Type 1 hand crews, two Type 2 dozers, a Type 2 helicopter with a ten member helicopter crew, two Type 3 (S-2) air tankers, a Battalion Chief, and a fire investigator. The rate of spread is temporarily contained. The time is 1530, the temperature is 95 degrees, humidity is 20%, and wind is south approximately 8 mph.

Even though you have not checked with Battalion Chief Dolittle and most of the other forces (mainly because no one is in radio contact), you release two air tankers that have been orbiting the fire because, even though you cannot see the whole fire, it looks good to you with not much smoke showing.

At 1535, you notice a rather large smoke over the ridge near the head of the fire. Again, you start calling for Chief Dolittle, who is supposed to be Operations Section Chief. He answers but cannot help you because he is helping Investigator Gotcha locate the origin of the fire. Finally, you contact Engineer Clutch who states the fire jumped her wet line and is burning rapidly up a moderate slope. She states they are making a hose lay to try to flank one side and that Captain Hook and his hand crew are starting up the other flank of the slop-over.

You call back the two air tankers. They arrive and tanker pilot Missmore advises that the slop-over amounts to about one-quarter mile of moderately burning fireline. You have both air tankers make trail drops across the new head. Pilot Missmore advises the fire is knocked down. Figuring the hand crew and the hose lay should pick up the slop-over, you release the air tankers. You try to call Engineer Clutch, but cannot contact her. Neither can you contact Captain Hook who you think has a handi-talkie.

You call Chief Dolittle, and ask if he can check the slop-over for you and report back. You wait 15 minutes and notice two columns of smoke in the vicinity of the slop-over. Chief Dolittle finally calls you and states that the crew working on the slop-over had pulled back because they thought more drops were coming and they did not want to get hit, and that the slop-over was developing into two heads and to call for more air tankers.

The fire continues to burn into the night, and it is necessary for Chief Neverfails to assume command. She finishes controlling the fire by 0700 in the morning.

QUESTIONS

1. What are the major problems?

2. Who was at fault?

3. How could these problems have been resolved?

Safety Rules for Fire Crews in Areas Where Air Tankers are Operating

- ❒ Retardant drops from air tankers can be dangerous. A low drop has sufficient velocity and mass to not only knock you off your feet, but it can also throw you a considerable distance.
- ❒ While being hit directly by a load of retardant is, at best, a sloppy mess, generally no serious bodily injuries will be caused by the retardant if you take proper precautions. The major cause of bodily injury resulting from a low drop is being thrown against rocks, tress, etc., or being struck by flying debris picked up by the retardant.
- ❒ Air tanker pilots are constantly cautioned about the dangers to ground personnel resulting from low drops. You can expect to be thrown and bounced around rather violently.
- ❒ If you are standing or running and are hit by the main force of the load from a low drop, you can expect to be thrown and bounced around rather violently.
- ❒ If you are prone and are hit be a low drop, the risk of injury is reduced considerably over the injuries you might receive were you standing or running.
- ❒ If a low drop hits you, do not add to the flying debris. Hold onto the tools or other equipment you might be carrying. Those flying tools or equipment could cause injury to you or someone on your crew.

Aircraft Use

Key ICS Air Tactics Positions

- ❒ Air Tactical Group Supervisor
  - In-air control aircraft
  - Crewed with a pilot and a Captain or Battalion Chief
  - Controls all fixed and rotary wing aircraft over the fire
  - Coordinates aircraft use with the IC or Operations Chief if that position is activated
  - IF you have questions about aircraft use or number of tankers and helicopters needed, contact Air Tactics
  - Capability of communicating on any VHF radio frequency
  - Use as your "eye in the sky"
- ❒ Air Tanker Coordinator
  - Primarily used on federal wildland fires
  - Leads tankers into the drop area and is referred to as "Lead _____" on the radio
  - Reports to Air Tactics
- ❒ Helicopter Coordinator
  - May be ground or helicopter based
  - Coordinates airborne helicopter operations
  - Reports to Air Tactics

ICS Typing

Air Tankers

See ICS 420-1 Field Operations Guide, FIRESCOPE, 2004 Edition, page 11-3.

- ❒ Type 1
  - 3,000+ gallons
  - Aircraft such as the P-3 Orion
- ❒ Type 2
  - 1,800+ gallons
  - Aircraft such as the DC6, DC4, SP2H, and P2V

- ❒ Type 3
  - 600+ gallons
  - Aircraft such as the S2T and S2F

Helicopters

See ICS 420-1 Field Operations Guide, FIRESCOPE, 2004 Edition, page 11-4.

Uses for Helicopters

- ❒ Dropping water or foam
- ❒ Ferrying fire fighters
- ❒ Reconnaissance
- ❒ Medivac
- ❒ Aerial ignition (helitorching)
- ❒ Aerial or infra-red photography
- ❒ Mapping
- ❒ Delivering supplies

Safety Around Helicopters

- ❒ Approach only when directed by the pilot, crew, or helibase personnel
- ❒ Never approach from uphill
- ❒ Observe a 100-foot danger zone, including no smoking
- ❒ Be aware of materials thrown by landings, take-offs, and water drops
- ❒ Wear full personal protective equipment
- ❒ Fasten seat belts
- ❒ Ensure nothing goes into the rotor system
- ❒ Stay away from the tail rotor
- ❒ Notify the pilot of other aircraft or obstacles you might see

Aircraft Use

Limiting Factors

- ❒ Smoke
- ❒ Afternoon and early evening shadows

- ❒ Utility lines
- ❒ Winds
  - Over 25 mph for tankers
  - Over 35 mph for helicopters
- ❒ Darkness
  - Tankers and most helicopters cannot drop after the cut-off time
- ❒ Terrain
  - Tankers cannot drop while flying uphill toward the terrain
- ❒ Other aircraft in the fire area

Air Space Restriction

- ❒ FAR 91-137
  - Provides authority for restricting air space
- ❒ Usually Air Tactics will request a restriction if air space is congested or dangerous
- ❒ Generates a "Notice to Airmen" (NOTAM), which specifies restricted space above ground level and radius
- ❒ Does not apply to the media, although they are strongly encouraged to stay clear until advised by Air Tactics

Retardants

Types

- ❒ Short term
  - Water
  - Foam
- ❒ Long-term
  - Phos-Chek®
  - Fire-Trol®
  - Gels

Tanker Delivery Systems

- ❒ Doors
  - ■ Salvo
    - • Drops from all doors at the same time
    - • Gallons dropped divided by 4 equals effective fireline on the ground
  - ■ Trail
    - • Doors are opened in sequence
    - • Gallons dropped divided by 2 equals effective fireline on the ground
- ❒ Computerized sequencing systems
  - ■ Variable coverage levels
  - ■ Single opening varied by coverage level selected
- ❒ Split drops
  - ■ Partial leads on various targets
  - ■ Used for smaller targets
- ❒ Rely on Air Tactics to establish effective patterns and coverage levels for the fuels

Buffalo Canyon Structure Protection Plan

MILEAGE CHART SYMBOLS

From Hwy 26-287 on Buffalo Canyon Road

Box K	1.1 miles
Atkinson Motel	1.3 miles
Buffalo Valley Ranch	1.4 miles
Heart 6 Ranch	1.5 miles
Fern Creek Ranch	3.6 miles
Mt. View Ranch	7.6 miles
Diamond D	7.8 miles
Turpin Meadow	10.0 miles

LEGEND

B	Barn
H	Home
S	Shack
WP	Wood Pile
W	Water Source
F	Fuel (propane, gas, diesel)

TACTICAL AREAS

The Buffalo Canyon Structural Protection Plan is designed to quickly and safely place forces to save structures. The plan is divided into the following tactical areas:

1. Turpin Meadow Lodge Area
2. Turpin Meadow Summer Homes
3. Mid Canyon Area
4. Heart 6 - Atkinson Motel Area
5. Buffalo Valley Estates, Box K Ranch Area, and Evergreen Estates Area

MAPS

Each area is marked 1-6 on a forest map. Each individual area is laid out on a tactical map. The road into each area is flag coded:

1. Yellow: Homes on road
2. Blue: Water supply
3. Hot Pink: Haz Mat, i.e., propane tanks or fuel storage

If there is no flagging on a road, there are no structures on it.

CONTENT

Each segment area can be used individually it contains:

1. Maps
2. General Information
3. Water supply
4. Tactics (suggested)
5. Equipment required
6. Probability for success rate from:

Poor:	20%
Fair:	40%
Good:	60%
Very Good:	80%

PREPLAN

Discuss this plan with each company under your command. Each strike team leader should have a copy.

HELPFUL HINTS

1. Always stay mobile
2. Back your engine in so you can get out fast
3. Coil a short 1½" charged line with fog nozzle on your engine for safety and quick knock down
4. Do not make long lays
5. Check roads before the fire hits

6. Check each home for defense: move wood piles; close windows and doors
7. Leave home lights on inside and out day and night
8. Place owners ladder at a corner of home on least fire threat side
9. Coil and charge garden hoses
10. Check and mark Haz Mats, i.e., LPG-Fuel
11. If a home becomes well involved, LEAVE IT; yes, leave it and move on to one you can save
12. ALWAYS wear your SAFETY GEAR
13. Fire fighter safety and survival is always our number one priority

GOOD LUCK

Strategy

The Buffalo Valley area will become Branch II under operations. There will be two structural protection groups, Group "S" and Group "T" working under Branch II. Each group will contain four strike teams of engines.

Two light dozers (D-4 Type) on transports and three hand crews will be under Branch Control and will be assigned as needed. Also, four water tenders and four portable pumps will be assigned to the groups. Two water tenders and two pumps with 1,000 feet 1½" hose each to each group.

TOTAL EQUIPMENT

- ❒ 8 strike team engines (2 Type 1 or 2, 4 Type 3, and 2 Type 4)
- ❒ 3 hand crews (Type 2)
- ❒ 4 water tenders
- ❒ 4 portable pumps - 4,000 ft. 1½"
- ❒ 1 Type 3 helicopter (day only)

TURPIN MEADOW LODGE AREA

General: This area is 10 miles east of the junction of Buffalo Canyon Road and Highway 26-287. It contains a ranch complex of 18 structures. Buildings are of log and tin roof construction. Little fuel except on the east side. Good clearance in most areas. Above ground storage of fuel and propane tanks.

Water Supply: Use water tenders draft from creek.

Tactics: Fire out east side. Construct hand line behind east side cabins. Have hand crew remove woodpiles.

Equipment: 1 strike team engine Type 1, 2, or 3
1 water tender
1 hand crew

Probability for Success: Good

TURPIN MEADOW SUMMER HOME AREA

General: This area is 10 miles east of the junction of Buffalo Canyon Road and Highway 26-287. It contains 19 homes and many out buildings. Homes have very poor clearance, built in the timber on a slope. All are of wood construction and some have shake roofs and close woodpiles. There is heavy flash fuel near these homes and several have steep driveways.

Water Supply: Use water tenders

Tactics: Fire from back yards is a major safety problem for crews if fire crowns - clear safety area in meadow first!

Equipment: 3 strike team engines on line, 1 with reserve
2 water tenders
2 dozers
3 hand crews

Probability of Success: Poor

MID-CANYON AREA

General: This area is 7.6 miles in on Buffalo Canyon Road. It contains some 25 homes; however, only the structures on the north side of the road area are at risk. South side homes are in the clear and would take little effort to protect. North side homes are near the road and back into the brush line.

Water Supply: Water tenders, draft from Neville's pond and creek crossing just west of the area.

Tactics: Fire out behind homes and hold fire north of road.

Equipment: 2 strike team engines (any type)
1 water tender
1 hand crew

Probability for Success: Good

HEART 6 - ATKINSON MOTEL AREA

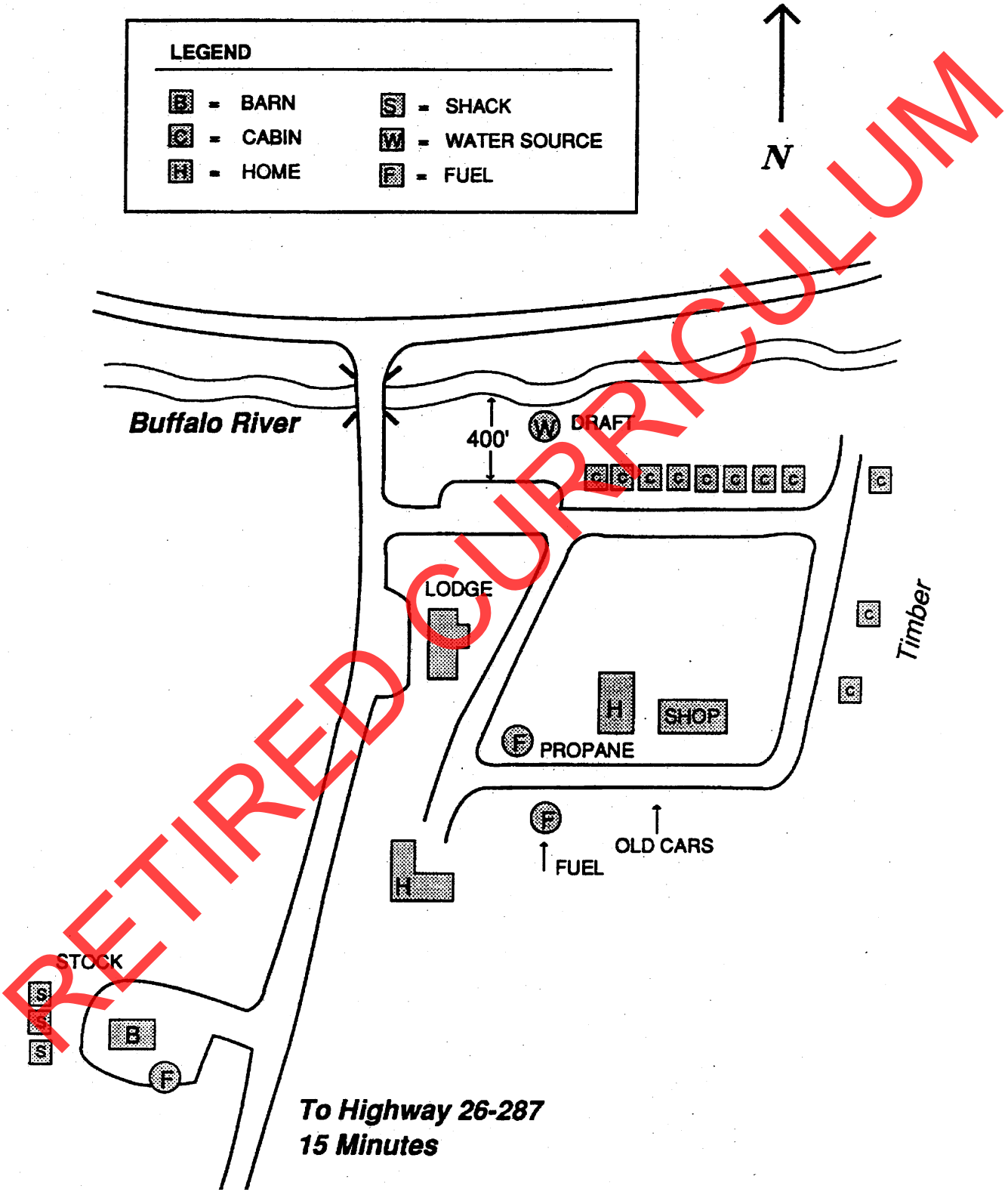
General: This area is 1.5 miles in on the Buffalo Canyon Road. Both the Heart 6 and motel are right next to the road with good fuel clearance. The area contains 27 structures and stock pens. Dangerous fuel storage 1000+ gas with tin garage at Atkinson's (flagged) and many propane tanks.

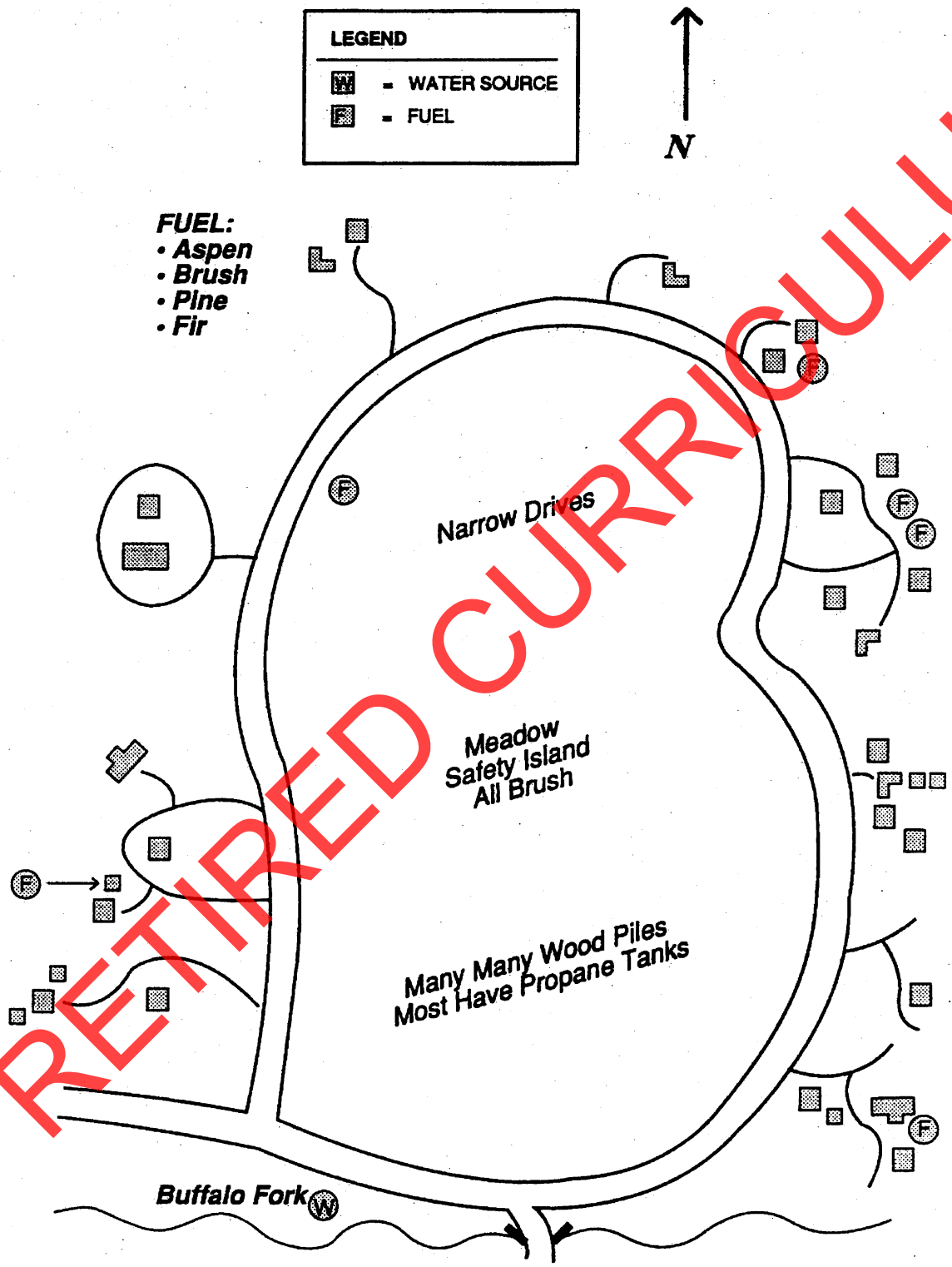
Water Supply: Water tenders and a 1,000 stock tank at Atkinson's.

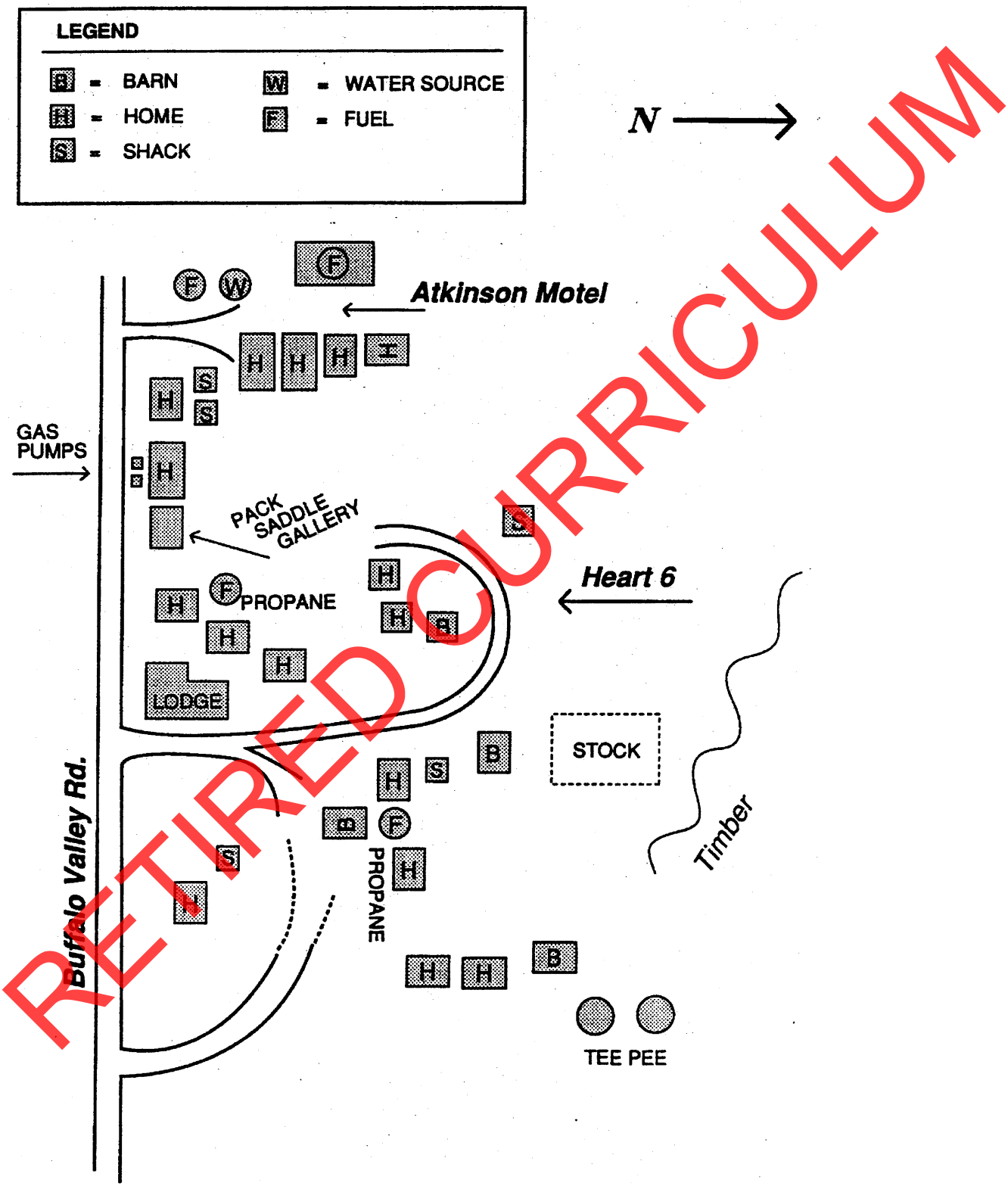
Tactics: Fire out slowly and have engines stand by.

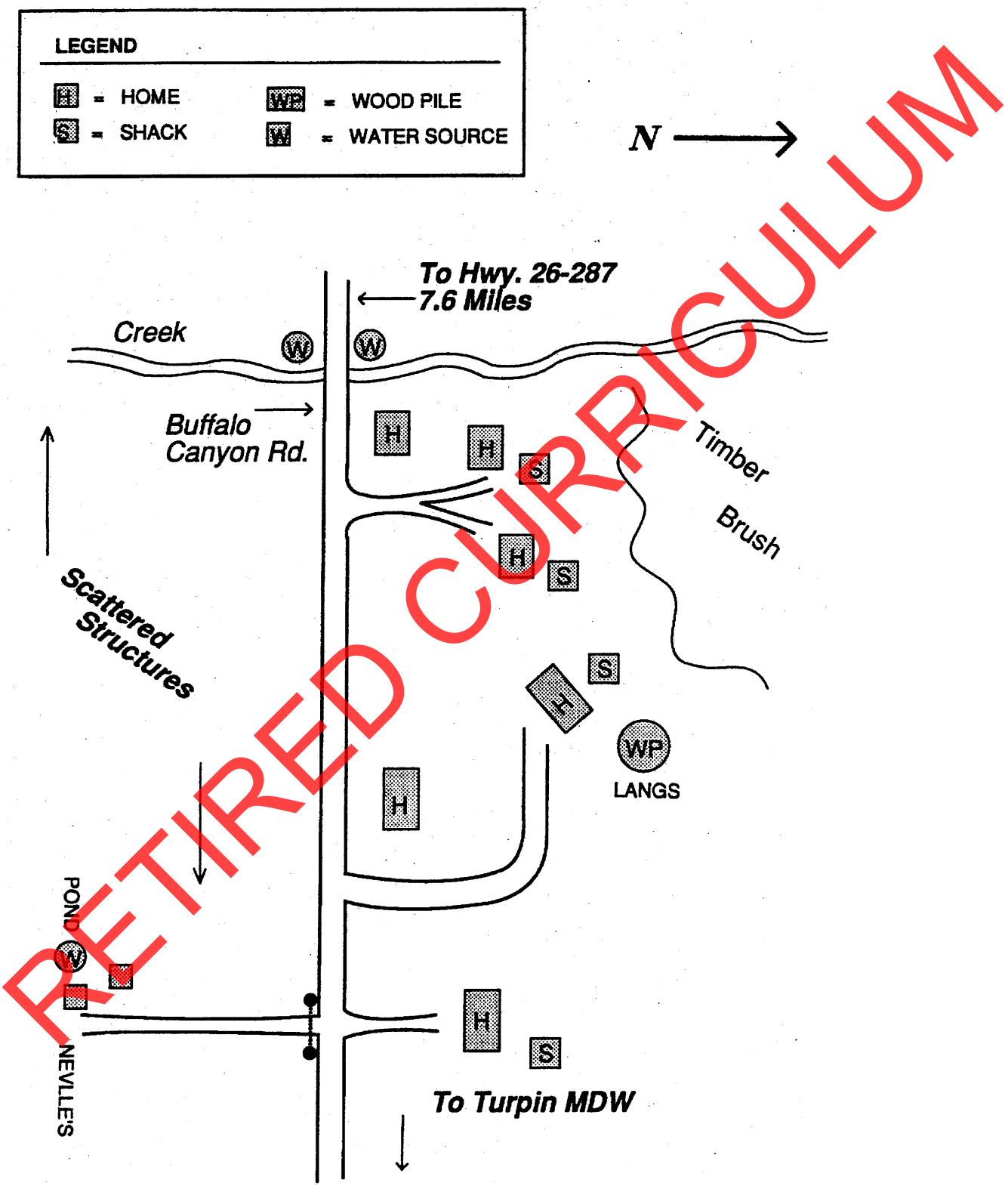
Equipment: 2 strike team engines (any type)
1 water tender
1 hand crew

Probability for Success: Good

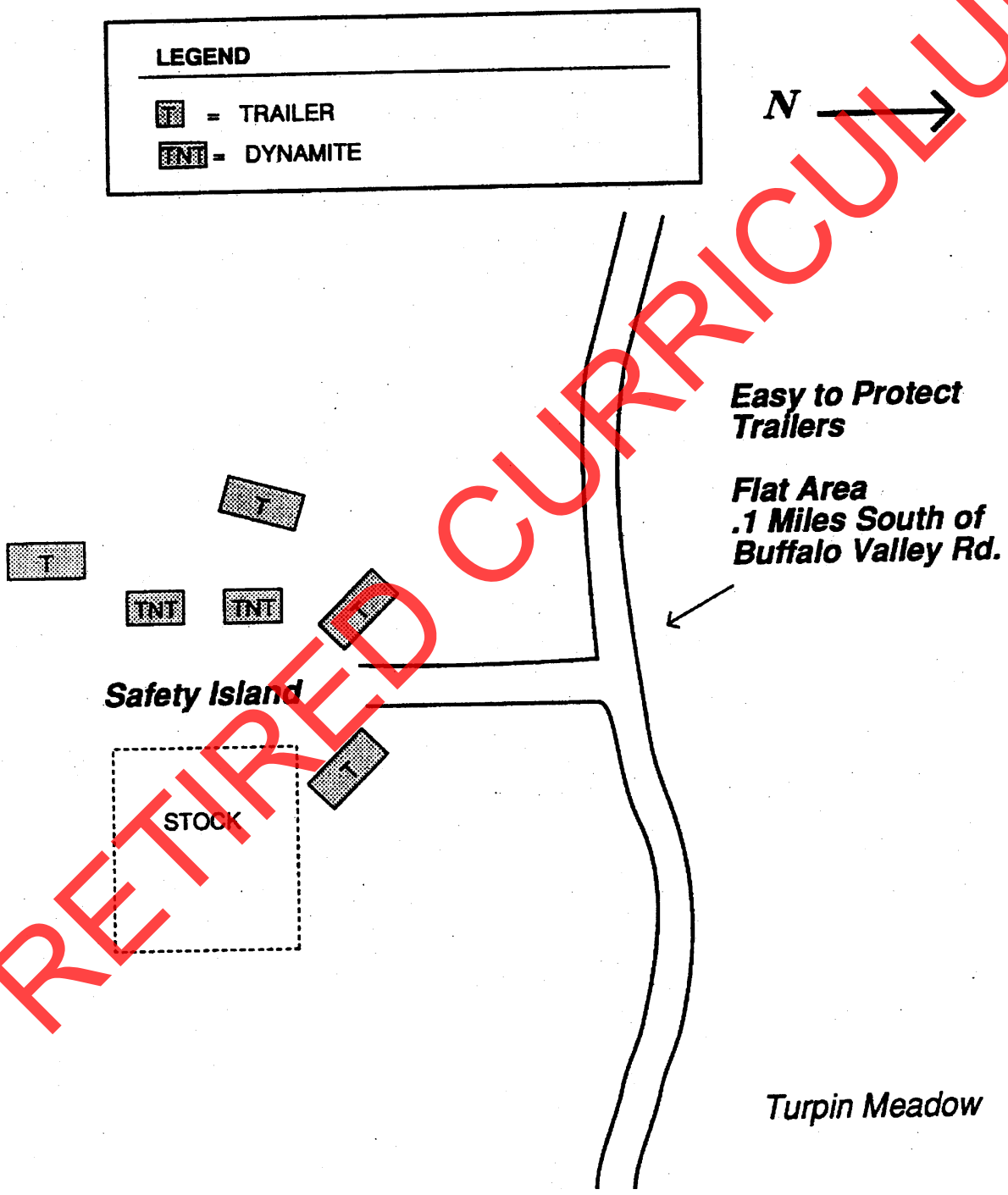




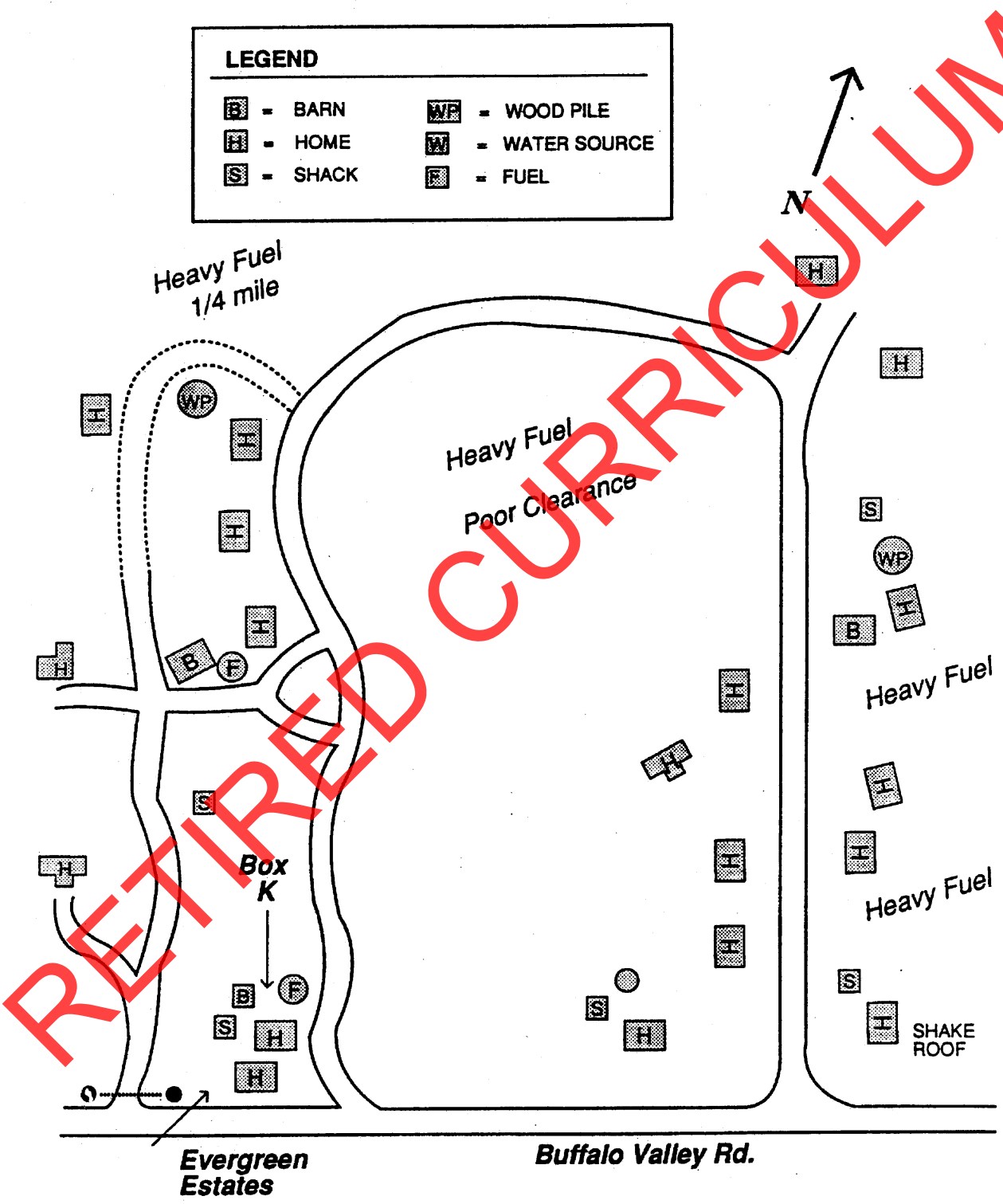




Haecker Camp



Buffalo Valley Estates / Box K / Evergreen Estates



Stand-and-fight or Cut-and-run Fire Engine Capabilities and Tactics

Choosing the Engine for the Job

Equipment Complement

- ❒ Hose complement
  - ■ Single or double jacket hose
  - ■ Amount of 1" and 1½ hose
    - • Type 3: 1,000 feet of 1½", 800-foot of 1"
    - • Type 1: 1,200 feet of 2½", 400-foot of 1½", 200-foot of 1"
  - ■ Reel or hard lines, booster line
- ❒ Tools
  - ■ Wildland versus structural

Water Tank Capacity

- ❒ Ability to sustain an attack absent a static source
- ❒ Type 1
  - ■ 400 gallons minimum
- ❒ Type 2
  - ■ 400 gallons minimum
  - ■ 500 gallons is average in California
- ❒ Type 3
  - ■ 300 gallons minimum
- ❒ Type 4
  - ■ 200 gallons minimum
- ❒ Tenders
  - ■ 1000+ gallons

Open or Closed Cab

- ❒ Open cab is very dangerous on wildland fires
  - ■ There has never been a recorded instance in California where a fire fighter was burned to death in a closed vehicle
  - ■ Numerous fire fighters are burned out in the open, on the back of an engine, or attempting to outrun the fire
- ❒ Hose bed
  - ■ Is it covered?
  - ■ With what?
  - ■ Diamond plate is best

Conventional or 4-wheel Drive, Off-road Capability

- ❒ Depending on terrain, a 4-wheel drive may be required if traction, climbing ability, or ground clearance are important
- ❒ Remember, 4-wheel drive engines may require longer travel time on the highway and may not be as readily available
- ❒ Most 4-wheel drive engines are Type 3 or Type 4

Wheel Base

- ❒ Ability to negotiate narrow roads with short radius or steep climbing turns
- ❒ Turning radius short enough to change directions rapidly when needed

Weight

- ❒ Roadbed
- ❒ Bridge capacity
- ❒ Septic tanks

Mechanical Condition

- ❒ Strike teams often may end up with relief engines that are not first line equipment
- ❒ Structural type engines may not be equipped with adequate air cleaner protection
- ❒ Flying embers in paper elements - motor quits
- ❒ Tires not adequate for off road use

Pump Type

- ❒ Main pump - midship

- ❒ Disadvantage - not mobile
- ❒ PTO
- ❒ May be capable of pumping and rolling slowly
- ❒ Auxiliary pump with separate power source
- ❒ Best if pump and roll is what you need - hit and run
- ❒ Water curtain can be provided for safety even when engine is moving

Personnel on Engine

- ❒ Type 1 = 4
- ❒ All others = 3
- ❒ You cannot expect a 3-person crew to put a progressive hose lay in as fast as a 4 or 5-person crew - order what you need
- ❒ Experience of the company officer and crew members determine what the capability of an individual engine is
- ❒ Fatigue becomes a critical factor
- ❒ Remember that when things are tough and homes are burning, what you need is just the closest engines of any type right away

Type Of Assignment for an Engine or Strike Team Will Help You Determine the Best Suited Engine for the Job

Mobile Attack On Grass Fires

- ❒ Ability to pump and roll
- ❒ Shorter wheelbase generally is better
  - ■ Better approach angles
  - ■ Better ground clearance

Stationary Pumping On A Hose Lay

- ❒ Length of hose lay may indicate the need for a larger water tank if supply is being transported to scene
- ❒ Hose lay elevation may require a pump that will pump 450# pressure

Primarily Off-Road Pumping

- ❒ Generally best to use Type 3 engines
- ❒ Avoid damage to larger more expensive engines

Structure Protection

- ❒ Water tank capacity is important - larger the better
  - A strike team of OES engines for example can sustain themselves longer without replenishing their water because most carry 750-800 gallons
- ❒ Depending on terrain and area you are working, smaller and shorter wheel base engines may be better due to narrow winding roads and short steep driveways

Fire Engine and Strike Team Tactics on Wildland Fires

Strike Teams

- ❒ Up to five strike teams per division; five divisions per branch
- ❒ Strike team components
  - Common capability
  - Common communications
  - Common leader
- ❒ Although there are three kind, we will focus on engines
  - Typical type first
  - Remember, you can also use mixed task forces

Strike Teams May Be Dispatched To Staging Areas Or Directly To The Fire

- ❒ If you report to staging area, the strike team leader must check in the staging area manager, remember
  - Responding directly to incident, check in with Division Supervisor
  - Responding to staging area, check in with Division Supervisor
  - A staged strike team is under the direct control of the Operations Chief
  - Usually through a Staging Area Manager
  - A staged strike team is considered an available resource and must be able to respond within 3 minutes. This means no wandering around in the staging area, keep teams parked together
- ❒ The STL must report his/her arrival either by radio or in person to obtain his/her assignment

Deployment Of Equipment

- ❒ When assigned to a fire engine deployment is critical. Get a clear assignment from your supervisor
  - Always have an escape route
    - Back engines in

- Use buildings or natural barriers for protection
- Do not park at top of draws or natural funnels

- Do not park under power lines. Keep engines working as team. Exercise tight control
  - Do not spread out too far. Visual contact is best
- Strike Team Leader should survey area to check for special conditions or hazards
- Unless absolutely necessary, do not have engines lay long hose lays. They will cut mobility and may burn up a lot of hose

❒ Before deploying, assure that all personnel are in full protective equipment, all water tanks are full, all engines have adequate fuel, and all radios work

Use Of Water - Plan And Discuss Its Use Ahead Of Time

❒ Water conservation - with hydrant supply

- Consider effect of heavy water consumption on other lines tapped off main line laid
- What about adjacent water main? Other companies working out of your vision? Residents or fire fighters working off garden hose?
- When water conservation is important, do not wet down ahead of fire, extinguish only what is absolutely necessary
  - Do not waste water on wood shingle roofs - they dry too fast
- Remove strategic combustibles that require more water use
  - Move garden furniture
  - Cut the cypress hedge down
  - Cut and remove brush along hillside road where stand is to be made - while waiting for fire
- Let everything burn that is not vital to fire control or not an exposure hazard to objects of value
- Do not lay a line, just because there is a lot of fire and a hydrant. Have a compelling reason
- If lines are left at a fast moving fire, take the fittings with your apparatus if possible

❒ Water conservation, with tank supply

- Conserve limited supplies, use hand tools in conjunction with a hose line when working on brush
- Always know what your water level is
- Never go below 100 gallons or 60 seconds worth of water

❒ Water tender use

- Where water supply is a problem Strike Team Leaders, Division Supervisors or Operations Chiefs should order sufficient water tenders to keep strike teams adequately supplied
- Depending on travel time and distance, 1 or 2 water tenders can keep a strike team supplied
- Water conservation must be enforced even when working with water tenders

Protecting structures and motor vehicles (ahead of fire)

- ❒ Close windows - garage doors, etc.
- ❒ Leave lights on so house can be seen at night
- ❒ Put combustible garden furniture in garage or house, in any event place furniture so that it will not expose a structure
- ❒ Move wood piles away from structures
- ❒ Move combustible fences away from structures
- ❒ Ask residents to move lace-type curtains from windows on exposed side. Heavy drapes may be advantageous
- ❒ Chop down highly combustible shrubbery and place where it will not expose a structure
- ❒ Remove any combustibles from vicinity of LPG tanks
- ❒ Shut off gas
- ❒ Have civilians place stepladders, etc, on front porch, or where readily visible
- ❒ Use fire department extension ladders where necessary
- ❒ Hook up available garden hose
  - Test for water pressure
  - Put in engine water tank
- ❒ Remove leaves from roofs and gutters
- ❒ Call for truck companies where or if practical
- ❒ Civilian motor vehicles
  - Put in garage - preferably heading out, not in
  - Close all windows - no matter where vehicles are
  - Park where least exposed - but not in the driveway where the fire apparatus might operate or hoselines laid
    - Not in a narrow street; the front lawn would be better if practical

Protecting Structures (When Fire Hits)

- ❒ A structure seldom will burst into flames; it usually will start as a small fire in one or more spots
  - ■ Blowing sparks trapped under shingle or shake roofs
  - ■ Heat or flames trapped beneath the eave of a roof
  - ■ Burning debris blown through ground vents or attic vents
  - ■ Windows broken from heat and drafts
  - ■ Doors or windows left open
  - ■ Exposures from burning (remove if possible and desirable)
    - • Shrubbery, trees
    - • Combustible garden furniture
    - • Fences
    - • Wood piles
    - • Automobiles
    - • Adjacent structures
    - • Combustible rubbish
- ❒ Survey ahead of fire and give priority of protection considering construction and topographical factors, equipment and personnel to be utilized and fire spread
- ❒ Common errors
  - ■ Laying hose lines too far away from the structure using too much hose and tiring out the fire fighters
  - ■ Meet the fire where an easier standard can be made
  - ■ Not maintaining sight or radio contact with engines in the strike team
  - ■ Wasting time and energy on structure that will be lost no matter what your effort
  - ■ Employing unnecessary apparatus, where less will do - clogging roadways
  - ■ Parking equipment where it is unnecessarily exposed to direct fire
  - ■ Laying unnecessary line
  - ■ Wetting down shingle roofs and adjoining areas when insufficient water is available
  - ■ Do not use hard lines

Safety

- ❒ If fire is too hot, retreat into structure, close engine cab, or even swimming pool temporarily, when fire passes, extinguish burning exterior or exit engine
- ❒ Without a specific purpose, do not face an intense fire, retreat to protection (behind fence, ledge, house) and go
- ❒ Keep apparatus mobile - At a fast moving fire, this is called hit and run or stand and fight or cut and run. Run not in fear but because it is the best decision
  - Move from structure to structure with the fire
  - You may leave a fire fighter at difficult situations
  - If the civilian owner is present, point out possible places of dangerous flare-ups before you leave
  - Park behind a structure, heading out of the driveway
- ❒ Engine safety
  - Headlights on at all times (spotlight can be turned upward at night for visibility)
  - Windows closed
  - Coiled preconnected charged 100 feet 1½" or 1" hoseline
  - Pump running if auxiliary or skid mount
- ❒ Park on roadway adjacent to structures, always choose between heading with direction of fire travel or heading towards a possible escape route
- ❒ When protecting structures and also making a stand along a road, detail fire fighters to prevent fire from spotting across
- ❒ Fire out around structures where possible but only after advising your supervisor of your intention
- ❒ Stay out of topographic saddles and chutes

What to Tell Civilians about the Dangers

- ❒ Remind them that even fire department activities can be dangerous to them
- ❒ Ideally, evacuation is primarily a police problem - leaving the fire department free to operate
- ❒ Encourage civilians, especially elderly or ambulatory individuals to leave fire area on foot or in vehicles if practical
- ❒ Inform them of danger of running up hills, canyons or draws ahead of moving fire
- ❒ Explain that in almost all instances, a person is safe in a well-built structure when a fire sweeps past, even though it may eventually be destroyed

- ❒ If civilians are determined to stay with their homes, explain the value of removing any exposures (furniture, shrubs, woodpiles, etc.), and how to protect themselves and handle a garden hose
- ❒ Try to impress the mother or father with the importance of keeping the family together; this reasoning sometimes assists the evacuation effort

Structure Protection Triage

Company Officers, Strike Team Leaders, Division Supervisors, and Operations Chiefs must be capable of making one of the most difficult decisions on a wildland fire, which homes to try and save and which ones to write off. Some guidelines for making these decisions include:

- ❒ If it is well involved and others are not, go for the ones that are not
- ❒ Look at types of roof coverings, wood over hangs, and proximity to brush. In an intense fire shake single roofs and wood sided houses are very difficult to save
- ❒ Consider personnel safety
- ❒ Consider available personnel
- ❒ Consider water supply
- ❒ Consider values at stake including human life
- ❒ Sometimes everything you try will not be enough, and
- ❒ At other times the rewards and thanks will be great

Remember, each of us must decide whether to "STAND-and-FIGHT" or "CUT-and-RUN"

DEVELOP & COMMUNICATE ACTION PLAN

ATTACK MODES

Defensive (No main fire control, save structures)
Offensive (Can control main fire, save structures)
Combination (Offensive and Defensive)
No action

WHEN IT IS HOPELESS

Fire making sustained runs & poor structure clearance
More spot fires than can be extinguished
Water supply less than threat
Can't remain & escape route cut off
Roof more than 1/2 involved & windy
Inside fire, windows broken & windy

FIRE SUPPRESSION

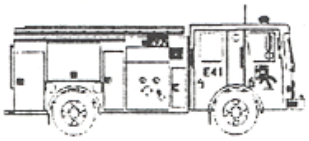
Fight fire at rear of structure
Use structure as *heat shield*
Get in structure until heat wave passes
Use water carefully. Keep 100 gals in tank, if possible

STRUCTURE PREP

Outside (cover openings, rid roof needles/leaves, utilities)
Inside (close drapes/windows, lights on, HVAC off, leave note)

ENGINE OPERATIONS

Back in, use structure as *heat shield*
Walk around assessment (clearance, hazards, gas off, elect on)
Test communications; Engine running, windows closed
Implement I-Zone Evolution
Two hoselines wrap structure (1 hose between 2 close str)
Hoselines off same connection or *same side of engine*
Roof line & ladder, if needed
Garden hose to booster tank, Supplemental hoselines
Class A foam application
Re-evaluate as conditions change

LCES  **LCES**

Initial I-Zone Engine Set-up

Engine Crew: _____

1.	Back into position (**3 minutes**) ***Start Time***	
	Away from fire	
	Away from hazards - wires, trees holes, press tanks, etc.	
	Nonflammable ground	
	Engine windows and doors closed	
	Start auxiliary or engage pump	
	Give instructions to crew	

2.	Exit cab	
	Chock block engine	
	Set engine pressure	
	Charge protection line	

3.	Walk around structure	
	Check for:	
	Occupants	
	LP gas tank	
	Woodpiles	
	Sheds	
	Hazards	
	Utilities	
	Fences	
	Pets	
	Openings in structures	
	Water supply	
	Others	

4.	Return to engine and verify ready for water	
	Charge 1½" lines	
	Verify lines have been charged and nozzles are off	
	Place ladder to roof	
	Pull reel line and coil at base of ladder or take to roof	
	Put garden hose in engine tank ***Stop Time***	

5.	Prepare structure (**verbal**)	
	Leave lights on - turn porch light on	
	Shut off A/C	
	Close all windows	
	Remove any material from windows that may burn	
	Close blinds or heavy drapes	
	Fill bath tub with water	

6.	Reload and go (**3½ minutes**) ***Start Time***	
	Instruct crew to reload and go, (face to face, radio, siren, Horn)	
	Return to engine and shut off lines	
	Disengage pump & make sure auxiliary is running	
	Roll up reel line and remove garden hose from tank	
	Reload lines in configuration that best suits your engine	
	Pick up chock blocks	
	Drive away ***Stop Time***	

7.	Set up and deploy from reload configuration (**2 minutes**) ***Start Time***	
	Back into position	
	Give instructions to crew	
	Engine windows and doors closed	
	Start auxiliary or engage pump	
	Chock block engine	
	Walk around structure	
	Ladder to roof with reel line coiled	
	Charge lines	
	Verify lines have been charged and nozzles are off	
	Put garden hose in engine tank ***Stop Time***	

8.	Abandon lines **(1 minute)** ***Start Time***	
	Instructs crew to abandon hoselines, (face-to-face, radio, siren, horn)	
	Returns to engine, shut off lines	
	Uncouple lines	
	Disengage pump	
	Pick up chock blocks	
	Drive away ***Stop Time***	

Problem #5

TITLE:	Fuego Beach
TIME FRAME:	2:00
MATERIALS NEEDED:	• Writing board/pad with markers/erasers • Pen or pencil
INTRODUCTION:	This activity provides you the opportunity to develop a briefing for a structure protection group.
DIRECTIONS:	1. As a group, read the scenario below. 2. In your group, answer the questions at the end. 3. From your answers, create a briefing for the members of your structure protection group on the writing board/pad. 3. You have 20 minutes to complete this activity. 4. Be prepared to discuss your answers with the class.

Date: Sunday, September 29

Time: 0600

Weather

Temperature: 78°F

Relative Humidity: 9%

Wind: Northeast 22, gusts to 45 mph

A brush fire of major proportions is burning about two miles east of the community of Fuego Beach. The fire, which is approaching on a wide front, will burn through Fuego Canyon into town. It poses a major threat to the numerous homes that dot the hillsides of Fuego Canyon and the surrounding areas. The weather forecast calls for increasing winds this morning and warmer and drier conditions. The fire front is advancing at over one mile per hour.

When the fire reaches the coast highway, the losses will be tremendous. There are hundreds of homes in the outlying areas of Fuego Beach.

The topography is steep and fuel is a mixture of grass and medium to heavy brush. Most of the streets, except for Fuego Canyon Road and Skyline Drive, are narrow and winding, creating a difficult ingress and egress situation.

You are at the Command Post located at the municipal parking lot on Fuego Canyon Road. You have been assigned as a structure Group Supervisor (see map) in charge of structure protection on the east side of Fuego Canyon, north of Third Street. Your radio designator is Skyline Group on Tac 29. You have five engine strike teams located at the Command Post Staging Area. (ICS Types 1, 2, 3 - one each; you pick the remaining two ICS types). You are not responsible for perimeter control of your group's area. The map shows the structures you are responsible for.

Your assignment is to develop a quick overall plan for structure protection. Answer the following questions and prepare a briefing for your Strike Team Leaders.

QUESTIONS

1. How long do you have for initial deployment? Show fire edge at one and two hours on the writing board/pad.

2. How would you coordinate evacuations with the immediate threat now taking place?

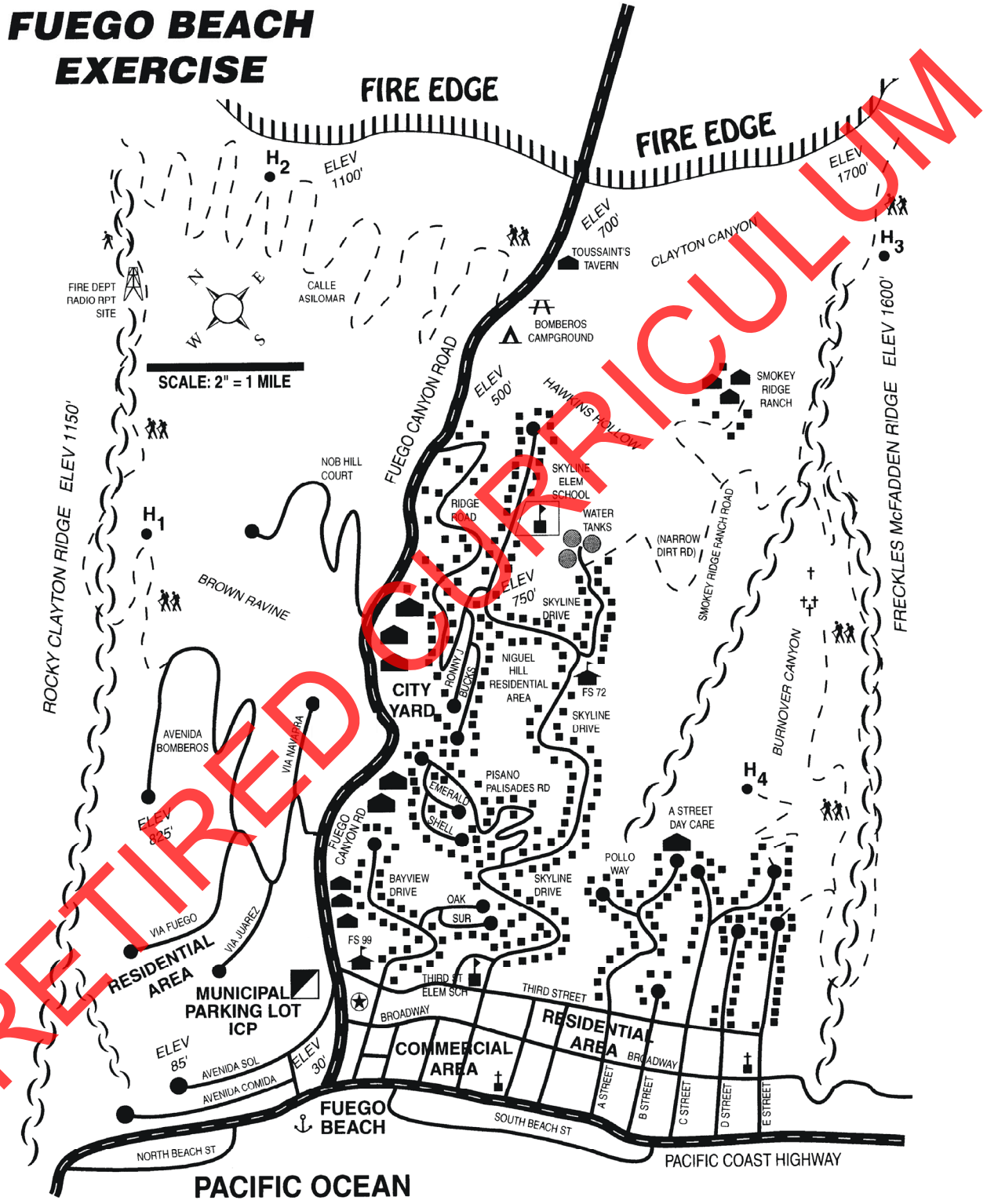
3. How and where would you deploy the strike teams?

4. What safety instructions would you give?

5. What other specific instructions would you give Strike Team Leaders?

6. What logistics problems would you need to prepare for?

7. What other resources have you ordered?



Fire Modeling On The Fuego Beach Fire

The figures shown here indicate the predicted spread rate for a fire that has just started. Since the Fuego Beach Fire is approaching on a wide front, the acres burned per hour would be much greater. For comparison use, several variables were given to the computer. All entries used the same date, fuel age, and fine fuel moisture. For this exercise, a 0% slope will indicate behavior of a fire burning downhill.

Using **0%** for slope and **22** mph wind, the firemod predicted:	
Forward rate of spread	102 fpm
1-hour ellipse length	6,115 feet
1-hour ellipse width	1,176 feet
1-hour area	130 acres
1-hour perimeter	210 chains
Flame length	22.84 feet
Burning intensity	5099.86 BTU/sec/ft

Using **0%** for slope and **45** mph wind, the firemod predicted:	
Forward rate of spread	266 fpm
1-hour ellipse length	15,978 ft
1-hour ellipse width	2,643 ft
1-hour area	761 acres
1-hour perimeter	545 chains
Flame length	35.53 ft
Burning intensity	13325.27 BTU/sec/ft

Fire Suppression Interpretations Of Flame Length And Fireline Intensity

Flame Length in Feet	Fireline Intensity (BTU/ft/sec)	Interpretation
4	100	Fires can generally be attacked at the head or flank by persons using hand tools. Handline should hold the fire.
5-8	101-500	Fires are too intense for direct attack on the head by persons using hand tools. Handline cannot be relied on to hold fire. Equipment such as dozers, engines, and retardant aircraft can be effective.
9-11	501-1000	Fires may present serious control problems – torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
12	1000+	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

Radiation

Radiation is energy in the form of electromagnetic waves moving at the speed of light. All substances radiate energy when their temperature is above absolute zero. Radiant energy is not the same as thermal energy of heat, but radiant energy can be converted to heat and heat can be converted to radiant energy. Heat transfer by radiation is accomplished through this interconvertibility of radiant energy and heat. Radiation is the only means of heat transfer that does not require an intervening substance between the heat source and the receiving substance.

Radiant energy varies greatly in wavelength. All of the radiant energy arranged in order of wavelength forms the electromagnetic spectrum of radiant energy. Thermal radiation ranges from the longest infrared wavelengths to the shortest ultraviolet waves. The intensity of thermal radiation increases with an increase in temperature of the emitting substance, and the wavelength of the most intense radiation shifts toward the shorter wavelengths as the temperature increases.

The electromagnetic waves of radiant energy move only along straight paths. The intensity of radiation received depends on the angle of the incoming radiation and the distance from the source. Radiation perpendicular to the receiving surface is most intense. For a point source of radiation, the intensity decreases inversely with the square of the distance from the source. But for a surface source, the decrease with distance is smaller. The amount of decrease depends on the area of the radiating surface - the greater the surface area, the less the decrease.

Different kinds of substances vary in ability to emit and to absorb radiation. Generally, substances that are good emitters are also good absorbers. Dark- colored materials are usually better emitters and absorbers of radiation than are light-colored materials, and opaque materials are better than transparent ones. A substance capable of emitting and absorbing all thermal radiation is called a black hole.

Not all thermal radiation reaching a substance is absorbed. Part of the radiation may be transmitted unchanged through the substance, and some may be reflected. Reflection does not change the wavelength of the radiation, only its direction of travel. Only absorbed radiation is converted to heat.

Heat Conduction and Wildland Fire

Wildland fuel does not burn in flaming combustion directly. The fuel must first be converted to gases through pyrolysis, a chemical process brought about by heat. Fuel ignition, or the initiation of self-sustaining pyrolysis, requires a finite quantity of heat. This heat must be supplied at a rate adequate to generate enough gases to produce a flammable mixture with air, and from a source hot enough to cause the gas mixture to flame or the char to glow. Radiation and convection can transfer the heat necessary for pyrolysis to the surface of the fuel, but transfer of heat to the interior must be by conduction.

Moisture increases the amount of heat required to raise the fuel temperature to a point where combustible gases are produced; it absorbs part of the heat otherwise available for pyrolysis; and it dilutes the gases produced. Thus, moisture in wildland fuels increases their ignition time and decreases their burning rate.

The thermal conductivity of most wildland fuels increases as the density of the fuel increases. When the thermal conductivity is high, the available heat is transferred through a deeper layer of fuel in a given time than when the thermal conductivity is low. Moreover, there is more material to heat per unit of volume in the dense fuels. As a result, fuels with low density tend to ignite more readily and often burn more rapidly than do high-density fuels. This effect is most important in the larger fuels, which have sufficient mass to absorb significant quantities of heat. Char, with its low thermal conductivity, also slows pyrolysis by reducing the rate of heat conduction from the surface into the interior of the fuel.

Small fuels ignite more easily and produce heat at a faster rate than large fuels because their greater ratio of surface area to volume and their thinner layer of char permit more rapid heat conduction. Small fuels in fuel beds of mixed sizes contribute most to the main flame wave that largely controls fire behavior and determines the difficulty of suppressing the fire. Large fuels usually require an external heat source for complete combustion, and frequently stop burning when the fine fuels have burned out. Large fuels can also be deprived of heat by moving them farther apart or by scraping away surrounding hot material.

We can slow down or stop pyrolysis and reduce heat conduction by cooling burning fuels with water or dirt. Because dirt is a good insulator, however, it should be scraped away and fresh dirt applied repeatedly until pyrolysis has been stopped. Removal of char increases the effectiveness of both water and dirt as cooling agents.

Humidity

For fire control purposes, we can think of the atmosphere as being composed of two gases - air and water vapor. Each of the various ways to measure the amount of water vapor in the air has its own use. For wildland fire, we are principally concerned with the relative humidity, because it affects the moisture content of the wildland fuels. Both air and fuel, like sponges, are limited in their capacity to take up moisture. The capacity of air is controlled by temperature and pressure. However, air is seldom filled to its capacity with water vapor; relative humidity simply indicates the amount of moisture the air actually has compared with what it could hold.

The amount of moisture dead wildland fuels can adsorb is fixed for every level of relative humidity and fuel temperature. The fuels are continuously striving to attain this equilibrium value, but wildland fuels are slow-acting sponges. Because relative humidity and fuel temperature are usually continuously changing, the actual moisture content of the fuels lags behind their equilibrium moisture content. For individual fuel particles, the amount of lag depends mostly on the fuel dimensions - the larger the surface area in relation to the fuel volume, the less lag there will be. Thus, fire fuels are usually close to their equilibrium moisture content, but the moisture content of large fuels may deviate considerably. The compactness of the fuel bed also affects the lag of actual fuel moisture behind the equilibrium value. Loosely arranged, well-aerated fuel beds will have moisture contents nearer equilibrium than more compact fuel beds.

The equipment needed to measure relative humidity in the field is simple and inexpensive. All that is needed is a sling psychrometer and a set of humidity tables. Understanding of its relation to fuel moisture makes relative humidity a convenient and useful tool in wildland fire control activities.

The Fire Environment Concept

Fire environment is the surrounding conditions, influences, and modifying forces that determine the behavior of a fire. Prediction of fire behavior for safe and effective control and use Of fire requires understanding of the interactions of fire with its environment.

The fire environment consists of three major components: topography, fuel, and air mass. From a fire standpoint, topography does not vary significantly with time, but does vary greatly in horizontal space. The fuel component varies in space and in time; however, fuel characteristics, except for the moisture content of dead fuel, change slowly enough to be considered static for any one fire. The air mass is usually the most variable component, changing rapidly in both space and time.

The thermal energy responsible for most environmental interaction comes from the sun. Because the earth's surface is not heated uniformly, temperature and air circulation patterns are set up that create large scale, local, and microscale climatic and weather patterns. The interaction of these patterns with other conditions determines the fire environment for a particular area.

Fire can be considered as a local heat source. As such, it influences and modifies the fire environment. Because a fire creates high temperatures, it can dominate sun-caused heat sources.

The extent of the environment of concern to fire behavior depends primarily on the size and characteristics of the fire. It ranges from a few feet to many miles horizontally and thousands of feet vertically. The vertical extent of the environment varies with fire intensity.

Most changes in fire behavior occur as the fire moves over the terrain and as time passes. Nevertheless, abrupt changes can occur when a fire moves vertically from one kind of environment to another, as when a surface fire in timber crowns.

Fire behavior is the interactions of the environmental components with each other and with the fire. The current state of each of these influences and their interactions determine the behavior of a fire at any moment

Fire behavior is the result of complex interrelationships of aerodynamics, chemistry, thermodynamics, and combustion physics. Nevertheless, it is possible for fire fighters to acquire sufficient skill in predicting fire behavior to allow safe and efficient control and use of fire. Development of this skill must come from experience, and from training in the fundamentals of fire behavior and fire environment.

Fire Whirls

Fire whirls appear frequently in and around wildland fires. Most of the whirls are small and short lived, but occasionally one becomes large and strong enough to do tornado-like damage to forests and structures. Many of the whirls--even small ones can cause problems in fire control operations. The high wind speeds in the whirl increase the fire intensity and also permit it to pick up burning debris, increasing the amount and extent of fire spotting. Fire whirls pose other hazards to fireline personnel. Although part of their life, the whirls re filled with hot and sometimes noxious gases. Often they contain debris moving at high speed that can cause serious injury to anyone caught in the whirl. Although little can be done to prevent or break up fire whirls in wildfires, we know the conditions under which they are likely to develop and the places they appear most frequently. Armed with this knowledge, fireline supervisors can take action to provide for the safety of their crews and to minimize the effect of the whirls on fire control operations.

An unstable atmosphere is often favorable for the development of fire whirls. Easily recognizable signs of instability include numerous dust devils in the general fire area, fair-weather cumulus clouds, gusty and erratic winds, a tall and coherent s smoke plume over the fire, and generally good visibility.

Fire whirls frequently appear where eddies in the airflow can be expected--either the natural airflow or that generated by the fire. Thus, whirls can be expected on the lee side of obstructions, at sharp bends in canyons, and at the confluence of two or more canyons. Since the fire itself may sometimes serve as a block to airflow, fire whirls often develop on the lee side of a fire, particularly near the outside "comers" of the fire front. Fire whirls are often associated with strong convective activity, so within a fire area, whirls re most likely in or near hotspots, such as those created by fuel concentrations or terrain configurations that concentrate the heat from the fire.

Rate Of Spread

Fire History

- ❒ The rate of spread from the approximate time of ignition to time of first crew's arrival
  - This could be in feet per minute of forward progress of the fire
  - Usually reported as acreage upon arrival

Primary Factors That Influence Rate of Spread

- ❒ Slope
- ❒ Wind
- ❒ Fuel type
- ❒ Fuel moisture

Rules of Thumb on Rate of Spread

- ❒ Disregard fuel moisture
  - In an afternoon extended attack situation, it will not normally change significantly until nighttime
- ❒ Wind
  - Generally speaking, as wind doubles, rate of spread will double
  - This applies at wind speeds above 10 mph
- ❒ Slope
  - Generally speaking, the rate of spread will double for each 20% increase in slope
- ❒ Fuel type
  - From brush to grass
    - Generally speaking, the rate of spread will double
  - From timber mixed with brush to grass
    - Generally speaking, the rate of spread will triple
  - From timber and second growth to grass
    - Generally speaking, rate of spread will quadruple
  - From timber and second growth to brush
    - Generally speaking, the rate of spread will double

Rate of Spread versus Slope

Given Slope	Burning onto Slope of	ROS Factor Increase
0%	10%	2.20
0%	30%	3.00
0%	55%	5.90
10%	0%	0.45
10%	30%	1.35
10%	55%	2.95
55%	0%	0.17
55%	30%	0.46
55%	90%	6.55

Using the 1978 National Fire Danger Rating System

California Department of Forestry and Fire Protection
National Wildfire Coordinating Group
By James W. Lancaster, USFS Retired

Fire Management Applications of the NFDRS

The capabilities of the national Fire Danger Rating System have been improved with the 1978 update to the system. The improvements should give Chief Officers a better tool for matching their organizational readiness levels to the fire problem anticipated for tomorrow. The system provides usable answers that are scientifically based, adaptable to need, uniform nationwide, and reasonably inexpensive. Suggested approaches for use of NFDRS numbers in prevention, presuppression planning, initial attack efforts, prescribed fire and fuels management are presented. All such uses of the NFDRS numbers require that Chief Officers be more than casually familiar with the system in order to take full advantage of it.

Chief Officers in most organizations with wildland fire responsibilities daily face the problem of estimating tomorrow s fire business. If you are in this position, here is good news for you!

The key to matching your organization s readiness level to the fire problem anticipated for tomorrow is fire danger. You must come up with realistic estimates of fire danger in order to get effective dollar management. You need a fire danger system that will help you make a judgment decision ***today*** on what kind and number of fires you can expect ***tomorrow***.

To do this, your system needs to consider the kind of fuel (mostly size and amount) and topography that would most likely be involved. This suggests some knowledge on your part as to where fires usually burn in your protection area. Such information is needed for a worthwhile evaluation.

You need to know how likely it is that a fire would burn today, and you need to know how the weather will change the fuels between now and tomorrow night. The NFDRS provides these answers.

It is that simple. Years ago, the estimate was made by looking at the sky, scuffing the ground, and snapping a few twigs in your hand. If you stay in a job long enough, you can be effective that way. However, most people move around a lot today, and valuable structures now exist where there used to be trees, grass, or brush. The trees, water, recreation, grazing, and wildlife on those areas which might burn have become immensely valuable. Therefore, you need a system that will provide answers that are:

- ❒ Scientifically based
- ❒ Adaptable to need
- ❒ The same everywhere in the country
- ❒ Reasonably inexpensive

The NFDRS is scientifically based. Each segment is carefully built on demonstrable principles. However, it is important to remember that its prime purpose is to aid judgment. The numbers are not an end in themselves.

The revised NFDRS can be as simple or complex as your fire organization demands. Each component may be used separately, or combined with other components to provide indexes. Each demonstrates its own message.

The system can be used with ease any place where the proper fuel model has been defined. Additional fuel models can be developed, but all fuels in the 50 states appear to fall within one of the twenty models now available for danger rating purposes.

Cost of NFDRS operation is relative. There does not appear to be any other system in the world offering more accuracy or greater ease of operation for less cost. The cost of operating an effective fire danger system must be judged against the use made of it and the possible losses if a lesser system is installed.

What Do the Numbers Mean?

First, this is not an instruction manual on how to use NFDRS. For that, you need specific instruction in installation, operation, and maintenance of weather stations, in fuel mapping, in slope determination, and in the NFDRS itself. The purpose of the following information is to give you a reference for the components and indexes of the NFDRS and explain how they can be used. Included are some estimates of the relative accuracy of each, and the estimate of what the numbers mean to you as a Chief Officer.

Let s take each component and index of the NFDRS and highlight its use and possibilities of application. To do this, we will first look at the definition, its ranges and number, the designed functions, and possible applications that can help you.

Ignition Component (IC)

A rating of the probability that a firebrand will cause a fire requiring suppression action.

Note that the emphasis on action. For example, will a fire result that requires a fire manager to make a decision? Such action might vary from an all out suppression effort to a decision to allow the fire to continue to burn.

Expressed as a probability, an IC of "100" means that every firebrand will cause an actionable fire if it contacts receptive fuel. Of course, an IC of "0" would mean that no firebrand would cause an actionable fire. This is one reason that the spread component (SC) values are entered into calculation of IC. If a fire will ignite and spread, some action or decision is indicated.

However, the hitch in the application lies in the lack of information on how many firebrands will be present. That is handled in the risk evaluation portion of NFDRS. In the case of person-caused fires, historical data analysis is essential. For lightning fires, the fire-weather forecast provides the basis for estimates of firebrand numbers.

The IC provides some additional guidance for suppression as well as for prescribed fire. For example, experience has shown spotting probability to be closely related to on-site IC values. When firebrands were landing in unburned areas and IC values were over 50, fire fighters can be certain that many would result in spot fires. In higher ranges of 60-80, most will ignite spots. At IC ratings above 80, spot fires will be certain if firebrands are active. Burnout and backfiring planners should also consider IC value in this and similar aspects.

A word of caution is always necessary about extrapolation of any NFDRS numbers. It is essential that ratings computed for a specific location and time be applied very carefully at any other location or time of day. All factors must be considered, and they should be similar. These include elevation, aspect, drainage orientation, surrounding cover type, as well as other factors that go into the danger rating. Also included are the fuel type (model) and slope. When similar conditions are not met, the number must be adjusted with consideration for the changed factors.

One further word about the "relative" numbers in NFDRS. "Relative" in this case means that as a number such as IC doubles, the activity measured (in this case ignition probability [IP] also doubles. This helps thoughtful users of NFDRS to interpret the meaning of these numbers on their management unit.

Spread Component (SC)

A rating of the forward rate of spread of a head fire.

Deeming, et al, (1977), states that the spread component is numerically equal to the theoretical ideal rate of spread in feet-per-minute... This carefully worded statement indicates both guideposts and cautions that must be used when applying the SC.

Rate of spread estimates given by this component can be used as a direct guide to judgments made for readiness levels. This is an appropriated technique in areas where the rapid spread of fire in light or flash fuels is the chief problem involved. It has been used effectively by several organizations in the past - future use will prove even more valuable.

Knowledge of the forward rate-of-spread of a fire can provide excellent presuppression aids in many areas. Dispatchers can use this information, along with reaction and travel times, and crew/equipment production rates to preplan and make dispatches that are more effective. Fire fighters, on a going fire, should be advised, if possible, what rates-of-spread to expect. Actual spread compared to NFDRS predicted spread will provide a reasonable guide for suppression action in the next few hours or perhaps on the next fire encountered.

For prescribed fire, the forward rate-of-spread should be of considerable value in guiding, planning, or carrying out burns. As experience is gained in this area, prescribed burn managers will become more proficient at all aspects of this important job. Use of spread numbers provides a reliable measuring stick.

Whether wildfire or prescribed fire, the forward spread may change drastically when the head fire enters even a small type change in the fuel. Fire officers and fire fighters should be aware of the variability of fuels in which they work. It is a good idea to study and learn some of the "benchmark"

spread levels. This means: look at specific values of fuel moistures and wind speeds, work out the spread values in the fuels concerned and become familiar with the differences. Get a "feel" for the numbers this way, as well as a reference point fixed in your mind. It will help, since actual spread is so often the key to fire containment.

When estimating spread from SC, one must remember the conditions that must be met or evaluated. IF the fuel model that is used and the fuel bed considered for rating agree perfectly, and IF the slope class is evaluated properly, a head fire should move forward at the numerical SC in feet-per-minute. That is, if the SC is 66, the flaming front will move one chain per minute, when no spotting, crowning, or other erratic fire behavior is occurring. With erratic fire behavior, all bets are off, and overall spread may greatly exceed values indicated by the SC. It is important to establish a correlation between the SC numbers and localized fire experience. Remember the big "IFs."

Most of the time, however, in natural fuels, the fuel bed will not be perfect - that is, exactly as the fuel model applied. Usually it will be somewhat less uniform, with resulting slower rates of spread. There will be few situations encountered when the variations in fuel beds will act such that the spread may exceed the predicted by SC. Only experience will reveal this problem. The user should then reconsider the fuel model assigned. Again, local fire experience will help to "calibrate" the system in the minds of the user.

In the 1978 version, SC sensitivity has been dramatically increased by using an open-ended scale rather that the 0-100 scale used in 1972.

It must be remembered that only standard weather instruments and measurement techniques are to be used. Anything different in either of these categories will produce NFDRS values that **cannot** be expected to predict accurately the behavior of a going fire. The use **must** consider these factors when applying the system.

How then with all these preconditions, can one make valuable use of the NFDRS in the field? The answer is that the user must use the numbers as a judgment aid - not as a hard and fast rule. He or she must take into account the factors that may act or result in fire spread which are different than the numbers predict. Usually differences will be acceptable if the user is knowledgeable and aware of the system limitations.

Energy Release Component (ERC)

A number related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of a fire.

Since this number is based upon the potential "heat release" per unit area in the flaming zone, it provided guides to several important fire activities. Daily variations in ERC are due to changes in the moisture content of the fuels present. It may also be considered a composite fuel moisture value or "index."

ERC has a high potential for special applications. Its chief immediate value is probably for planning, especially in the medium and long-range areas, i.e., one day to one year. Once analysis has been made,

and a history built in terms of the new ERC, the way is opened for several immediate planning applications.

As a composite fuel moisture "index," ERC also becomes a relatively stable evaluation tool for planning decisions that might need to be made 24 to 72 hours ahead of an expected fire situation. As a composite fuel moisture "index" and since wind does not enter into its calculation, the daily variation will be relatively small. The 1000 Hr TLFM is a primary entry into the ERC through both living and dead fuels. There may be a tendency to pull the 1000 Hr TLFM out and use it as a separate "index" for drought considerations. Once again, let us put forth a word of caution - any use of the 1000 Hr TLFM as a separate "index" must be preceded by an analysis of historical fire weather data in order to identify critical levels of 1000 Hr TLFM. A better solution to a consideration of drought lies in the ERC since it reacts similarly to the 1964 DFDRS build-up index and considers all dead and living fuel classes.

Because of the ERC built-in stability, it becomes a valuable tool for prepositioning fire fighters and machines. With all other factors equal, one can expect that the area with the highest ERC will usually experience the most difficulty in fire containment, given a fire occurrence.

As in all NFDRS evaluation, it is important to have a history of past ERC values experienced in your area. With this in hand, ERC values can be related to the extremes for a rating area.

As soon as some experience is gained in use of ERC, it is expected to be applied to many management problems. In prescribed fire, it will be a specific tool to predict the depth of burn of litter fuels, and in consumption of other fuels of various sizes. Correlation will be worked out and as the new ERC values become more familiar, additional application, possibly some not yet recognized by the system creators, will be made. The special values of most applications will become apparent as local experience and work is related to new ERC values.

It should be again pointed out that the ERC is a "build-up" type of index. With the new modifications prepared especially for the 1979 version, this value is greatly enhanced. ERC will now do a good job of handling drought evaluation in fuels. It is no longer restricted to a 0-100 scale, and thus its sensitivity has been increased.

Some experience with running 3-day averages of ERC has indicated this number will be quite valuable. For example, the 3-day average (yesterday's and today's observed value and tomorrow's predicted value, averaged together) has been successfully applied to prescribed natural fire decisions. When evaluated against historical 3-day averages through analysis, its value for such decisions becomes readily apparent.

Occurrence Indexes

Lightning Fire Occurrence Index (LOI)

A numerical rating of the potential occurrence of lightning-caused fires.

Man-Caused Fire Occurrence Index (MCOI)

A numerical rating of the potential occurrence of man-caused fires.

Deeming, et al, (1977), has prepared an excellent detailed discussion of the interpretation of these indexes. As he noted, they can be interpreted directly in terms of number of fires per million acres. A value of 100 in either index indicates 10 fires per million acres, on an average. For a full understanding, that publication should be both read and studies.

CAUTION! You must remember that these occurrence numbers have been developed on an average basis. If the rating area is reasonably large, and fires frequent, the chances are that the numbers predicted will be reasonably close. Conversely, if rating areas are small and fire numbers low, it is likely that numbers of fires predicted may vary considerably from actual numbers. Because of the uncertainty in firebrand and risk evaluations, the system cannot help much in low fire business situations. As a guide, system evaluations are questionable when a total fire's per million acres average twenty or fewer. If you already have a predictive scheme that works in these situations, you d best stick with it. Please advise the developers of NFDRS about your system!

To translate fires per million acres to fires per rating area simply multiply either Occurrence Index by the area of the rating area in millions of acres and divide by 10.

Much experience needs to be gained in the use of occurrence indexes. Evaluation of risk has been a problem in the past. This has been due primarily to the lack of guidelines that are now available in a very workable form. Again, please refer to and study Deeming s treatment of risk in his 1977 publication.

Burning Index (BI)

A number related to the contribution of fire behavior to the effort of containing a fire.

BI is represented in NFDRS by a calculation of flame length in feet multiplied by 10. To improve its sensitivity, the scale is no longer restricted to 0-100. This makes the 1978 version of the BI about three times as sensitive as it was in the 1972 version. This, together with other changes allows a range of numbers adequate to define problems, even in time of low to moderate fire danger.

The following table, adapted from Deeming (1977) will provide a discussion base. It gives several checkpoints that relate BI to fireline intensity and flame length. It s important to remember that a computed BI represents the near upper limit to be expected on a rating area. That is, if a fire occurs on the worst fuel, weather, and topography on a rating unit, these numbers indicate its expected fireline intensities and flame length.

BI-1978	Flame Length (FT)	Fireline Intensity (BTUs/S/FT)	Narrative Comments
0-30	0-3	0-55	Most prescribed burns are conducted in this range.
30-40	3-4	55-110	Generally, represent the limit of control for direct manual attack methods.

BI-1978	Flame Length (FT)	Fireline Intensity (BTUs/S/FT)	Narrative Comments
40-60	4-6	110-280	Machine methods usually necessary or indirect attack should be used.
60-80	6-8	280-520	The prospects for direct control by any means are poor above this intensity.
80-90	8-9	520-670	The heat load on people within 30 feet of the fire is dangerous.
90-110	9-	670-1050	Above this intensity, spotting, fire whirls, and crowning should be expected.

In the 1972 version of NFDRS, calculations of flame length at the fire's head were used to provide the BI tables. Later studies indicated the containment job is not proportional to flame length but to the fireline intensity, the rate of heat release per unit length of fireline, (Byram 1959). The use of fireline intensity shows the containment job actually increases more than twice as fast as BI does. Flame length is related to fireline intensity because BI is based on flame length, so the BI fireline intensity and flame length are interrelated.

To really zero in on what can be expected in your area, you should first look at the historical values of BI that have occurred there. Computer program FIRDAT provides the best way to do this. The use of FIRDAT requires fire weather data in machine-readable form (Cards or tape) otherwise the data must be hand calculated from your NFDRS records. In the end, machine-readable data is much cheaper since it allows machine analysis.

So, what will the BI values really tell you? Well, without historical analysis and some time spent studying the system and analysis, probably nothing. In other words, you have to listen and learn. Here are some additional suggestions.

Start by thinking in terms of BI and flame length. Fireline intensity can come later. This fire season looks at current values and makes some estimates of flame length when you are on a fire. Make some notes, and relate the fire sites to the danger station site. Are they comparable? If not, what adjustments are needed in the ratings? In the observed estimates? Why are differences apparent?

Better yet, take some fire site weather measurements. If you have access to a fire weather forecaster, work with him or her. Remember that lots of fire research work has gone into establishment of these relationships. If they seem wrong, try to find out why.

Another necessary step is to encourage your associates to give fire danger a chance to help. The numbers may not, probably will not, represent exactly what you get. However, they will provide good guides - and that s what NFDRS has been designed to do.

Fire Load Index (FLI)

A rating of the maximum effort required to contain all probable fires occurring within a rating area during the rating period.

The FLI has been designed to be the product of NFDRS - the basic preparedness or strength-of-force presuppression index for an administrative unit. It should be used to help set the readiness level for the suppression unit. This may be a USFS Ranger District; a National Forest; a BLM District a county, a DNR District; a National Park, or whatever. It focuses attention upon the total daily fire containment problems for a manager.

Again, as with all other NFDRS numbers, it is intended to aid a judgment decision. In many cases, this can mean high dollars hinging upon its proper application. Thus, it is very important that some historical data be analyzed. Again, the FIRDAT program is the best aid. Using this program, and the accompanying techniques that have been successfully adopted by many agencies, a manager can set realistic, workable levels for governing readiness in his/her organization.

Because the meaning of FLI values will vary from one organization to another and from one area to another, managers will have to assign the relationships between FLI and their own evaluation of total fire containment effort. It is, in effect, an administrative index, intended to measure the potential fire situation. The user thus assigns the units of measurement. The scale is 0-100.

FLI values provide no specific information on the nature of the potential fire problem. To get that, one must look at the other indexes and components. Because FLI includes a consideration for the number of fires expected as well as the problem they will present to contain, it does provide an overall evaluation for managers.

If a land manager has a speaking acquaintance with FLI, and if he or she has capable, knowledgeable people handling his/her fire responsibilities, the guidance that FLI provides can be the key. Get acquainted – it is worth the time!

How Can Chief Officers Use NFDRS?

Even thought the NFDRS is not a fire behavior prediction system, the rationale is sound for use of NFDRS numbers to provide guidance in applying it to predicted fire business. If you know that the approximate upper limit of fire behavior is going to pose a specific control problem, steps usually can be taken to handle the problem.

The NFDRS cannot predict how every fire on a rating area will burn. However, because it provided short-range guidance (the next 1 to 24 hours) it can be made into a very valuable tool. It does evaluate the near upper limit of the behavior of fires expected on a rated area during the rated period.

For the Chief Officer who wants to know more about what goes into NFDRS, a structural diagram is included. It is taken from Deeming s publication (1977). A few considerations and changes are not

apparent. These include length of day, latitude, number of slope classes (now 5), and the improved methods of handling live fuel moistures. Again, information that is more detailed is available in USDA Forest Service Technical Report INT-39, "The National Fire Danger Rating System - 1978," by Deeming, Burgan, and Cohen.

However, the Chief Officer rarely has time to study and become an "expert" on danger rating. It is suggested that all Chief Officers take the time to become at least familiar with the rationale and the terms of NFDRS. At least, know the difference between components and indexes, and what each is supposed to evaluate. These are a part of the vocabulary of the fire professional.

Of course, to make realistic and valid judgment for fire decisions requires much more than the preceding paragraph implies. If today you are going to make such decisions for the "future," one of the best aids is to study the patterns of the past. The best source for this type of study is a collection of statistical analysis programs called FIREFAMILY that consists of three programs FIREDAT, SEASON, and FIPINF. The analysis process consists of extracting the recorded weather information from the National Fire Weather Data Library for the fire danger weather station of interest. The more stable factors of topography, climate, fuel type, elevation, herbaceous type etc., are provided as user input and combined with historical weather records to calculate the NFDRS components and indexes. This provides a direct comparison of the NFDRS now with what it would have been if the NFDRS had existed at the time the weather data was collected.

Briefly, the FIREFAMILY programs can be used like so: FIREDAT is used as a planning tool to determine the relative efficiency of fire protection measures by normalizing the fire weather across the years being compared. It can also be used in a predictive scheme by providing the basic information used by the program SEASON. SEASON uses the historical components and indices generated by FIRDAT to provide a trace of fire weather across a graph representing the months of the year. This product is useful as a quick visual impression about the "normal" appearance of a station s seasonal pattern. A high and low value is also shown to indicate the amount of daily variation that occurs in that area.

The FIRINF has as its major function the task of relating the occurrence of any particular range of one NFDRS product and the occurrence of another particular range of a second NFDRS product in the same day. FIREFAMILY is a FCC based statistical analysis program that draws its data from the National Fire Weather Library at Fort Collins, Colorado, and from NFDRS users. The program is maintained and controlled by the NFDRS work unit, CFP Liaison Office, Boise, Idaho.

Local Calibration - A Frame of Reference

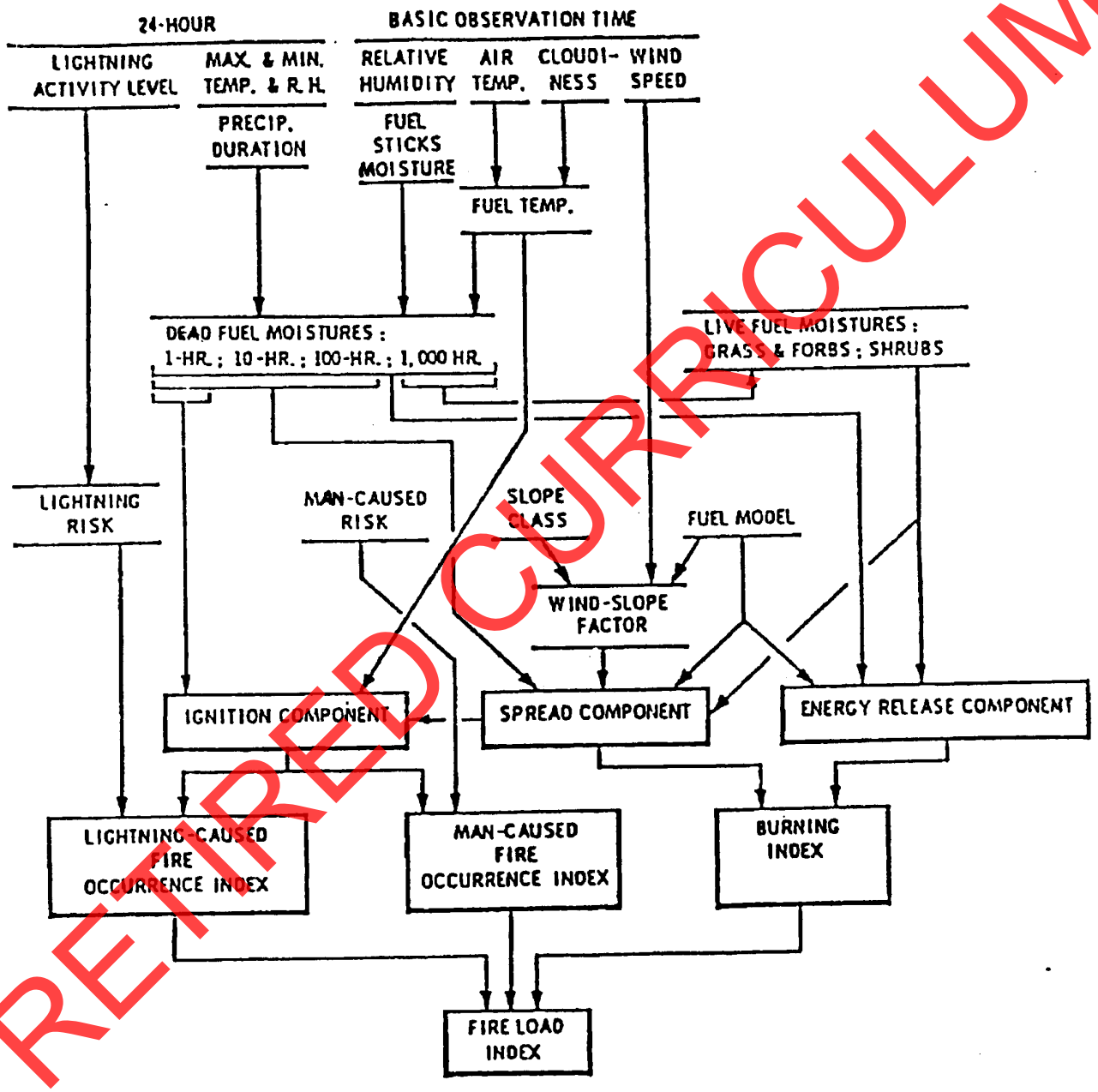
O.K. NOW WHAT? You now have the basic information on what the system is all about and what the numbers mean p but you need more. Not much more, but you have to have some frame of reference for your area of responsibility. You need some analysis plus a look at the statistics involved.

This is a pitch of the Chief Officers to take a quick look at what he or she requires his or her managers to study and digest.

Because of the elemental differences in fire danger between areas, your extremes are going to differ from your neighbors. These differences are due to fuels and topography as well as to weather. These

are the real differences. The summation of these factors spells out the fire danger differences, provided rating stations are installed, operated, and maintained to national standards. It is important to recognize that fire danger differs from place to place.

1978 NATIONAL FIRE DANGER RATING SYSTEM



Organization

Principles of Organization

What is organization? Simply stated, an organization is a group of people working together to achieve a common objective. It can also be visualized as a formal arrangement of people to do a job. Organizations must have certain significant characteristics including the following elements:

- ❒ A system of authority and responsibility
- ❒ A system of direction and communication
- ❒ Coordinate action toward specific objectives
- ❒ A system of maintaining acceptable norms and standards

Now let us specifically apply them to our extended attack fire situation.

System of Authority and Responsibility

Your agency head has set up part of this system for you. "There shall be one and only one Incident Commander. This person has the authority and responsibility to do whatever is necessary to achieve the agency's objective. Within guidelines such as ICS, that person can set up the organization as they want it."

A System of Direction and Communication

Basically, you use the two communication methods of radio and face-to-face communication, supplemented by written messages, computers, the telephone when possible, and electronic media such as a PDA. Face-to-face is always the best method of communication. You must recognize the communication system as a key element in passing information and directives in your organization.

Messages that everyone should know about, such as appointment of key players and changes in fire behavior, should be delivered over the radio.

Coordinated Action toward Specific Objectives

How well you organize your forces helps determine how successful you will be in obtaining your objective - rapid, efficient, control of the incident.

A System of Maintaining Acceptable Norms and Standards

You already have formed in your own mind, based on your knowledge and experience, some reasonable norms and standards. We have attempted to suggest some more standards brought out by scientific case studies. (Dozer studies, hand crew capabilities, progressive hose lay speeds, fire history, etc.) The point here is to make sure that you establish a system within your organization to see that these norms and standards are met.

The Incident Command System was designed to provide these basic organizational elements in a universally understood format. The initial attack Incident Commander has a Field Operations Guide and ICS Form 201 to guide early organizational activities. The California Incident Command Certification System (CICCS) also supports norms and standards.

Elements

Now that we have talked about some of the elements of an organization, let us look at the four key principles you can use to set up your organization.

Span of Control

What is span of control? It is the number of people or units a manager can effectively direct and control. A management unit is that person or unit that reports directly to you. It is an acceptable principle that your span of control should not be less than three or more than seven. Five is the norm.

Unity of Command

Each employee should have only one supervisor. While we all probably agree to this principle, it is probably the hardest to attain, and the *most violated*.

Clear Definition of Authority and Responsibility

A person should know what authority they have and what their duties and responsibilities are. A person should not have responsibility for a job for which they do not have clear authority to perform.

Unity of Objective

This is obvious in our fire situation, but it must never be forgotten in the setting up of our fire organization. It is a principle that can never be overlooked in any organization. The objectives should be conveyed to everyone combating the incident.

Commit these four key elements to memory and use them. They apply to virtually all organizational situations:

❶ Span of control

❷ Unity of command

❸ Clear definition of authority and responsibility

❹ Unity of objective

Direction

We have now had discussions relative to the management terms of planning and organization. The third step in the four steps of management is "direction." The word sounds simple enough; it is a very common word, and one we use almost every day. Do we really understand the word, especially as applied to the principles of good management?

We are more interested in the latter definition, especially that portion where it states, "Instructions to be followed."

Webster's dictionary offers two definitions for "DIRECTION"

1. Management; guidance; as the direction of a business
2. Instructions to be followed; order; command; as to give directions

Direction, as applied to fire management, is quite simply, communication. It is how we communicate our directions that determine if we will succeed or fail. All too often in the management of incidents, we are in a hurry and under all kinds of pressures, ranging from the supervisor who wants to know what you are doing about getting that fiasco under control, to the person who is screaming in your ear about the barn or house being on fire.

It is tough at best to communicate under these conditions. However, if we are going to be good Chief Officers, then we must discipline ourselves to the point that we are sure our directions are understood.

You can have the finest plan and the greatest organization, but if you cannot communicate your directions so they are well understood, then you have lost the game.

Generally speaking, there are two systems of communication available to you on a fire - either radio or face-to-face. Generally, the radio is more difficult to use when it comes to giving directions. You are better off if you can communicate face-to-face. This allows a free flow of conversation.

Now, let us get to the point. A good directive must provide the following information:

① **Who** is to perform the work?

② **What** is to be done?

③ **When** it is to be done?

④ **Where** it is to be done?

⑤ **Why** it is to be done?

At the end of your directive, do not be afraid to ask, "Do you have any questions?" Oftentimes, direction can be conveyed by simply passing on your objective(s) to the receiver of the information. Remember good directions and communications can lead to success. Poor directions and communications can lead to misunderstanding and eventual failure.

Control

What is control? Why have controls? What control do Incident Commanders need to employ? For our purposes, a control can be defined as a method, or system designed to inform the IC of a breakdown in the operation in time to correct the situation and still meet the objective.

Sounds simple does not it; but it is not. We have already seen planning, organizing, and directing are not easy tasks. In fact, it is hard, intellectual work in any situation. In a fire situation, it is even worse. Why? Because it has to be done right now. In fact, as extended attack Chief Officers, we have to do the whole show. We have to plan, organize, direct, and control. We have to do it, and do it right now. Among the functions of planning, organizing, directing, and controlling, the most important for us as officers and those that are most poorly done, are the managerial functions of planning and control. It is almost impossible to separate the two. Why? Because you cannot possibly control without a plan. You cannot know if you are going where you want to go unless you know where you want to go. Since control is the job of making sure things happen according to your plan, you must, obviously, first have a plan.

Webster's dictionary defines control as

1. Power, authority
2. Holding back, keeping down, restraint
3. Means of restraint, a check
4. To regulate

Planning is hard to do; controlling is no easier. In fact, controlling is probably harder because you are dealing with people. In many cases, people we know well, either as subordinates or of equal rank, or even of superior rank. Yet, in our role of IC, we have to control all these people. It is not easy. We know how we dislike stringent controls. We know our jobs and do not like people constantly checking on us. Now, how can we, as Incident Commanders reconcile our need for control and basic subordinate resistance to control?

In day-to-day operations, a good rule to work by is not to impose too rigid a system on your subordinates. Use only that amount of control that is necessary to get the job done. How about control of emergency incidents? Remember that you have to meet your objective of controlling the fire... not sometime tomorrow, or next week, but right now. Your control of an extended attack fire situation, or any fire situation, should be quite rigid, even at the risk of annoying your subordinates, peers, and even your supervisors.

Remember the definition of control - to inform you in time ... to permit you to correct the situation and still meet your objective. Any deviations of your plan or breakdowns in operations that may change your plan must be known by you in time enough to correct the situation. That is why our control system must be rigid. We have to know what is going on almost constantly; and that is what our control system must show us.

Elements of Control

What are some control elements available to us during a fire situation?

Constant Visual Control

There are many fire situations where you can actually watch what is going on almost constantly.

Periodic Reporting from Your Subordinates

Especially important when you cannot see everything that is going on; also periodic checking with your subordinates.

Periodic Inspection by You

A good control method. However, remember that the role of the Incident Commander dictates that you remain at the command post the majority of the time.

Aircraft (Fixed Wing and Helicopter)

A very effective control tool when available. You (they) can see the big picture and can immediately report any breakdowns.

Listening

Listen carefully at all briefings. Pay attention to what others are saying on the radio.

Incident Report on Conditions

1. Type of incident
2. Location
3. Size of incident
4. Extension
5. Topography
6. Material involved
7. Potential
8. Equipment needed

1. Plan of attack
2. Weather
3. Special problems
4. Life hazard

-- or --

What **has** happened?

What **is** happening?

What **will** happen?

Clear Text

Affirmative ..... Yes.

At Scene ..... Used when a unit arrives at the scene of an incident. Example: "Dispatch, Engine 8, at scene."

Available ..... Used when a unit is ready for a new assignment or can return to quarters. Example: "Engine 71, available."

Available At Residence ..... Used by administrative or staff personnel to indicate that they are available and on-call at their residence.

Available At Scene ..... Used when a unit is still committed to an incident, but could be dispatched to a new emergency if needed.

Burning Operation ..... Used to describe three types of managed fires: 1) a back fire or burning out on a wildland fire, 2) a prescribed burn, or 3) a vegetation management project

Call ____ By Phone ..... Self-explanatory.

Can Handle ..... Used with the amount of equipment needed to handle the incident. Example: "Dispatch, Battalion 9, can handle with units now at scene."

Command ..... Radio designator for the Incident Commander. Normally preceded by the name of the incident. Example, "Dispatch, Battalion 10, at scene and assuming command as Pine Command."

Copy, Copies ..... Used to acknowledge message is received. Unit radio identifier must also be used. Example: "Engine 1, copies."

Disregard Last Message ..... Self-explanatory.

Emergency Traffic ..... Term used to gain control of radio frequency to report an emergency. All other radio users will refrain from using that frequency until cleared for use.

Emergency Traffic Only ..... Radio users will confine all radio transmissions to an emergency in progress or a new incident. Radio traffic that includes status information such as responding, reports on conditions, at scene, and available will be authorized during this period.

En Route ..... Normally used by administrative or staff personnel to designate destinations. En route is ***not*** a substitute for responding. Example: "Dispatch, Chief 4 en route to City Hall."

Fire Contained ..... Forward rate of spread of the fire has been stopped.

Fire Under Control ..... The fire will no longer spread anywhere on its perimeter and mop-up has started.

In Quarters ..... Used to indicate that a unit is in its station. Station identifier must also be used. Example: "Dispatch, Engine 5, in quarters, Station 5."
(with station name or number)

In-Service ..... Used to indicate a unit is operating, not in response to a dispatch. Example: "Dispatch, Engine 7, in-service, fire prevention inspections."

Is ____ Available For A Phone Call? ..... Self-explanatory.

Loud And Clear ..... Self-explanatory.

Negative ..... No.

Out-of-Service ..... Used to indicate a unit is mechanically out-of-service. Example: "Dispatch, Transport 6, out-of-service."

When repairs have been completed, the unit is back in-service. Example: "Dispatch, Transport 6, back in-service, available."

Repeat ..... Self-explanatory.

Report On Conditions ..... Brief description of incident characteristics.

Respond, Responding ..... Proceed to or proceeding to an incident. Example: "Engine 72 responding." or "Dispatch Engine 3 responding."

Resume Normal Traffic ..... Self-explanatory.

Return To ..... Used to direct units that are available to a station or another location.

Stand-By ..... Wait.

Stop Transmitting ..... Self-explanatory.

Uncovered ..... Used to indicate a unit is out-of-service because no personnel are available to operate it.

Unreadable ..... Used when the signal received is not clear. In most cases, try to add the specific trouble. Example: "Unreadable, background noise."

Vehicle Registration Check ..... Self-explanatory.

Weather ..... Self-explanatory.

What Is Your Location? ..... Self-explanatory.

Unified Command

This chapter expands the explanations of Unified Command that are contained in Sections 4.1.2 and 4.2 of the Operational System Description (ICS 120-1). The supplement begins (Section II) by briefly describing the kinds of incidents that can occur in today's complex environment. Section III defines the Unified Command concept as a viable framework for managing complex incidents more efficiently. This section also provides goals and broad guidelines for the concept. Sections IV and V provide a broader perspective on the ICS and its planning process, and show how the proper application of ICS will enhance the effectiveness of a Unified Command.

Section VI addresses the perplexing question of "Who is in charge here?" It shows how the Operations Chief utilizes the Incident Action Plan as his direction from the Unified Commanders, and how that Operations Chief becomes the single focus for all tactical and operational activities.

Sections VII through IX provide more depth to the responsibilities of Unified Command participants, and offer guidelines and alternatives for implementation of the concept. Section X offers questions and answers that will further help to describe Unified Command.

Why Unified Command?

More than 90% of the emergencies that occur daily in the United States are readily and effectively handled by local, jurisdictional agencies with their first, second, or sometimes third response. On a small percentage of emergencies, the responsible agency may exhaust its own resources and call on neighboring jurisdictions for assistance. Many agencies are adept and experienced with "automatic aid" and assist each other on a routine basis. These incidents do **not** call for Unified Command and are best managed under the "single-command" structure.

Some 3%-7% of all emergencies, however, become serious enough to **require** the response of two or more agencies, each with its own legal obligation to perform some type of action on the incident. It is on these critical, multiple-involvement emergencies that Unified Command is applied. Some examples:

Incidents that Impact More Than One Geographical Jurisdiction:

The classic example is of wildland fire starting in one jurisdiction and burning into one or more others. The responding agencies in each jurisdiction all have the same basic mission (fire control) and it is the political, geographical boundaries that mandate multi-agency involvement.

Incidents That Impact More Than One Functional Jurisdiction:

Major commercial airplane crashes are an example. Here, the management challenge increases. In one geographical location, fire, law enforcement, health services, the FAA, and others **all** have legal responsibilities to perform their **different** missions, all at the same time, and in the same place. It is the functional role (legal obligation) and not the geography that brings about the multiple involvement.

Incidents That Impact Multiple Geographic AND Functional Agencies:

These occur with storms, earthquakes, and other massive emergencies. They present the greatest incident management challenge and are typified by the Mt. Saint Helen's eruption and the Three Mile Island nuclear accident. In these cases, large numbers of federal, state, and local agencies become involved. These emergencies cross geographic boundaries and overlay multiple functional authorities. Roles, missions, and responsibilities are intermixed.

In today's world, the public, private, and political values at risk in major emergencies demand the most efficient methods of response and management. Meeting this demand when multiple and diverse agencies are involved becomes a very difficult task. The Unified Command concept offers one major tool that all participating agencies can use to improve overall management.

What Is Unified Command?

Unified Command is the first consistent, systematic means of organizing a variety of agencies into one concerted effort. The concept offers a uniform and "trackable" procedure that enables all emergency response agencies to perform their roles effectively. Unified command overcomes much of the inefficiency and duplication of effort that now occurs when "functional" and "geographic" jurisdictions, or agencies from different government levels find themselves trying to work together without a common system.

The concept follows all the known and established principles of emergency management. It does **not** require new or untried approaches, or change the way various parts of the actual emergency are handled. There is a large flexibility to the concept number that is, there are not "hard and fast" rules to restrict an experienced emergency manager. There are goals, recommendations, and procedural guidelines. These are presented to assist in establishing a management framework that fits the size and type of emergency, and the agencies involved.

No two emergencies are ever exactly alike. It is to be expected that Unified Command will never be applied in exactly the same configuration on any given emergencies. Goals and guidelines provide only a general pathway for the commanders. Specific actions and decisions, even those that may seem to modify the concept, must be made by those who bear responsibility for the outcome of the emergency effort.

The Goals of Unified Command

- ❒ Improve the information flow and interfaces between all involved agencies
- ❒ Develop a single, collective approach to the incident, regardless of its functional or geographical complexities
- ❒ Optimize the efforts of all agencies as they perform their respective missions
- ❒ Reduce or eliminate duplicated efforts and omissions

Initial Guidelines

Learn the System

The Incident Command system has a tremendous adaptability. The more it is understood, the easier it will be to establish a Command structure that fits the particular character of any incident. Pre-emergency simulations involving those agencies that may be expected to participate in an actual incident are an excellent tool for both learning the system and acquainting the players with one another.

Co-locate

Establish the on-site Command Post (and other facilities) where all agencies can operate together. Avoid the confusion created by separate command, planning, and logistical set-ups.

Start Small

Technically, Unified Command should begin the moment two or more agencies have jurisdictional responsibilities on an incident. Getting together early in an incident's development, staying together, and sharing intelligence and individual agency decisions, helps smooth the way for more complex operations if the emergency escalates. Avoid the perception the Unified Command is something "rolled out of the closet" after conditions reach crisis proportions.

ICS Characteristics Pertinent to Unified Command

The Incident Command System is based on commonality. All agencies use the same terminology and the same organizational structure. When they meet together on an emergency, there is clear understanding of information and immediate knowledge of the chain-of-command. ICS procedures should be uniform from agency to agency, thus facilitating every individual's ability to obtain instructions, pass on information or requests, and perform assignments.

This commonality is a major departure from "traditional" ways agencies formerly operated, and it creates significant opportunities to improve over old methods. On emergencies, if all involved agencies are using the same organization and procedures, there are few differences in operations. In essence, they are "one" organization and they can be managed as such. Instead of several command posts, operating independently, the organization can be directed from only one location. Instead of preparing several sets of plans, only one set need be prepared to inform all participants. In place of several logistic systems, only one logistical procedure need be used. Instead of multiple operations occurring randomly, there is only a single operational organization.

These five ICS characteristics - ***one*** organization structure, ***one*** Incident Command Post, ***one*** planning process, ***one*** ordering process, and ***one*** Operations Chief (at any given time) enables an effective approach to the management of a multi-agency organization.

That approach is called Unified Command. However, it can be most helpful in understanding the concept to first visualize it as "unified effort." In fact, the ultimate command and responsibility for

each involved agency is not shared or abdicated. Each agency's senior officer present maintains authority and accountability for their forces and actions throughout the incident.

However, by meeting and working together at one location, preparing a single plan of action, having a single Operations Chief, and using one logistical process, the senior officers (Unified Commanders) are able to share information, coordinate actions, best utilize resources, and cope with rapidly changing incident conditions. This unified effort is supported and reinforced by the ICS planning process.

The Planning Process for Unified Command

Throughout this discussion, the word "process" will be used. The process consists of 1) collecting and documenting incident intelligence (conditions, resource status, situation status), 2) formulation of agency objectives, 3) preparation of an Action Plan, and 5) activation of the plan. There is a great deal of flexibility in the **way** this process can be performed. If, for example only a few minutes are available to save a life or a structure, the objectives **and** "Action Plan" can be formulated in an instant, and all directions and orders will be verbal. On the other hand, if the incident response effort is a major one, then the whole process can be formalized and thoroughly documented. For experienced commanders and planners, the formal process only takes an hour or so, even on complex incidents.

The planning **process** for a Unified Command incident is the same as that for a "single" command, except that more players are involved. The process allows for both functional and geographic response authorities to input and combine objectives and action.

The process starts with the documentation of the Incident Commander's (in this case, each of the Unified Commanders') objectives, based upon the character and potential of the incident. The objectives stated by the commanders may be widely different, depending on their agency's role(s) in the incident.

Example:

Agency A:	"I must keep this fire from entering this watershed."
Agency B:	"I need to protect these structures."
Agency C:	"I must evacuate the people in this subdivision."

These objectives and all others the Commanders may have, are developed and documented with all agencies present. They are developed in an atmosphere that recognizes the autonomy of each Commander. It is extremely important to recognize that this is **not** a "committee process" that must somehow resolve all differences in agency objectives before any action begins. It is, however, a "team process," and through the open sharing of objectives and priorities, the team formulates a set of collective directions to address the needs of the entire incident. Experience to date has shown that this collective sharing of information and objectives has led to a voluntary sharing of resources and

modification of original objectives to meet overall requirements. The process results in a collective, unified effort that exposes (and reduces or eliminates) duplications and omissions in incident response strategy.

The Unified Commanders' objectives are given to the Planning Section. Here, the staff works through the details and analysis necessary to develop an Incident Action Plan that will respond to each of the command objectives. Needed resources are ordered, and assignments are made to all components of the organization. When the Action Plan has been drafted, it is reviewed and approved by the Unified Commanders before it is "published" and action begins. In this way, each Commander can ascertain that his agency's mission will be met to the highest degree circumstances will permit. If certain objectives have not, (or cannot) be met, or if incident character has changed, readjustments to the total plan can be made at this time.

Role of the Operations Chief in Unified Command

We have explored (above) some of the modern-day complexities of incident management. We have briefly discussed two primary functions of command (developing objectives and approving the Action Plans). The fact that Unified Command is **not** a "committee" project has been presented.

Yet experienced professionals are probably still bothered by the significant questions, "Who is in charge here?" "Who makes decisions?" and "Who is accountable?" To answer those questions we shall now examine the position of Operations Section Chief and that position's relationship to the Incident Action Plan.

Once the Action Plan has been approved by the Unified Commanders, it is presented to the Operations Chief (and all other line and staff) for execution. If the Plan has been properly prepared, it will contain all involved agencies' input and approval. The Plan becomes, in effect, the Operation Chief's "manual" or "Standard Operating Procedure" (SOP) and the Chief becomes the "line officer" responsible for carrying out its direction.

The Operations Chief is the ***single*** responsible party for achieving the ***tactical*** application of the Action Plan as it relates to incident response activities (Finance and Logistics also receive direction from the Plan, but theirs are supporting roles.) The Plan contains the Operations Chief's objectives, assignments, and orders. The Operations Chief is responsible and accountable for all tactical decisions or changes that may be necessary to comply with the Plan. Even though the Operations Chief works under a Unified Command, in a multi-agency environment, the Operations Chief is guided by only one "boss," and that is the Incident Action Plan.

If we return to the questions presented above, we begin to find some answers:

"Who is in Charge Here?"

For all tactical, operational activities, the Operations Chief is "in charge." He or she receives direction and guidance from the action plan.

"Who Makes Decisions?"

Each commander participating in a unified effort makes the strategic, political, and fiscal decisions for his/her agency. The Operations Chief makes tactical decisions, based on command objectives.

"Who is Accountable?"

Each commander is accountable to his or her agency for strategic, policy, and fiscal decision and actions. The Operations Chief is accountable for all tactical efforts, whether or not they were included in the Action Plan.

More About Unified Commanders

The preceding sections covered three major components of unified command. They are: 1) agency objectives, 2) the planning process and action plan, and 3) the Operations Chief position. Each commander's roles, responsibilities, and relationships with the three components have been mentioned. It should be obvious that command carries more responsibilities, and this section will address some of the more important of those.

Limitations

We have established that Unified Commanders meet and work in one location. When they meet, they share information on incident status, character, and their agency objectives. It is extremely important that they also present their agency's limitations. That is, they must inform the other team members of what they cannot accomplish (example: "My agency has three other fires going. We will not be able to obtain more resources.")

Authorizations

Each commander is responsible for authorizing certain activities and actions. He or she is responsible to his or her own agency for these authorizations, and not the other agencies involved. For example, the commander may authorize:

- ❒ The ordering of additional resources
- ❒ The possible loaning or sharing of his resources to other jurisdictions involved
- ❒ Financial arrangements with participating agencies (if allowed by his own agency policy)
- ❒ Variations from his agency's policies if necessary to meet extreme conditions

Management

Each member of the Command has the responsibility to manage his people in the organization in a manner that supports the total operation. These are the typical managerial requirements that include:

- ❒ Providing sufficient competent staff and resources
- ❒ Anticipating and resolving problems
- ❒ Delegating

- ❒ Inspecting and evaluating performance
- ❒ Communicating with "home base" on priorities, plans, and problems

Coordination

In many ways, this is the most important function of each Commander. There will be two distinct levels of coordination:

1. First, it is with other members of the team. It is imperative that all partners are kept mutually informed, involved, and consulted. This is the "glue" that will hold a unified effort together. It requires time and significant energy.
2. Second, on major or complex incidents, coordination must be maintained with higher authorities (i.e., the Mayor, County Administrator, Forest Supervisor, Governor, etc.) It is of critical importance to keep these authorities well informed and confident that the incident is being competently managed. Most of these authorities answer to the public, and they must have up-to-date facts, explanations, and plans. (Incidentally, this is another value of a good Action Plan - it keeps the "higher-ups" quite well informed!)

Finally, the reader will note that little has been said about "suppression," "mitigation," or any other direct "doing" activities. Some such work and involvement by Commanders may be necessary and proper on incidents of lesser magnitude, but that is not the case on major emergencies. Once an incident reaches proportions that require a formal Unified Command, the Commanders must focus their energies on management of the organization, and not on the more direct (and also more exciting) tasks that should be delegated to others.

Guidelines for Establishing Unified Command Participants

The ICS is a common-sense system, designed with great inherent flexibility. It can, and should, be "tailored" to meet the specific conditions, character, and workload of each incident. To assist in determining the proper participants for any given incident, there are two simple guidelines:

Agency Roles

Responding agencies will be filling one of two roles: They will either be "Jurisdictional," with direct responsibility and authority, or they will be "Supporting" (or "Assisting") agencies who have been called for help. Supporting agencies will generally have been obtained initially through the dispatch procedures of one or more of the jurisdictional agencies. As a rule**, *only jurisdictional agency personnel will be Commanders*.**

Agency Capability

Commanders must have the authority, and their agencies must have the legal authority to order, transport, and maintain the resources necessary to meet the Command Objectives. Thus, ***fiscal authority is a determinant of Command.***

These guidelines apply equally whether the incident is functional or geographic in nature. The guides can be modified to meet exceptional conditions. It would be recognized that, as an incident increases in magnitude, these guides might indicate the need to escalate the level of Command. For example, if a state - (or federal) level disaster is declared and then state -(or federal) officials could participate in Command.

Alternatives to Unified Command

Multi agency involvement does not automatically require Unified Command. Even with the guidelines presented in Section VII, other Command configurations are available.

Three considerations can help determine whether an agency should be within the formal Unified Command group or an alternative thereto. These are:

- ❒ The relative size of the agency's involvement. Each agency that is responsible for a substantial physical area, functional role, or is providing a large proportion of resources should probably be directly represented in Command.
- ❒ The agency's "values at risk." In many cases, a small geographic entity may contain the highest values or the greatest risk to life. These agencies should share in Command.
- ❒ Time of involvement. The longer an agency will be directly involved the more reason to be included in direct command. Agencies with relatively short exposure should consider an alternative.

The alternatives are several, and various alternatives may be used at the same time. They include:

1. Deputy Incident Commanders: Agencies with lesser, or limited involvement may choose to fill their commitment to the incident with a Deputy, rather than "full" Commander. This will enable adequate input to objectives and provide support to the unified effort.
2. Filling subordinate positions: For small jurisdictions in a large incident, it may be appropriate to designate that agency's area or function as a Branch, Division, or Group and place a senior officer of the agency in charge. The officer will have input to the planning process and be an integral part of the organization. At the same time, the officer can fill his or her "at home" position and responsibilities (most likely with their own forces) with the least disruption.
3. Input through the Agency Representative: This is another option for agencies with minimal involvement in the overall effort. Those agencies may wish to only provide the team with their input through their agency representative who deals directly with the Incident Liaison Officer.
4. Deputies or assistants in other ICS positions: Some agencies may be able to contribute to incident success by filling other incident roles such as Deputy Plans Chief, Assistant Information Officer, etc.

Questions and Answers

Q In this paper, you place emphasis on Unified command for major incidents. Is not the concept also applicable on smaller, routine actions?

A Yes, it is certainly applicable on smaller incidents. In fact, you may find that establishing a unified effort when the incident is small may help to keep it that way.

Q Well then, when do you activate a Unified Command?

A Technically, Unified Command is called for the moment more than one jurisdiction (either functional or geographic) becomes involved. Again, on smaller incidents, you may not choose to make a formalized big deal out of the organizational titles and procedures, but each involved agency should be committed to melding into one unified effort. This can be done by each party verbally describing objectives and plan, and agreeing to coordinate actions.

Q You present some alternatives to a formal Unified Command. Can some of those be used just as well on smaller, routine incidents?

A Yes, subject to the size and complexity of the emergency.

Q With all of that flexibility, how do you know which Command structure or alternative to choose?

A With a little practice, you will find that the magnitude of the incident and the number of types of involved agencies will lead you to the best early organization. Remember too, that you can change your organization if the incident character changes.

Q Seems like it would be a whole lot simpler to just get together at first and have all involved agencies choose or "elect" just one Incident Commander. Is not that an alternative?

A If that decision represents the best managerial sense at the time, then it could be, but it is definitely not a recommended or preferred alternative.

Q Why not?

A There are three reasons: First, the ICS is designed to accommodate the objectives of all responsible agencies in the Action Plan, and to provide the best chance for each of those objectives to be met during operations. It will be very difficult to find one individual (to "elect" as Incident Commander) who can appreciate and articulate the

objectives of other agencies and then see that they are carried out according to the policies and standards of those other agencies.

Second, the function of Command carries with it the authority to expend funds. It will be very rare to find a responsible agency that is willing to allow another agency's officer to spend their funds.

Finally, do not overlook the discussion in sections IV and V of this supplement. The role of command includes organization, management, and coordination. The action or operational role belongs to the Operations chief. His is the position that provides the single focus of "doing" authority.

Q Introducing the Operations Chief into this just confuses the issue. Have not we, in effect, "elected" this single individual to represent other agencies? How do we know he or she is qualified to do that?

A Yes, a single individual fills that position, but does not "represent other agencies." The Operations Chief fulfills the assignments in the Action Plan, which is the expression of the other agencies authorities and objectives. Also, if the Operations Chief needs additional knowledge or information to adequately perform his role, several deputies or advisors may be assigned to the position.

Q What is the best number of participants in a Unified Command?

A The number of participants actually depends on the type and complexity of the incident. In very complex situations, someone needs to take a hard look at whether or not all the players need to be direct participants. This is one of the places where alternative means of learning and meeting agency objectives can be useful.

Q Okay, let us say that there are six or seven of us who are all direct participants in a Unified Command. What do we do if we cannot agree on the incident objective?

A Remember that you are not a committee. Your chore is not to develop a unanimous solution, but rather to establish a collective set of objectives that reflect the responsibilities and authorities of each individual agency. Autonomy will be preserved. Others do not have to agree to your objectives. You may not have much influence on theirs.

However, to soften that reply, you must consider that in our experience to date, this problem has not been encountered. To the contrary, when Commanders work together, with the same information and one organization, there is a great deal of positive compromise done in an effort to work most effectively on the entire incident.

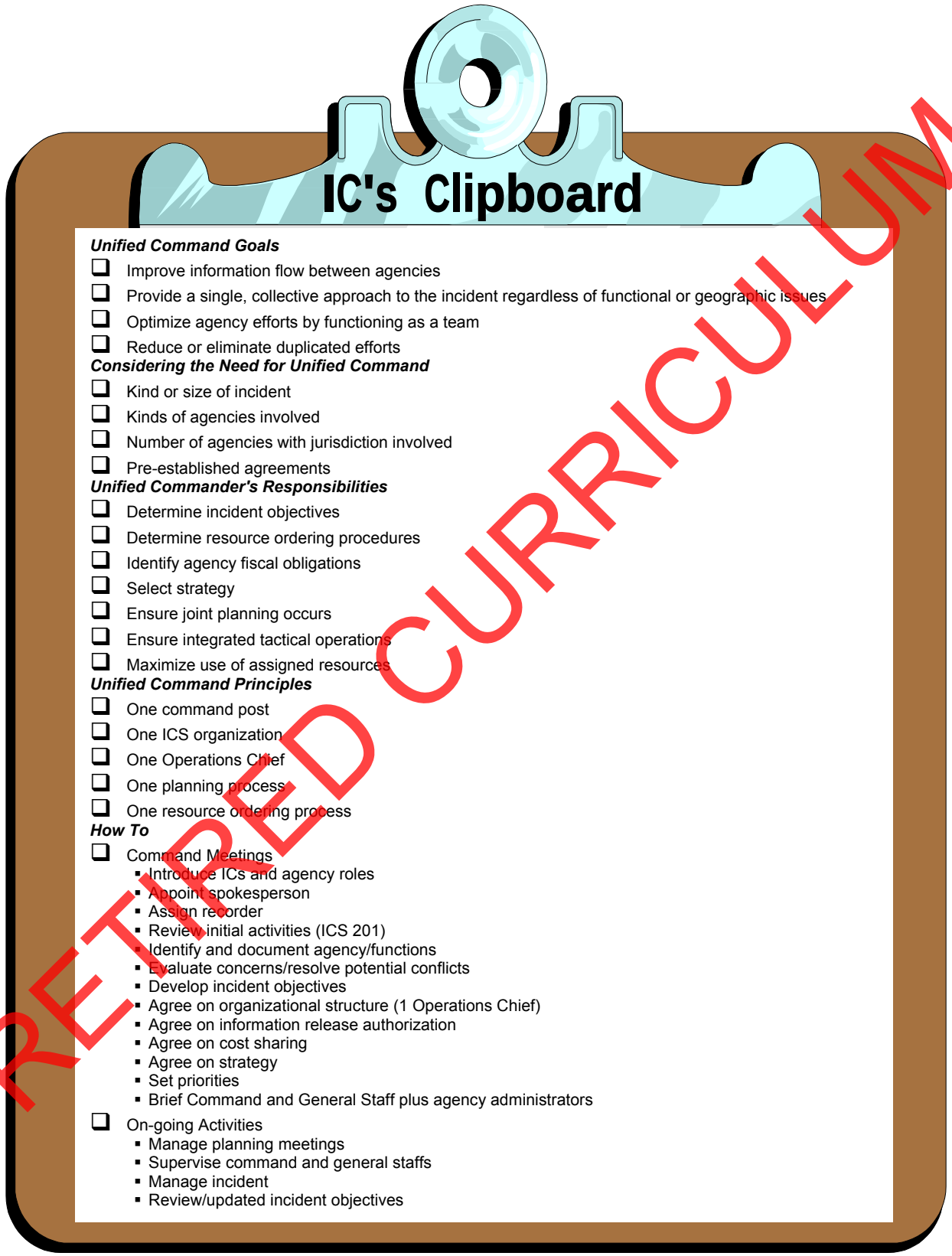
Q Oh yeah? Well it is obvious that you do not work with the types of people I have to deal with. How will Unified Command help me with people who are power-hungry, publicity hounds, or just plain know-heads?

A ICS (or its Unified command concept) does not resolve "people problems." You will have to take your own steps to deal with difficult personalities.

Although there are some indirect benefits that come from working together, most of us are more amenable in a group. We tend to be less pretentious and more cooperative. If that does not happen with your associates, there is one faint consolation: at least you'll know what the other people are up to if they re working beside you!

Q What are the key components of an effective unified command?

A
1. Unified ICs
2. Single Command Post
3. One set of incident objectives
4. One Operations Chief
5. One ordering point for off-incident resources



Unified Command Goals

- ❑ Improve information flow between agencies
- ❑ Provide a single, collective approach to the incident regardless of functional or geographic issues
- ❑ Optimize agency efforts by functioning as a team
- ❑ Reduce or eliminate duplicated efforts

Considering the Need for Unified Command

- ❑ Kind or size of incident
- ❑ Kinds of agencies involved
- ❑ Number of agencies with jurisdiction involved
- ❑ Pre-established agreements

Unified Commander's Responsibilities

- ❑ Determine incident objectives
- ❑ Determine resource ordering procedures
- ❑ Identify agency fiscal obligations
- ❑ Select strategy
- ❑ Ensure joint planning occurs
- ❑ Ensure integrated tactical operations
- ❑ Maximize use of assigned resources

Unified Command Principles

- ❑ One command post
- ❑ One ICS organization
- ❑ One Operations Chief
- ❑ One planning process
- ❑ One resource ordering process

How To

- ❑ Command Meetings
  - Introduce ICs and agency roles
  - Appoint spokesperson
  - Assign recorder
  - Review initial activities (ICS 201)
  - Identify and document agency/functions
  - Evaluate concerns/resolve potential conflicts
  - Develop incident objectives
  - Agree on organizational structure (1 Operations Chief)
  - Agree on information release authorization
  - Agree on cost sharing
  - Agree on strategy
  - Set priorities
  - Brief Command and General Staff plus agency administrators
- ❑ On-going Activities
  - Manage planning meetings
  - Supervise command and general staffs
  - Manage incident
  - Review/updated incident objectives

Simulator Problem #1

LOCATION: ..... Off Highway 20 near Lake Mendocino
DATE: ..... August 15
WEATHER: ..... Temperature: 107°F
..... Relative Humidity: 17%
..... Wind: NE, 8 mph
TIME FIRE REPORTED: .. 1600
TIME NOW: 1620

Initial Dispatch at Scene	ICS Type	
Engine 10	3	All at scene shortly after your arrival
Engine 11	3 (4-WD)	
Engine 12	2	
Engine 13	3	
Transport/Dozer 40	2	

Initial Dispatch En route	ICS Type	ETA
Patrol 1	(4x4)	:08
Helitender 101	2	:08
Engine 14	3	:10
Engine 15	3	:10
Engine 16	2	:12

ADDITIONAL INFORMATION

Air tankers not available for at least one hour. High incendiary caused fire area. You are flying in Copter 101 (Type 2) for surveillance and have a helitack Captain and one fire fighter with you.

Dispatch Center radio call designator is "Dispatch." When you assume command, your radio designator will be "Mendocino Command."

Simulator Problem #2

LOCATION: ..... On Silverado Trail near Napa
DATE: ..... September 15
WEATHER: ..... Temperature: 97°F
..... Relative Humidity: 21%
..... Wind: SW, 6-8 mph
TIME FIRE REPORTED: .. 1445
TIME NOW: 1500

Initial Dispatch at Scene	ICS Type
Engine 10	1

Initial Dispatch En route	ICS Type	ETA
Engine 11	1	:03
Engine 12	3	:05
Engine 13	1	:07
Air Tac 100		:07
Transport/Dozer 41	2	:10
Water Tender 34	1	:12
Crew 53	1	:12

ADDITIONAL INFORMATION

Area of expensive homes. Municipal water system along Golf Road.

Dispatch Center radio call designator is "Dispatch." When you assume command, your radio designator will be "Silverado Command."

Simulator Problem #3

LOCATION: ..... Mt. Helix, San Diego County
DATE: ..... September 15
WEATHER: ..... Temperature: 90°
..... Relative Humidity: 18%
..... Wind: SW, 15- 25 mph
TIME FIRE REPORTED: .. 1425
TIME NOW: 1430

Initial Dispatch at Scene	ICS Type
Engine 17	1
Engine 18	1
Engine 19	1
Helix Air Tac	1

Initial Dispatch En route	ICS Type	ETA
Engine 20	3	:02
Engine 21	3	:03
Transport/Dozer 42	2	:04
Tanker (Air Tanker) 70	3	:05
Tanker (Air Tanker) 71	3	:05
Engine 22	1	:05

ADDITIONAL INFORMATION

Area has many expensive homes and narrow roads. Municipal water system is present.

Dispatch Center radio call designator is "Dispatch." When you assume command, your radio designator will be "Helix Command."

Simulator Problem #4

LOCATION: ..... Near Paradise, Butte County
DATE: ..... August 30
WEATHER: ..... Temperature: 99°
..... Relative Humidity: 15%
..... Wind: S, 15 mph
TIME FIRE REPORTED: .. 1400
TIME NOW: 1415

Initial Dispatch at Scene	ICS Type	LOCATION
CDF Battalion 2111 (IC)		Skyway and Russel Road
Paradise Chief 1 (IC)		Skyway and Russel Road
Paradise Engine 1	1	Origin of fire (Honey Run Road)
Paradise Engine 2	1	Russel Road
Paradise Engine 3	1	Russel Road
Paradise Air Tac		Orbiting fire
Tanker (Air Tanker) 78	3	Orbiting fire
Tanker (Air Tanker) 19	2	Orbiting fire

Initial Dispatch En route	ICS Type	ETA
CDF Engine 2186	3	:02 (en route to origin)
CDF Engine 2176	3	:02 (en route to origin)
Chico Engine 4	2	:07 (en route to Russel Road)
Butte Co Engine 33	2	:07 (en route to Russel Road)
CDF Transport/Dozer 2142	2	:15 (en route to origin)

ADDITIONAL INFORMATION

Dispatch Center radio call designator is "Dispatch." When you assume command, your radio designator will be "Paradise Command."

Simulator Problem #5

LOCATION: ..... Plymouth, Amador County
DATE: ..... September 1
WEATHER: ..... Temperature: 95°F
..... Relative Humidity: 22%
..... Wind: S, 8 mph
TIME FIRE REPORTED: .. 1500
TIME NOW: 1507

Initial Dispatch at Scene	ICS Type
Engine 1	1

Initial Dispatch En route	ICS Type	ETA
Truck 1	1	:02
Engine 2	1	:03
Engine 3	1	:04
Patrol 4	Brush Patrol	:05

ADDITIONAL INFORMATION

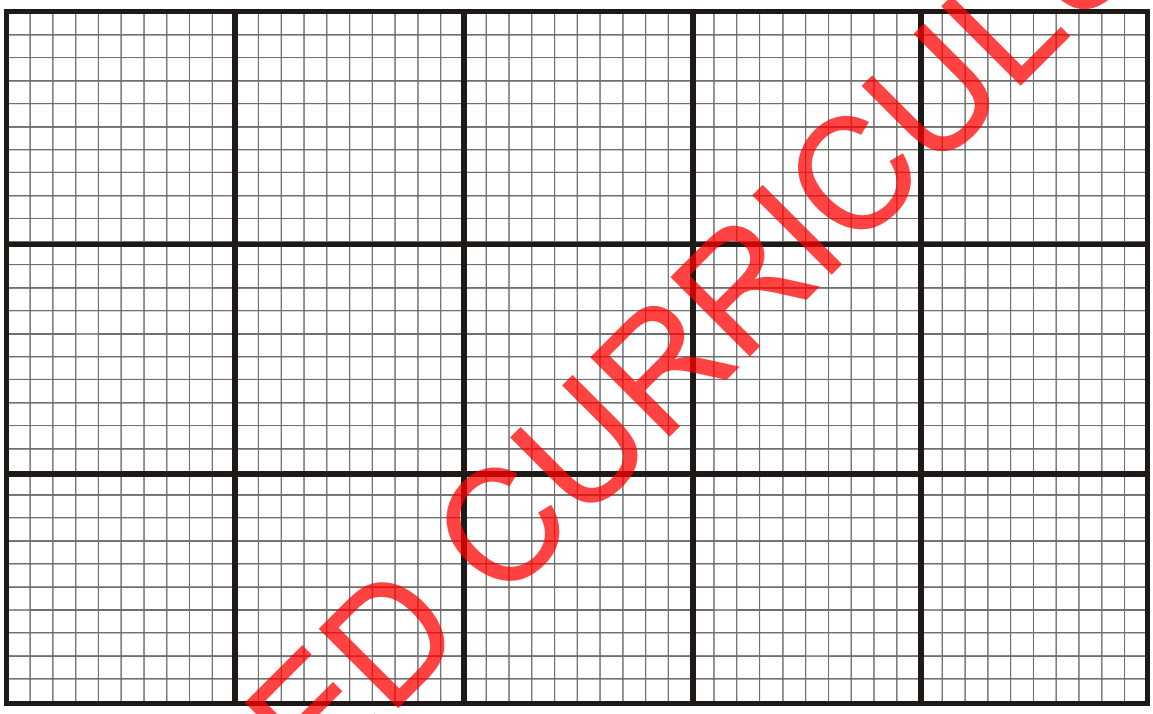
This is a structure fire. The initial response is a structure response augmented by a brush patrol because of the proximity to wildland.

Dispatch Center radio call designator is "Dispatch." When you assume command, your radio designator will be "Plymouth Command."

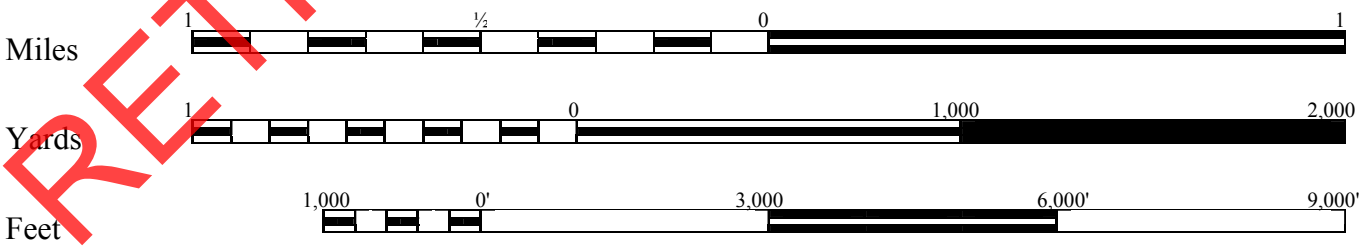
Grid, Distance Scales, and Slope

Acreage Grid

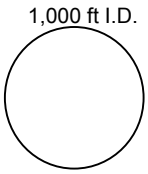
Each small square = 1 acre **7.5 Min. Quad** Each large square = 100 acres



Distance Scales



Slope



1. Place the circle over an area.
2. Count the contour lines within the circle. Do not count across ridges or creeks.
3. In the table below, find the number of contour lines counted (next to proper contour interval for your quad) and read % slope at the bottom.

		NUMBER OF CONTOUR LINES COUNTED						
CONTOUR INTERVAL	20	12	20	28	30	32	36	40
	40	6	10	14	15	16	18	19
	50	5	8	11	12	13	14	15
	60	3	5	7	8	8	9	10
% Slope ▶		25	40	55	60	65	70	75

Wildfire Command Checklist

Size-up

- ❒ Major Factors
  - Life hazard(s)?
  - Fuel, topography, and weather?
  - Time of fire start? Type of fire?
  - General Location? Where is the fire?
  - What is burning? What will burn?
  - Resource and situation status and availability?

Fire Behavior

- ❒ Relative Humidity (RH)
  - Cut in half for each 20° rise in temperature
  - Fires burn well <20%; explosive <10%
- ❒ Wind (direction and velocity)
  - Rate of spread doubles when wind doubles above 10 mph
- ❒ Ignition Component (IC)
  - Probability of fire start; Scale: 0 to 100%
  - Spotting >50%; Spots certain >80%
- ❒ Burning Index (BI)
  - Difficulty of control in worst case
  - Flame length = BI – 10; Scale: 0 to infinity (x)
- ❒ Rate of Spread (ROS)
  - ROS at head of fire, feet per minute
  - Doubles for each 20% increase in slope
  - Doubles as wind doubles above 10 mph
  - Halves or doubles with fuel type changes

Incident Action Plan

- ❒ PLAN the Incident
  - Do size-up; Complete ICS Form 201
  - Order and assign personnel
  - Order immediate need resources
  - Order next operational period resources
  - Order support (water, feeding, foam, etc.)
- ❒ ORGANIZE the Incident
  - Create Branches, Divisions/Groups, ST/TF
  - Assign Command Staff positions
- ❒ DIRECT Incident Operations
  - Give assignments and ensure understanding
  - Supervise activities with key to safety
- ❒ CONTROL Incident Operations
  - Compare accomplishments to planned activities
  - Adjust plan, if needed; be flexible

Safety

- ❒ Most critical factor
- ❒ Wear full personal protective equipment
- ❒ Have and know how to use fire shelter

Production Capabilities

- ❒ Engines – Progressive Hose Lay
  - Minimum 3 engines, 1 water tender, and 9 fire fighters per lay
  - Minimum 1½" or 1" hoseline; minimum 50 gpm nozzle
  - Laterals every 200 feet; average 4-5 minutes/100 feet
- ❒ Dozers – Line Construction
  - Single pass line = ½ mile or 900 yards per hour
  - Ask operator; use swamper
  - Production varies
    - Vegetation height, topography, dozer condition, operator

- ❒ Fire Crews – Line Construction
  - Production per hour for 15-fire fighter crew
    - Grass (2 feet high): 900 feet per hour, 3-foot wide line
    - Medium brush (4½ feet high): 450 feet per hour, 6-foot wide line
    - Heavy brush (6 feet high): 300 feet per hour, 9-foot wide line
    - Heaviest brush (9 feet high): 225 feet per hour, 12-foot wide line
- ❒ Air Tankers
  - Type 1: 3,000+ gallon capacity
  - Type 2: 1,800+ gallon capacity
  - Type 3: 600+ gallon capacity
  - Drop patterns: salvo, trail, split
- ❒ Air Tanker Safety Rules
  - Move out of area if possible
  - Avoid large, old trees/dead limbs
  - Never stand up in path of drop
  - Get behind solid object
  - Lie face down, face oncoming drop, hold tool at side, spread feet, helmet/goggles down, cover face and support drop
- ❒ Copter Tanker Safety Rules
  - Stay in full view of pilot
  - Approach/depart on downhill side
  - Chin strap fastened or helmet at side
  - Carry tools horizontally
  - Fasten seat belt
  - Follow instructions of pilot
  - Never throw anything from copter

10 Standard Fire Fighting Orders

FIRE WEATHER AND BEHAVIOR

1. Keep informed on fire weather conditions and forecasts.
2. Know what your fire is doing at all times. Observe personally; use scouts.
3. Base all action on current and expected behavior of the fire.

SAFETY

4. Have escape routes and make them known.
5. Post a lookout when there is possible danger.
6. Stay alert. Keep calm. Think clearly. Act decisively.

COMMUNICATIONS AND CONTROL

7. Give clear instructions and be sure they are understood.
8. Maintain prompt communications with your fire fighters, your supervisor, and adjoining forces.
9. Maintain control of your forces at all times.

SUMMARY

10. Fight fire aggressively, having provided for safety first.

18 Situations That Shout "Watch Out!"

1. Fire not scouted or sized-up.
2. Fire 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 communications link with crewmembers or supervisor.
8. Constructing a line without a safe anchor point.
9. Building fireline downhill with fire below you.
10. Attempting a frontal assault on the fire.
11. Unburned fuel between you and the fire.
12. Cannot see main fire and not in contact with anyone who can.
13. On a hillside where rolling fire can ignite fuel below you.
14. Weather getting hotter and drier.
15. Wind increases or changes direction.
16. Getting frequent spot fires across line.
17. Terrain and fuels make escape to safety zones difficult.
18. You feel like taking a nap near the fireline.

LCES

- ❒ Lookouts
  - Must be experienced and able to determine problem
  - Must be able to see fire fighters and fire
- ❒ Communications
  - Must be able to tell fire fighters of impending problem
  - Must have communications
- ❒ Escape Routes
  - Must have one, and desirably two, escape routes
  - Must lead to safety zones
- ❒ Safety Zones
  - Areas where fire shelters not needed
  - Consider topographical position
  - Consider fire environment on zone location

Common Denominators Of Fire Behavior On Fatal And Near-miss Fires

- ❒ Most incidents happen on smaller fires or isolated sections of larger fires.
- ❒ Flare-ups generally occur in deceptively light fuels, such as grass, herbs, and light brush
- ❒ Most fires are innocent in appearance before unexpected shifts in wind direction and or speed result in "flare ups." In some cases, tragedies occur in the mop-up stage.
- ❒ Fires respond to large and small-scale topographical conditions, running uphill surprisingly fast in chimneys, gullies, and on steep slopes.
- ❒ Some suppression tools, such as helicopters or air tankers, can adversely affect fire behavior. The blasts of air from low flying helicopters and air tankers have been known to cause flare-ups.