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Stoller

established 1959

Task Order LM00-502
Control Number 09-0524

February 12, 2009

U.S. Department of Energy
Office of Legacy Management
ATTN: Jane Powell
Site Manager
10995 Hamilton-Cleves Hwy.
Harrison, OH 45030-9728

SUBJECT: Contract No. DE-AM01-07000LM00060, Stoller
Task Order LM00-502, LTS&M – Other Defense Activities
Transmittal of the Wildland Fire Management Plan

REFERENCE: LM00-502-06-506 ODA CERCLA/RCRA Site, Fernald, OH

Dear Ms. Powell:

The purpose of this letter is to transmit the Draft Fernald Preserve Wildland Fire Management Plan. In recognition of the need to address fire risks and needs for U.S. Department of Energy (DOE) sites, this plan identifies the components and parameters of wildland/urban fire management for the Fernald Preserve. The plan also addresses the path forward for conduct of prescribed burns at the Fernald Preserve.

Upon your concurrence, the plan will be finalized. If you have any questions or require additional information, please contact John Homer at (513) 648-7519.

Sincerely,

Frank Johnston
Fernald Preserve Site Manager

FLJ/HS:dsm

Enclosure

c: With enclosure:
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Fernald Preserve

Wildland Fire Management Plan

February 2009

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Abbreviations

ANSI	American National Standards Institute
CAWWT	Converted Advanced Wastewater Treatment Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
FPVC	Fernald Preserve Visitors Center
H&S	Health and Safety
JSA	Job Safety Analysis
LMS	Legacy Management Support
NFES	National Fire Equipment Systems
NFPA	National Fire Protection Agency
NIFC	National Interagency Fire Center
OAC	*Ohio Administrative Code*
OEPA	Ohio Environmental Protection Agency
ORC	*Ohio Revised Code*
OSDF	On-Site Disposal Facility
PPE	Personal protective equipment

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1.0 Introduction

In recognition of the need to address fire risks and needs for U.S. Department of Energy (DOE) sites, this plan identifies the components and parameters of wildland fire management for the Fernald Preserve. It identifies and provides controls for risks associated with fire at the site.

1.1 Site Description

The Fernald Preserve is located on a 1,050-acre tract of land in southwest Ohio. The tract is located approximately 18 miles northwest of Cincinnati, Ohio, within Crosby, Morgan, and Ross Townships. It is found near the unincorporated communities of Fernald, New Baltimore, New Haven, Ross, and Shandon. Figure 1–1 shows the general location of the preserve. The Fernald Preserve is primarily an undeveloped park; however, environmental cleanup remedies are ongoing per Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements.

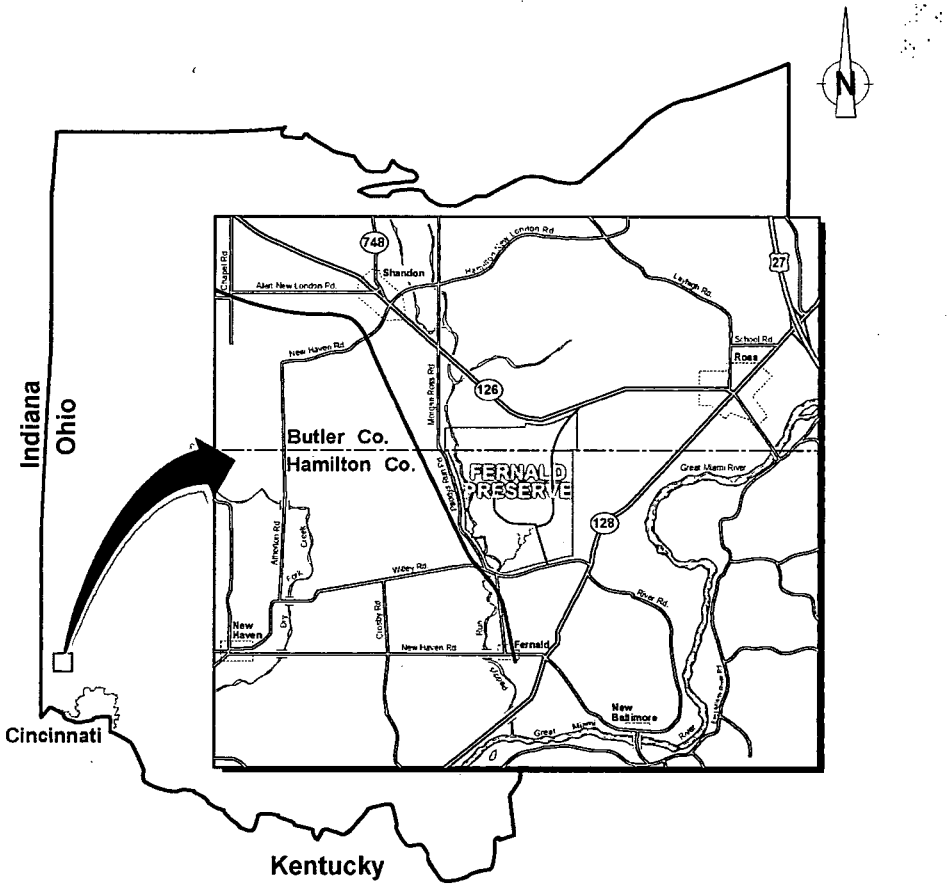

Figure 1–1. Site Location

The Fernald site was a former uranium processing plant. Uranium production halted in 1989, and in 1991, the mission of the site changed from production to environmental cleanup under CERCLA. With the exception of aquifer reclamation, remedial action of the site was completed in 2006. The Fernald site has been cleaned up to standards established by the community and meeting the requirements of the U.S. Environmental Protection Agency and the Ohio Environmental Protection Agency (OEPA).

As areas of the site were remediated and released for restoration, the task of establishing stable ecological communities began. Native prairie and tree communities were established in old fields and disturbed lands, resident forest lands were enhanced and supplemented, and depressions and excavations were transformed into wetlands and open waters with plant communities that mimic native ecosystems. Figure 1–2 shows the current site configuration. The Fernald Preserve now contains approximately 395 acres of woodland, 332 acres of prairies (136 acres of these are in the former production area), 33 acres of savanna, 81 acres of wetlands, 60 acres of open water, and almost 3 miles of streams. A paved road leads from the south entrance of the site to the Fernald Preserve Visitors Center (FPVC) and adjacent parking lot. A 120-acre grass-covered disposal facility contains the demolition debris and soils from the former production facility. The Converted Advanced Wastewater Treatment Facility (CAWWT) treats contaminated water from the aquifer and pumps it to the Great Miami River. Gravel roads traverse many portions of the site, leading to metal buildings that support site operations. Approximately 29 acres of the Fernald Preserve is occupied by infrastructure.

The FPVC is located near the center of the Fernald Preserve. The building has a steel frame and metal siding, a block wall, and glass along two sides. It is surrounded by concrete walks, rock and gravel, drainages, turf grass yard, and flowerbeds. Concrete walkways go from the building and connect to asphalt parking lots. Three trails extend from the FPVC area and pass through prairie and woodlands. Adjacent to the building is its wastewater treatment system. The system includes a septic tank, a sub-surface treatment wetland, and a surface treatment wetland. Beyond the turf grass, sidewalks, and parking lots are prairie grasses. This combination of prairies, woodlands, wildlife, and recreational facilities is why the Fernald Preserve has a number of visitors each day.

The CAWWT is located to the south of the FPVC and treats contaminated water from the aquifer. The building is made of steel and has numerous tanks, platforms, piping, and a holding pond outside of it. The facility is surrounded by gravel and mown yard area inside a perimeter fence. A storage building also stands inside the southeast corner of the fence. Prairie grass fields extend up to the fence of this facility. The CAWWT also has a series of well houses, transfer stations, and other buildings on site that are part of the water collection and treatment process.

The On-Site Disposal Facility (OSDF) is a series of disposal cells that contain 2.9 million cubic yards of contaminated debris and soil from the demolition of the buildings and infrastructure of the former production facility. The 120-acre site for the OSDF is in the northeast corner of the site. It has a prairie-grass-covered cap and is surrounded by a buffer area composed of a gravel road, drainage area, and perimeter fence.

Several additional buildings on site are used for storage. These buildings are small metal structures adjacent to roads. Most of the buildings are surrounded by gravel road and laydown areas.

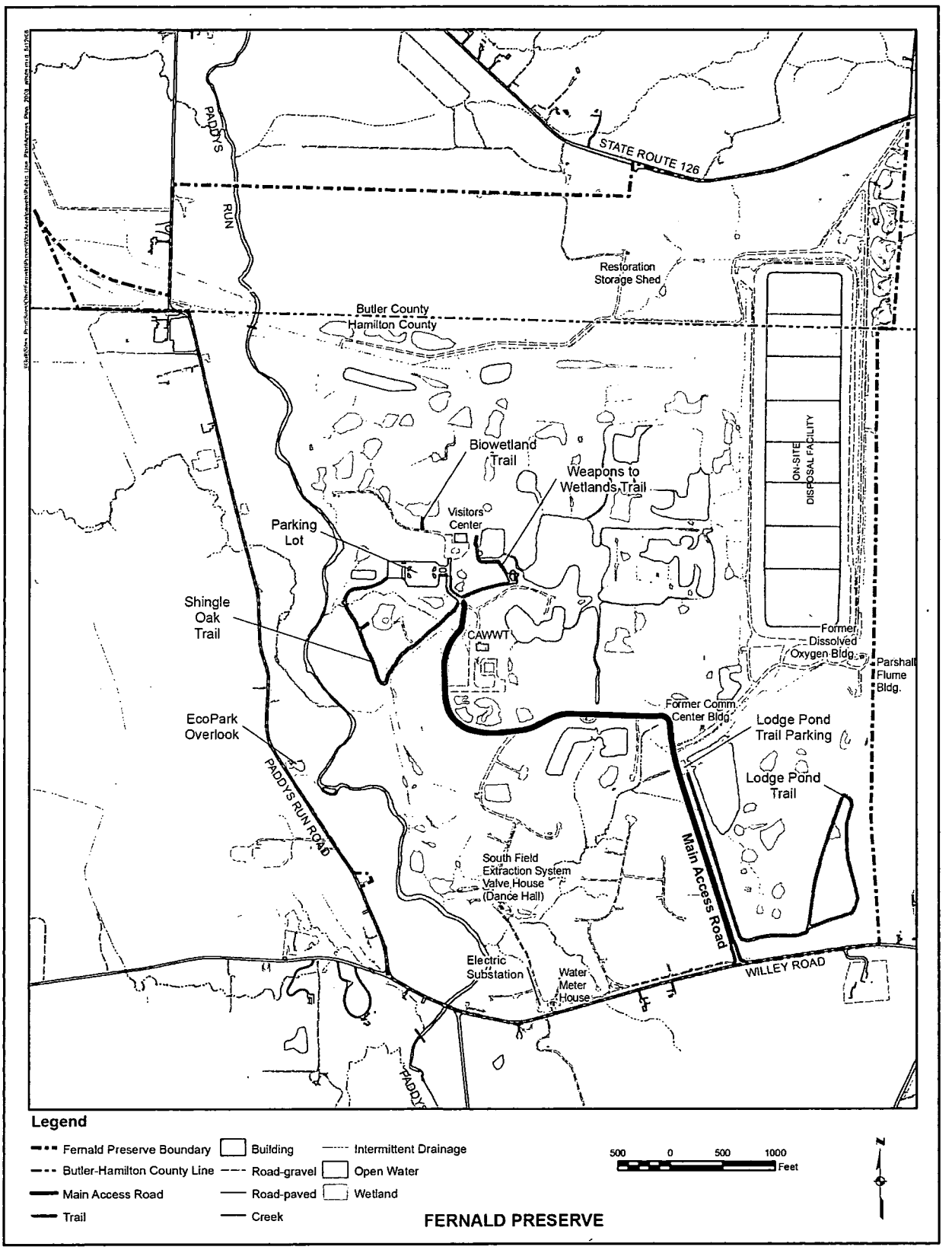

Figure 1–2. Current Site Configuration

The Fernald site is currently used as an undeveloped park. Portions of the site are open to the public. Public access is provided to the FPVC, its parking lots, and a series of nature trails around the site. For safety reasons, public access to the rest of the Fernald site is prohibited. Access to these areas of the site is provided to visitors by site personnel on a regular basis in the form of site tours and field trips.

1.2 Plan Purpose

This plan fulfills the requirements for the development of a Wildland Fire Management Plan as outlined in Stoller planning and performance manuals and the following federal directives: DOE Order 450.1A, *Environmental Protection Program*; DOE Order 420.1B, *Facility Safety*; NFPA Standard 1143, *Wildland Fire Management*; NFPA Standard 1144, *Protection of Life and Property from Wildfire*; and the 2001 *Federal Wildland Fire Management Policy and Implementing Actions* (NIFC 2001).

The Fernald Preserve, with its facilities and public access, represents a wildland/urban interface, an area where the prairies and forests meet the process and visitor facilities. These areas require a program for wildland fire prevention, preparedness, suppression, fuels management, and reporting that meets federal policy and exiting procedures (*Environmental Protection Manual*, LMS/POL/S04329). The program will integrate fuels and fire management into existing planning processes, develop strategies and program components, and identify personnel responsibilities to effectively control wildland and operational fires at the Fernald Preserve.

1.3 Process for Plan Development

The combination of woodland and prairies coexisting with the FPVC and trails along with the CAWWT and OSDF has created a wildland/urban interface at the Fernald Preserve. This creates a potential for wildland fires to affect the structures and infrastructures of the site, as well as a potential for site personnel and processes to create a wildland fire. Control processes must be developed to reduce fire risk and provide a process for controlling any fires that might be encountered, thus reducing the amount of damage to site resources.

Work processes currently in place at the site were reviewed. Each was examined to determine if activities could cause a fire. Hazards were identified in a Job Safety Analysis (JSA), along with mitigation actions necessary to prevent a fire or loss of control of a fire. These items have been included for consideration in the development of this plan.

Utilizing the *Implementation Guide* developed in DOE Guidance 450-1.4 and the information gathered in the JSA process, a comprehensive plan for effectively controlling wildland and operational fires was developed.

1.4 Land and Resource Management Planning

This Wildland Fire Management Plan is consistent with goals and objectives identified in the Fernald Preserve Comprehensive Legacy Management and Institutional Controls Plan. In addition, this plan conforms to contract provisions of mutual-aid agreements for fire protection and suppression assistance with local fire departments.

State requirements for the reporting of prescribed burns, management of smoke, and permitting of open burns have been incorporated into the process of this plan. The Wildland Fire Management Plan conforms to applicable state laws.

2.0 Wildland Fire Management Strategies

2.1 Management Considerations

The Fernald site has had a limited occurrence of wildland fire. Access to the site has been limited to authorized personnel who have operated within strict controls regarding operation of equipment and the use of fire. Those controls prevented or limited the fire risks.

Additionally, fuels have also been limited on site in the past. The grasses were cool-season grasses that had some green growth all year long. Most of the time, these grasses will not sustain a fire. Efforts were made to replace old fields with native prairie grasses in most wildland areas. This action has increased the potential for wildland fires to burn a larger area. The woodlands on site are composed of riparian, pine, and upland hardwood forest. The most prevalent understory is bush honeysuckle; many areas contain heavy concentrations of it. Additionally, there is a good amount of down and dead trees in the woods. The debris, if left in place, could fuel a hot fire that would burn for a very long time, increasing the risk for a damaging fire.

With the opening of the site to the public in many wildland areas, the potential for uncontrolled use of vehicles or ignition sources on site increases the risk of wildland fire. Additionally, trespassers on the site increase the potential for a fire.

The number of personnel on site that have experience in wildland fire suppression and control is limited. Resources are insufficient to effectively and safely respond to fires. For this reason, fire protection for the Fernald Preserve is provided by a local community fire department under contract to DOE.

Activities that involve the restoration or maintenance of site structures and resources are the responsibility of site personnel or contract personnel. Site and contract personnel will develop, install, and maintain functional and institutional controls at the site; they will also incorporate wildland fire controls into daily work processes and activities.

One silvicultural method being considered for the management of prairies and woodlands is the use of prescribed burns. Fire is an effective tool for controlling the composition of prairies and woodlands as well as improving stand health. Additionally, controlled burns can reduce the chance for catastrophic burns on a site by removing buildups of fuels in the form of thatch or wood debris.

Any task or activity planned for the site will be evaluated to determine if it constitutes a fire hazard. When a risk is identified, it will be addressed in a JSA or Safe Work Plan. That document will identify the hazards and actions to mitigate them.

2.2 Wildland Fire Management Goals

This plan will implement the following goals:

- Achieve a program where public and personnel safety is the highest priority in every fire management activity.
- Develop a program that facilitates the prevention of fires and the protection of resources and structures.
- Develop a program that minimizes fire loss and damage to structures, recreational developments, and wildland resources.
- Develop a program that minimizes the risk of wildland fire that could spread off site.
- Develop a program where fire is appropriately used as a tool to meet resource management objectives.
- Develop a program that incorporates Integrated Safety Management System and Environmental Management System principles into the fire control planning process.
- Empower workers to identify and report potential hazards in wildland fire events.

3.0 Wildland Fire Management Program Components

3.1 Fire Fighting Standard

The number-one priority in any type of fire at the Fernald Preserve is personnel and public safety. No action will be taken that places personnel or the public in danger.

An incipient fire is one in which the initial or beginning stage can be controlled or extinguished by a portable fire extinguisher without the need for protective clothing or breathing apparatus. It is Stoller policy that no employees will be authorized to fight incipient fires in general. Only trained, authorized employees will be allowed to fight incipient fires in the field or at project sites. Employees not authorized to fight fires must evacuate any area in which a fire exists. All employees must follow the steps below.

3.1.1 Immediate Actions

[1] Contact the fire department by dialing 911 or pulling a fire pull to activate the alarm. Inform the fire department of any hazards that are known to be present in the fire area.

[2] Stop or secure the operation causing the fire (e.g., secure hot work, shut off power and gas, shut off equipment) if this can be done safely.

[3] Warn others in the area.

[4] Evacuate personnel upwind and out of the affected area.

[5] Isolate the fire area and establish control boundaries, if possible.

[6] Notify the immediate supervisor.

[7] Notify the site Health and Safety (H&S) lead.

[8] Direct responding fire and emergency response service units to the location.

3.1.2 Supplemental Actions

[1] If possible, assign someone to meet the emergency response personnel.

[2] If the fire is in a hazardous material area, establish an access control point.

[3] Contact the H&S representative for appropriate decontamination procedures.

[4] Notify the site H&S representative.

[5] Obtain hazardous material monitoring data at the perimeter of the isolation area when warranted and when conditions permit.

[6] Initiate appropriate reporting requirements.

[7] Develop a Follow-Up Action Plan. The Follow-Up Action Plan for recovery must be documented and approved by the H&S manager and the site H&S representative or another management representative.

3.2 Fire Prevention and Control

Public and personnel awareness is the greatest tool for preventing fires. By including information on the fire hazards in key public areas, most fires can be avoided. A public education campaign prior to and during seasons when the conditions are favorable for wildland fire would make the public aware of what they can do to prevent a fire and what to do in the event of a fire on site.

Signs indicating not only the prohibition of smoking but also the hazard of not extinguishing smoking materials in wildland environments would give visitors and contractors an appreciation of the associated dangers. The information would identify dry native grasses and leaves as flash fuels that can ignite quickly and burn a large area in a short time.

Signs informing of state fire seasons, burning bans, or fire danger would help the public and site personnel recognize that they need to be more careful, both on and off site, with the use of possible ignition sources.

Information on fire hazards will be included in safety briefings and JSAs for tasks that have risk of causing fires. The tasks will be evaluated for ways to reduce or eliminate the hazard prior to work starting. Any welding, cutting, and allied processes must be performed in a designated hot-work area. Hot work will be performed in accordance with ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*. Requirements will be identified in a Safe Work Permit. The Safe Work Permit would include an Open-Flame Permit, and depending on the location and nature of the work, hot work may also require a Confined Space Permit or Radiation Work Permit. Fire watches, modifications to equipment or processes, and other controls will be established as necessary. An Electrical Work Permit is also required for any task that involves work on or near exposed electrical circuits or components. When pertinent, the permit will address potential hazards that electrical fires pose to wildlands. Actions and processes will be identified for the mitigation of hazards. Personnel will perform work in accordance with planned actions to mitigate hazards.

Fuels reduction is another method that can be used to prevent destructive fires. Heavy fuel loads are reduced from an area by mechanical methods or through prescribed burns (see Section 3.4). By removing or burning the fuels in a controlled manner, the potential for a large wildfire to damage operations and recreational facilities is greatly reduced. Fires in forested areas are then more easily controlled and extinguished following fuels reduction in the understory.

If a wildland fire does start on site, there are sensitive areas on site that will need protection from the fire. These areas were listed above and include the FPVC, the CAWWT and associated wells and pump stations, the OSDF, and storage buildings. Protecting these areas will require barriers to prevent fire from readily overrunning them. The barriers are fuel breaks that will rob the fire of fuel. These barriers will consist of buffers around the buildings and areas. In some areas, the buffers will consist of mowed, cool-season grasses adjacent to a building or trail and of sufficient width to prevent flames from crossing; for other facilities, they will consist of gravel perimeters of sufficient width.

Additionally, fuel breaks will be installed in strategic areas of the site to supplement roads and stream banks currently in place that will be used as fire breaks. Locations of fire breaks have been determined in cooperation with local fire department personnel and shall be installed only in areas where soil conditions will support fire apparatus access to and use of the fire breaks. A map showing proposed fire break locations is found in Figure 3−1. Fire breaks will consist of existing roads or 20- to 30-feet-wide mown lanes or paths; fuels will be mulched in or removed from breaks. These fire breaks will be maintained during late summer as prairie grasses die back and during state-declared fire seasons. They will be allowed to grow up during the growing season.

3.3 Fire Suppression

When an individual calls 911 and reports a fire on site, the emergency operator will dispatch appropriate fire apparatus to the site to handle the structure, equipment, or wildland fire. Only Fernald Preserve personnel trained in appropriate firefighting methods will be allowed to aid in fire suppression. Wildland fire management will be accomplished through a combination of mutual-aid agreement and site and contract personnel.

The Fernald Preserve is a diverse site with varying topography, facilities, and vegetation. Response on any given fire will be based on conditions at the site. Some of the factors that will affect the response are considered below.

3.3.1 Range of Potential Behavior

Fire behavior depends on the type of fuels present. The fuel types found at the Fernald site are addressed below, along with expected fire behavior in those fuels.

Buildings: Facilities at the Fernald Preserve have been built to reduce the chance for fire. They are built from materials that are not flammable (steel and concrete), and materials have been treated to be fire retardant. Three facilities on site have flammable construction materials inside them. These facilities (the FPVC and two trailers inside the CAWWT) have a sprinkler system installed, which will activate in the event of a fire. Flammable and combustible fuels in facilities

are kept in storage cabinets designed for flammables, to prevent inadvertent ignition. Any fires inside site facilities should be localized and easy for emergency response personnel to control.

Electrical: The greatest potential for fire around site facilities has historically been from electrical systems on the outside of buildings. Transformers have shorted and sent sparks spewing into the air. Animals have been set on fire after making contact with two power lines, before falling to the ground. Generally, materials on the ground have been the fuel for a fire. The fire would burn any available fuel. When electrical units are located within prairies or woodlands, they would be threatened.

Grass fuel: Grass fuel consists of flash fuels (fine fuels with a high surface-area-to-volume ratio, 1-hour fuels) that have the potential to ignite quickly and burn at a high intensity. It includes grasses and small stemmed woody plants that have not been compressed together. The fire will ignite and move through quickly, burning up available fuels in a few minutes and dying out.

Grass-shrub fuel: Grass-shrub fuel consists of flash fuels coupled with aerial/shrub fuels. The fire will ignite quickly and burn at a high intensity, as with grasses. Shrubs, which are listed as 10-hour fuels, will ignite in the high heat and continue to burn and smolder for an extended time after the grasses have burned up, still posing a hazard for aerial sparks.

Timber litter fuel: Timber litter fuel consists of some flash fuels, twigs (10-hour fuels), and some branches up to 3 inches in diameter (100-hour fuels). The fire will ignite quickly and run through the understory, leaving scattered smoldering embers that will present a hazard for some time. Temperature may be intense enough to scorch and kill some species of shrubs and trees.

Timber-understory fuel: Timber-understory fuel consists of leaves and litter on the floor of woods with shrubs or small trees that act as ladder fuels to crown fuels. As with timber litter fuel, the fire can move quickly and with intensity sufficient to ignite the 10- and 100-hour fuels. Fuel and weather conditions can cause the fire to climb into the understory and the overstory crowns (crown fires can advance in conjunction with or independent of the surface fire). The 1,000-hour fuels (fuels greater than 3 inches in diameter) will ignite and burn at a high intensity, and can continue to burn for days. This type of fire will kill all but the fire-tolerant tree species. Crown fires are generally limited to pine stands.

The potential for each of these fuel types to burn will depend on fuel moisture, fuel loading (density of fuels), air temperature, humidity, and wind. These can independently or corporately influence the ability of the fuels to burn.

3.3.2 Preparedness Actions

Site personnel will need to be aware of the fire danger. If smoke or fire is observed, they will need to be prepared to call 911 and report the location.

Fire extinguishers are provided in key areas of all facilities on site and in fleet vehicles. These are for safe escape from fires at the facilities or for use on vehicle or equipment fires. Site personnel are trained in the operation of site fire extinguishers for the purpose of escape and protection of the public. Personnel may also use extinguishers if the fire is small and can be controlled using a fire extinguisher after calling 911.

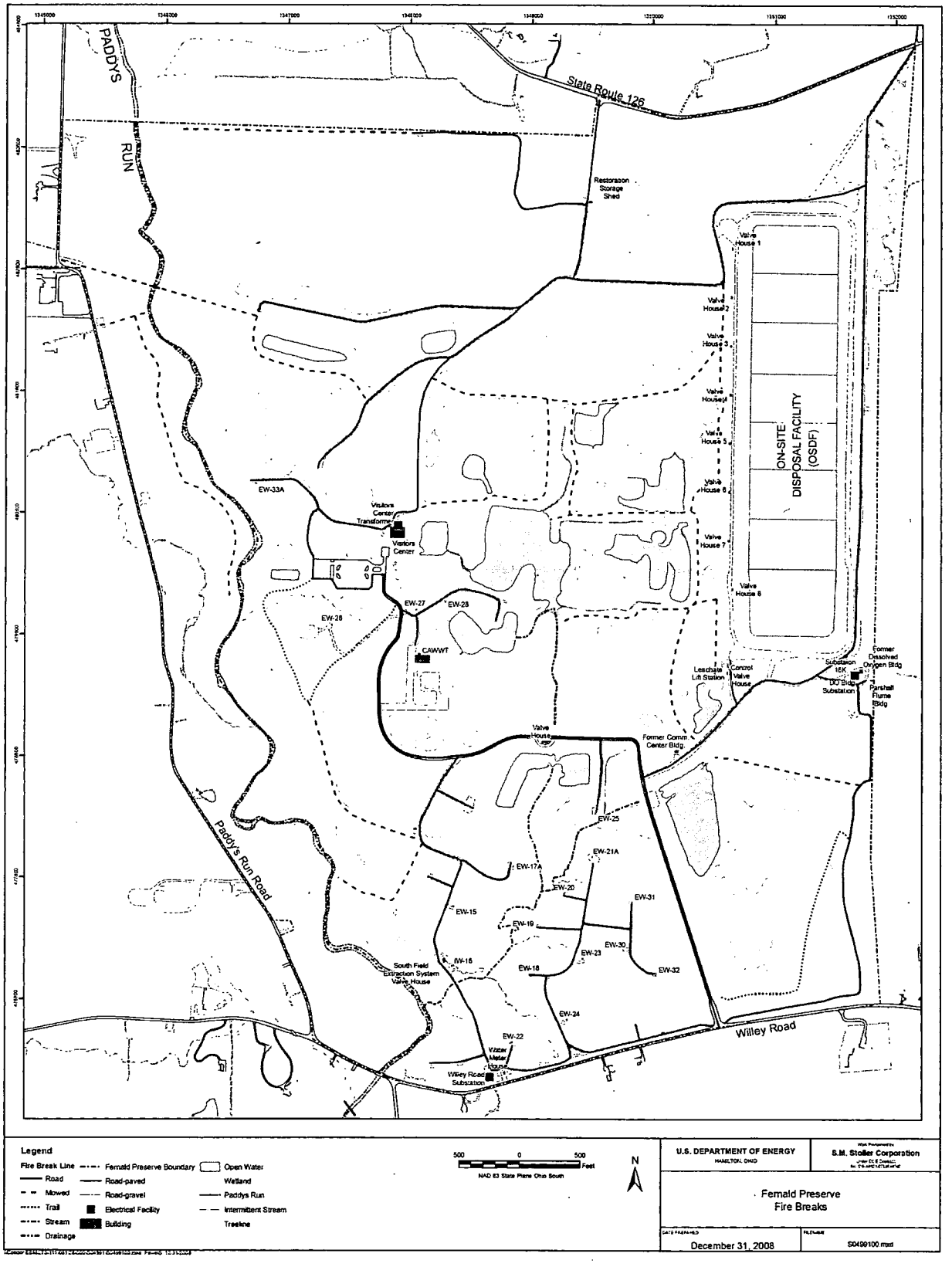

Figure 3–1. Fire Breaks

Personal protective equipment (PPE) for wildland fire suppression will be stored and maintained on site during fire season. PPE will be kept in one location. It will be kept clean and in good condition; repairs will be made prior to being stored away. No personnel will attempt to fight wildland fire in any way without proper PPE.

Tools and equipment for use in fire suppression and control will be maintained in a ready state during fire season or during prescribed burns. Tools will be sharp and in good working condition. Water pumps will be properly maintained and in good working order. Pumps will be fueled and ready to operate. Water tanks will be hooked to water pumps and ready for operation. Pump and tank units will have the hoses and tools necessary to fill each unit with water and discharge water from it.

3.3.3 Annual Training Activities

Any personnel trained in wildland fire suppression must have annual refresher training. To be qualified for wildland fire suppression, personnel have to complete state fire training. State training includes nationally recognized S-130, Firefighter Training; S-190, Introduction to Wildland Fire Behavior; and the National Incident Management System orientation. This 40-hour course is a combination of classroom and hands-on training in the art of wildland fire suppression for the line firefighter. Refresher training is a 1-day course.

3.3.4 Fire Season Readiness

Fire education, prevention, and control features need to be in place prior to and during fire season to maximize effectiveness. Readiness means site personnel must do the following:

- Maintain no-smoking signs.
- Ensure that controls are in place to safeguard the use of flame-producing equipment, materials, and tools.
- Ensure that fire break locations are properly established before the beginning of fire season and maintained throughout the fire season (see Figure 3-1).
- Ensure that grass buffer areas are kept mown during fire season.
- Ensure that materials that could compromise the integrity of a buffer zone around a facility or be the cause of a wildland fire are not stored along or within buffer areas.

3.3.5 Fire Weather and Danger

There are numerous weather factors that will influence fire behavior and intensity. As each weather condition changes, it will either increase or decrease a fuel's ability to ignite and maintain a flame. Combinations of weather conditions are indicators of high fire danger and the potential for erratic fire behavior. These conditions are covered below.

Air temperature is an ever-changing factor in fire weather. It can vary with time, location, and elevation. It can occur as migrating weather systems transport colder or warmer air into a region or as solar radiation warms the earth's surface and atmosphere. The air can also be heated as a result of radiant heat from other sources, such as a large fire. Fires and direct sunlight will

change the air temperature around them, preheating fuels and bringing them closer to their ignition point; however, cooler temperatures will have the opposite effect.

Relative humidity influences the amount of moisture that fuels can absorb or release to the air. Moisture in the air, in any form, is the primary element that affects fuel moisture content and the resulting flammability of fuels. Light fuels (e.g., grasses, forbs), with their high surface area, can absorb and lose moisture quickly with changes in relative humidity. Heavy fuels (e.g., wood) respond to humidity changes much more slowly. Relative humidity can range from 1 percent (very dry) to 100 percent (very moist, saturated). Small changes in relative humidity can have significant impact on wildland fire behavior. These changes can vary over time and have differing impacts for each fuel type. Low relative humidity is an indicator of high fire danger. An increase of 10 °F will cut the relative humidity in half, and decreases of 10 °F will double the relative humidity.

Atmospheric stability is the degree to which vertical motion in the atmosphere is enhanced or suppressed. It is directly related to the temperature distribution of the atmosphere. The atmospheric temperature is constantly changing due to variations in heating and cooling from one layer of the atmosphere to the next. These changes in the air temperature in the differing levels are responsible for winds and frontal movements. Wildfires are greatly affected by the presence or lack of atmospheric motion. In a stable atmosphere, there may be movement along the surface, but there is resistance to upward motion between layers of atmosphere. Smoke will either rise only a short distance or stay near the surface, blowing apart and creating a haze near the ground. Stable air masses include inversions and thermal belts. In an unstable atmosphere, the vertical motion of air increases. This vertical motion increases the chances for convection columns reaching greater heights, producing stronger in drafts, convective updrafts, and gusty surface winds. These conditions can create erratic fire behavior, and as a result, there may be a rapid spread of surface fire, spotting conditions as firebrands are carried aloft, and fire whirls. Smoke will rise to greater heights and be carried away from the fire more quickly with unstable air masses.

Wind is the most critical weather element affecting wildland fire behavior, and it is the most difficult to predict and the most variable in both time and location. Wind is the horizontal movement of air along the surface of the earth and is designated according to the direction from which it is blowing. (A north wind, for example, blows from the north to the south.) The direction of the wind will determine the direction of fire spread. The rate of fire spread is influenced by the wind; wind affects the amount of oxygen supplied to the fire and, thus, affects flame length. An increased wind will influence the drying rate of fuels. Also, winds will bend the flames, preheating fuels ahead of the fire.

Wind can be broken into two different systems: general and local. General winds are large-scale upper-level winds caused by both high and low pressure systems. Winds caused by warm and cold fronts are good examples of winds that will affect fire behavior. Local winds are found at lower levels and are caused by small-scale differences in temperature and pressure. These differences are best seen in local winds called "slope winds" and "valley winds." Temperature changes on slopes in rough terrain result in upslope and downslope winds that will affect the direction of fire spread.

Site personnel will be made aware of the weather factors that constitute a fire danger alert. During recognized fire danger alerts, personnel will follow established procedures to safeguard against fires.

3.3.6 Weather Thresholds

When any weather factor changes, it can increase or decrease the chance for wildland fire. As more weather factors become favorable for a fire, the fire danger grows. Limits to consider for these factors include the following:

- Relative humidity less than 25 percent
- Temperature greater than 85 °F
- Fine-fuel moisture less than 10 percent
- Surface wind speeds greater than 20 miles per hour
- Cold fronts
- Thunderstorm conditions
- Fuel temperature where a high percentage of fuels are in direct sunlight

3.3.7 Initial Attack Criteria

Protecting personnel and the public is the Fernald Preserve's first priority. Once people are safe, then attention will turn to protecting facilities at the site. Actions will be taken to secure the buffer zone for any threatened facility or extinguish fire within the facility. After site facilities have been addressed, suppression action will consist of controlling a fire within a set fire break. There will be no direct attacks on a wildland fire. Fire suppression should be along established fire breaks using pre-established entry routes (Figure 3-1). If conditions threaten a fire break, the fire break may be increased in size by setting a fire along its downwind edge and burning out (backfiring) additional fire break. Another option may be to wet down the fire break. Fire will be allowed to burn out within fire breaks.

The responding fire department's fire chief will direct all firefighting actions. The local fire chief helped develop Figure 3-1 and has a copy of it to help the fire department reach control lines. Fire departments should be able to respond within 10 minutes of any emergency call; therefore, no independent actions will take place outside the direction of the fire chief.

3.4 Prescribed Fire

3.4.1 Planning and Documentation

Each year, all areas of the Fernald Preserve are inspected, and restored areas are monitored to ensure that management objectives are achieved and to identify resource needs. Resource needs include the control of undesirable and invasive species, site repairs, and plant stand health limitations. Fernald Preserve ecologists will review conditions and develop strategies to ensure that objectives are met and that the integrity of restored areas is maintained. Strategies include mechanical and herbicidal control of undesirable and invasive species, mowing and baling prairies to promote growth and plant health, removing and chipping woody debris, and

conducting prescribed burns in grasslands and savannas to promote stand health and control undesirable and invasive species.

A Prescribed Fire Burn Plan (see Appendix A) will be developed for each area identified for burning. The plan will be site-specific and will identify existing conditions and fuel types, needed permits and notifications, limiting weather and fuel conditions, anticipated fire behavior, crew and equipment responsibilities, and pre-burn site preparation and fire break establishment. The Fire Burn Plan will be developed based on criteria established in this plan. Criteria include the following:

- Fire Regimes

  Four fuel types are found at the Fernald Preserve, but only two of them have been included in the management strategy for prescribed burn. The burning of grass and grass-shrub fuel types is being considered for the control of invasive and undesirable species and to promote the health of desirable species. Both prairies and savannas have historically depended on fire to maintain plant health and eliminate intruding species.

- Long-Term Strategies

  Controlling the composition of plant species in prairies and savannas often requires more than one method. Invasive and undesirable species most often can be controlled through a successive burn cycle. The temperature of the burn is high enough to burn up the plant and seed and to kill the shallow roots. The stalks and leaves of the native species are burned along with some of the duff, but the root system, which goes deep, is unharmed. Other invasive species have roots that go deep and are able to rebound after the fire burns over them. The invasive plants come in early in the blackened area and are easily sprayed with herbicide without injuring desirable plants. For areas that have infestations of invasive species, this two-phased approach will be taken.

  Burning identified prairies and savannas every 3 to 5 years in conjunction with spray applications will control undesirable species and stimulate native species growth. Burns will be controlled to fit inside of established fire breaks and utilize natural features of the site. Fire size will also be limited by the number of personnel available to conduct the burn.

- Personnel Needs and Responsibilities

  Crew size will vary with the size of the area planned for burning. Most of the fires that will be initiated at the Fernald Preserve can be controlled with an eight-person burn crew. As area increases, so does the number of personnel needed. Larger areas will be burned in phases to limit burn acreages to sizes that a burn crew can safely handle.

  Planning and implementing prescribed burn activities at the Fernald Preserve will be conducted through the Ecological Restoration Group, which reports directly to the Fernald project manager. Duties can be broken down into fire manager, fire watch/patrolling, firing personnel, line control, and mop-up. The fire manager is responsible for directing all fire activities. Firing personnel will use fusee or drip torches to create a line of fire; they will ignite grasses only as directed by the fire manager. Line control personnel will use backpack sprayers, vehicles with water pumps, or hand tools to control the fire line. They may be called on to spray the line ahead of the firing, to spray water on the line to limit fire spread into the fire break along the fire line, or to put out fire along the fire break once a black line has been established.

After the fire has burned over the planned area, the fire manager will direct personnel to make a sweep over the area and water down or bury all smoking materials. Any woody debris that is still burning will have the smoldering area cut off, broken up, and saturated with water.

All personnel on the burn have two responsibilities: maintaining communication with the fire manager and conducting fire watch. Radios will be available for burn personnel. Radios will be used to receive directions from the fire manager and to keep the fire manager informed of conditions along the fire line. All personnel are responsible for patrolling their respective area of the fire line and looking for out-of-control conditions or break-overs outside of the fire breaks. Any conditions different from the plan must be communicated to the fire manager.

Appendix B contains a table listing roles and responsibilities.

- Fire Weather

The single most important control for successfully burning an area is the fire weather. Small changes in weather can drastically change the expected fire behavior, and the fire itself can affect fuel and weather factors. Weather factors will be monitored prior to and during the course of the fire; changes will be noted to ensure that weather conditions remain within set parameters. Weather data will be collected from established weather sites (see Appendix C), fire weather instruments, pocket weather meters, or some combination. Fire weather conditions will be documented on individual Fernald Preserve Prescribed Fire Burn Plans. A typical Fernald Preserve Prescribed Fire Burn Plan can be found in Appendix A.

As shown in Section 3.3.5, weather thresholds will be established in which burning would be initiated or allowed to continue. These are the safety factors within which the fire can be controlled, for even small variations outside the thresholds can mean loss of control or violation of permits. Thresholds identified in individual Burn Plans will be expressed as the optimal range in which a burn can take place. Ranges will be documented on each Fernald Preserve Prescribed Fire Burn Plan. Values outside that range will be reason to postpone or stop a burn.

- Fire Behavior

Fire behavior can be predicted for each fuel type based on fuel and weather conditions. Tables included in Appendix D can be used to estimate the rate of spread, flame length, and wind limit. Even small changes to the weather (e.g., amount of sun or shade, wind speed or direction, air temperature, relative humidity) will quickly change the behavior of a fire; however, some general behavioral statements are true for grass and grass-shrub fuel types. See Section 3.3.1.

When limits are placed on weather and fuel parameters that are allowed for burning, then the rate of spread and flame length will be limited. The size and dimensions of a planned area, the placement of fire breaks, and the size of fire breaks are developed with fire behavior factored into the plans. Appendix D contains tables that will be used in estimating fire behavior based on predicted and current weather conditions.

- Fire Break Construction

Prior to the day of the burn, fire breaks will be constructed around the periphery of the fire in accordance with the Prescribed Fire Burn Plan. A fire break will consist of a road or a

mown perimeter. It will be at least 20 feet wide, with heavier fuels requiring greater widths (the fire break widths will be specified in the plan). It will be cleared of any piles of debris or grasses. If necessary, a secondary fire break will be established within 30 yards of the primary one. The backup line will be equal in size to the primary line.

Any structure or plant inside the fire line that will need to be preserved needs to be protected prior to burning. A boundary will need to be cut around each structure or plant. The distance from the edge of the buffer to the item should be equal to the anticipated flame height. All debris and grasses should be removed from the buffer.

- Safety Zones

  In case the weather changes or the wind shifts, preplanned escape routes and a safety zone are needed for each burn. The safety zone must be of sufficient size to accommodate all members of the fire team and keep them out of danger of being burned without additional protections. The area's size will be calculated using guides established by National Fire Equipment Systems (NFES) and should take into account the anticipated flame heights. The shape of the area should maximize protection in all directions (see Appendix E).

  The safety zone will not be placed in an area downwind of the fire (under anticipated winds). The safety zone will not be placed in ravines or drainages or in an area that requires an uphill escape route.

- Waivers and Permits

  During a state fire season, a waiver must be requested from the Ohio Division of Forestry for any burns in Ohio. A Certified Prescribed Fire Manager must submit the Request for Waiver of *Ohio Revised Code* 1503.18 through the Certified Prescribed Fire Manager Program prior to burning. The request provides the Ohio Division of Forestry with information on who will be conducting the fire, when it will be conducted, and where it will be conducted, and does not require approval. Additionally, a permit from OEPA must be received prior to burning. An Open Burn Request Form must be submitted to OEPA through the Hamilton County Department of Environmental Services. This request will provide information on the type of fire being conducted and its purpose, its projected timeframe, and a plan for smoke management. OEPA must approve the Open Burn Request Form.

- Pre-Fire Checklist

  Each prescribed burn will have a pre-fire Go/No Go checklist. A typical checklist is shown in Appendix F. It will identify all the steps that must be completed before a burn begins. As each step is completed, it will be initialed, and the date and time of completion will be entered. If there are unresolved or incomplete requirements, the burn cannot be started. The checklist will be included with the Burn Plan to be saved as a record of the burn.

3.4.2 Prescribed Burn Training

All personnel participating in prescribed burns must be briefed on the Fernald Preserve Prescribed Burn JSA, Prescribed Burn Training, and the Prescribed Fire Burn Plan. The Prescribed Burn JSA identifies hazards expected in conducting a burn and the controls need to mitigate the hazards. Prescribed Burn Training is a basic course in fireline roles and responsibilities, fire terminology, fire behavior, burn methods, and fire contingencies. The briefing will provide personnel with information necessary to safely perform the prescribed burn.

On the day of a prescribed burn, all personnel will be briefed on the Prescribed Fire Burn Plan to inform them of burn-specific conditions.

3.4.3 Prescribed Fire Escape

Burning within the fuel and weather parameters should prevent the fire from escaping its set boundaries; however, some sudden changes in conditions can cause a fire to escape the boundaries of the fire break (break-over). A predetermined plan of action will be set for any break-over. Firing with the drip torch or fuses will cease. Possible actions could include the following:

- The fire manager may direct individuals to attack any isolated break-over with water. Attack may include moving water pumps to the break-over to contain the fire at the point of ignition.
- The fire manager may direct personnel to move to predetermined secondary control lines to contain the break-over; equipment and personnel would be moved to those lines to wet down the fire break.
- The fire manager may direct all personnel to move to the safety zone. If conditions are beyond control for the burn team, the crew and equipment will move to the safety zone, and backup support will be called. The local fire department will be notified to respond. Equipment will be available to cut additional fire lines, if necessary.

Any prescribed burn that burns outside of the prescription will be reported as a wildland fire. Burning into the fire break does not constitute a break from prescription, but a break-over is a fire in the wildland.

3.4.4 Air Quality and Smoke Management

The purpose of smoke management is to minimize the amount of smoke entering populated areas and impacting public health and safety, to avoid visual impairment on roadways, to avoid problems at sensitive sites (e.g., nursing homes, schools, hospitals), and to avoid significant deterioration of air quality (National Ambient Air Quality Standards). To accomplish these objectives, each burn will be conducted only when meteorological conditions are favorable. Current and forecast meteorological data (http://fire.boi.noaa.gov/FIREWX/CLEFWFILN.html) are available for determining wind and atmospheric conditions to identify where smoke from a fire will go and how it will affect the region.

Atmospheric stability is a condition that greatly influences how smoke will move from a fire. Smoke is affected by atmospheric motion or vertical air movement. Atmospheric stability is the degree to which vertical motion in the atmosphere is enhanced or suppressed and directly related to the temperature variance aloft. The temperature and stability are constantly changing. In a stable atmosphere, there will not be vertical movement between the different layers of the atmosphere, which prevents smoke from rising. Smoke will stay near the ground surface and create smoke and visibility hazards in the local area. In an unstable atmosphere, there is vertical movement between the layers of the atmosphere, creating more winds and strong updrafts that carry the smoke higher aloft before dissipating. The effects of smoke on the local area and the ambient air quality can be minimized by burning only on days with upward air movement.

Prescribed burns will be limited to days when the air currents would lift the smoke to altitudes between 1,700 to 6,900 feet.

Land use in the Fernald area consist primarily of residential use, farming, light industry, and gravel excavation operations. However, a review of the community around the Fernald Preserve has identified several areas and facilities that could be impacted by smoke from a fire at the site if the atmospheric conditions were stable or included an inversion layer.

There are communities to the northeast (Ross) and southeast (New Baltimore) where additional land is being developed for housing. There are some light industries along the site's western boundary and a gravel company on the eastern boundary.

Miami Whitewater Forest, a Hamilton County park, is located about 4 miles to the west, with some portions as close as 1.5 miles from the Fernald Preserve.

Main traffic flow through the area is on State Highway 128 (a quarter mile to the east) and State Highway 126 (along the north property boundary). County roads run along the southern and western property boundaries. The CSX Railroad has a rail line that runs nearly parallel to the west property boundary. At its closest point, the rail is approximately 250 feet from the southwest corner of the site. The Cincinnati West Airport at Harrison is located 4.6 miles to the southwest of the Fernald Preserve. Each of these locations could be listed as a smoke-sensitive site that should be considered in any smoke management plan (see Figure 3–2).

There are 11 schools within 5 miles of the Fernald Preserve site boundary (see Figure 3–2). The U.S. Environmental Protection Agency recognizes schools as institutions sensitive to smoke. Table 3–1 lists the schools and shows their respective distances from the Fernald Preserve property boundary.

Table 3–1. Schools and Distances from Fernald Preserve Boundary

School	Address	ZIP Code	Distance (miles)	Direction
Morgan Elementary School	3427 Chapel Road	45013	2.4	NW
Elda Elementary School	3980 Hamilton-Cleves Road	45013	2.0	ENE
Ross High School	3425 Hamilton-Cleves Road	45013	2.8	ENE
Ross Middle School	3371 Hamilton-Cleves Road	45013	2.9	ENE
St John The Baptist School	5375 Dry Ridge Road	45252	3.5	SE
Colerain Elementary School	4850 Poole Road	45251	5.0	SE
Colerain Middle School	4700 Poole Road	45251	4.9	SE
Miamitown Elementary School	State and Mill Streets	45041	5.0	S
Crosby Elementary School	8382 New Haven Road	45030	1.4	SW
William Henry Harrison High School	9860 West Road	45030	4.6	SW
Harrison Middle School	9830 West Road	45030	4.6	SW

There are two senior-citizen centers within 5 miles of the Fernald Preserve boundary (see Figure 3-2). These are not live-in facilities and would not normally be listed as institutions that may be classified as sensitive to smoke, but they will be considered as such in this plan. Crosby Township Senior Center is 2.1 miles southwest of the site, and Colerain Township Senior and Community Center is located southeast of the site, about 4.6 miles away.

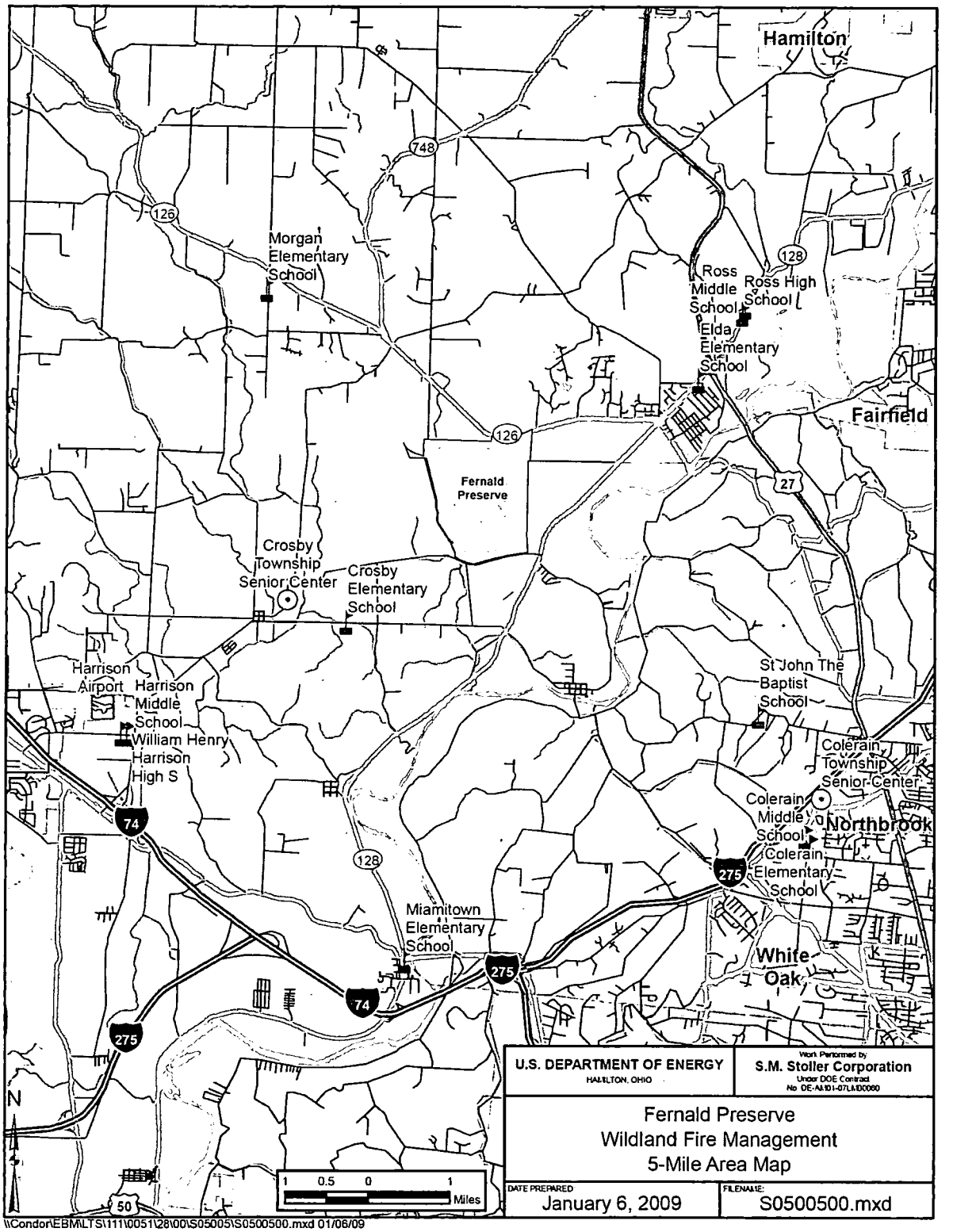

Figure 3–2. 5-Mile Area Map

Consideration for community infrastructure and sensitive areas will be included in individual Burn Plans. The direction of the wind is a critical factor in protecting these sensitive areas. Weather thresholds will include wind direction. If the smoke could be blown toward these sensitive areas without sufficient atmospheric lift, then the burn would be postponed until weather conditions are more suitable. Smoke-sensitive areas will be determined for each Burn Plan and included on a map attached to the plan and Open Burn Request Form to be submitted to Hamilton County Environmental Services for each prescribed burn. The map, a copy of the Open Burn Request Form, and approval from OEPA will be maintained in the burn records.

3.4.5 Surface and Groundwater Protection

One of the most common concerns expressed about burns is that the soils will wash away in a big rain, degrading surface water in nearby streams. Careless actions during a burn could damage soils and, in turn, water quality, but careful planning and proper execution of that plan should result in a burn that has little or no effect on water quality in the area.

Native grasses and forbs are deep-rooted plants that are adapted to fire. A hot fire that burns quickly through a stand of native plants while the soil is still damp will not kill the plant. Though the stem and leaves may be consumed, the roots will still be alive to hold the soil in place. Runoff will increase for a time on steep slopes and could carry suspended soil particles, dissolved inorganic nutrients, and other materials with it. The area should revegetate quickly to limit this movement.

To protect the streams at the Fernald Preserve from siltation following a prescribed burn, the following controls will be instituted:

- All prescribed burns will have a buffer left between them and streams or ponds. The vegetation will act as a filter to slow the flow of water and to prevent pollutants from reaching the water.
- The amount of burn area that will be on a steep slope will be limited. Most of the site has a moderate to flat slope; the steep slopes are located only adjacent to drainages and water bodies. Prescribed burns will not be conducted on slopes adjacent to drainages with slopes greater than 4 to 1.
- Burns will be conducted only when soil conditions are prime for achieving a good burn but soil moisture will limit soil damage. Optimal ranges for fine fuel moisture, days since rain, and rain amount—weather factors included in each Prescribed Fire Burn Plan—will identify the conditions necessary to protect the soil. If conditions are not within these ranges, the burn will be postponed.
- The burn area will be examined following fire to determine if any areas have been damaged and will need repairs to protect them from possible erosion. Damaged areas will be treated.

3.4.6 Wildlife Species Protection

Mammal and bird species utilize the prairies and savannas for food and nesting. The treated sites will provide better habitat for the animals, but care must be exercised to protect those animals from the fire. Nesting season for animals will be identified, and burns will be planned to avoid that season if possible. Fire breaks will be constructed during the winter, before most species are

nesting. Fire breaks will be maintained through the growing season to dissuade their use for nesting. Checks will be made prior to the day of the burn for active nests. Active nests will be precluded from fire.

3.4.7 Hazardous Materials

Efforts were made during site cleanup to identify and remove hazardous materials. The site was certified to meet final remediation levels pursuant to applicable Records of Decision.

No hazardous materials are anticipated within prescribed burn areas. Chemical use and storage are limited to the CAWWT and former Dissolved Oxygen Building facilities and should not be a hazard in prescribed burns.

3.4.8 Non-Fire Treatments

Some areas of site prairies and savannas have cool-grass components that are residual or have invaded the area. These grasses have some green components that will limit an area's ability to burn completely. A hot burn might kill these grasses, but they would not be affected under cooler or more humid conditions. To make them burn more efficiently, a chemical treatment could be applied while the native grasses are still dormant and at least 2 weeks before the planned burn. The cool-season grasses would be killed, but the native grasses would be unaffected. The cool-season grasses would then burn more completely. Either glyphosate or a target herbicide would be used.

3.4.9 Mop-Up Phase

In grass fuel fires, mop-up will consist of cold trailing the perimeter of a fire break—all embers and smokes will be extinguished along the fire break. This phase can be done as the fire burns away from the fire line. Once fire is about 5 feet from the edge of fire line, water is sprayed along the fire break to extinguish the edge. Once the fire has burned the whole area, water will be sprayed on all embers and smokes, using portable pumps. Personnel will walk inward from the fire break to locate hot spots and smoking debris within the boundary. Burning materials will be separated from any heavy fuels still burning within the area, using hand tools. Exposed burning materials will be extinguished with water until all fire is out.

3.4.10 Post-Fire Critique and Report

Even the best-planned burns can have room for improvement. Holding a post-burn critique is a way to identify those areas for improvement. All personnel who participated in the burn will participate in a review of the burn. They will discuss what went well and where problems or difficulties were seen.

Topics would include the following:

- Was pre-burn preparation sufficient and completed properly?
- Were changes made to the Burn Plan, or did personnel adhere to the original Burn Plan? Were any changes documented?
- Did the fire behave as anticipated?

- Were there any areas where holding the fire break was difficult?
- Did personnel and equipment perform as expected? Are the personnel and equipment mix matching the need of the burn?
- Would the equipment have been sufficient to hold the fire if conditions had changed?
- Did weather conditions remain within the planned limits? Do the thresholds for burning need to be reevaluated?
- Was the fire confined to the intended area?
- Were there any escapes of fire? Was the backup plan sufficient? Did personnel understand how to handle a breakout?
- If the fire escaped, how well did the burn crew work with the local fire department chief and suppression crew?
- Were there any breaks in communication along the fire line?
- Were any protected areas within the area of the burn damaged?
- Did personnel have any other issues during the burn?

Issues identified in the critique will be documented, and the burn will be summarized. The summary and critique will be included with the completed Fernald Preserve Prescribed Fire Plan as the report on the prescribed burn. The completed plan will include the predicted and actual conditions and behaviors, notifications, crew responsibilities, site preparation, mop-up, restoration, and final fire-line conditions. All of this information has a designated location on the site form. The form is not only a plan for the burn but also documentation of the burn, and is to be included with the report.

3.4.11 Burned Area Rehabilitation

In the days following the burn, the burn area will be checked to determine soil and vegetation conditions. Any areas that may have burned too hot and removed all duff may need to be seeded and armored to protect the soil until grasses emerge. Areas that have not burned completely may need other treatments to control undesirables. A plan consistent with site seeding specifications will be developed for rehabilitation work.

The general need for site restoration following the burn will be determined prior to the burn. Some areas have a limited amount of established native species. These areas will require over-seeding following the burn to supplement existing native species and replace undesirable species. Seeding will be done either by broadcasting seed, using a seed drill, or a combination of the two.

4.0 Organizational and Budgetary Parameters

4.1 Budget

Prescribed burning activities were baselined under the current Legacy Management Support (LMS) contract. The costs for each year have been estimated; fiscal 2009 costs have been

estimated at approximately $26,000. Following the initial burns, a more definitive budget will be established on a per-acre basis.

4.2 Cooperative Agreements

The LMS contractor has contracted with the Ross Fire Department for support in the event of a fire on site. A call to 911 to report a fire will result in response by this fire department. In the event that Ross is not available, the Crosby Township Fire Department would respond. Fire departments should be able to respond within 10 minutes of any emergency call.

The Hamilton County Park District natural resource manager has walked down areas that have been proposed for burning and provided information used in the planning of prescribed burns. Some Hamilton County Park personnel may be available as volunteers to assist in the Fernald Preserve prescribed burns.

5.0 Reporting

All wildland fires found on or threatening the Fernald Preserve will be reported in accordance with the requirements identified in Section 5.9 of the Safety Incident Reporting of the Office of Legacy Management Fernald Project H&S Plan. Events will be identified, reported, evaluated, and tracked in accordance with DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*. Reporting shall be completed within the timeframe identified. Any prescribed fire that burns outside of the prescription will be reported as a wildland fire.

The fire manager will follow up with the fire chief of the responding fire department to ensure that any required reporting by the fire department has been accomplished.

Completed prescribed burns will be reported to the fire training coordinator with the Ohio Division of Forestry at the Ohio State Fire Academy. Reporting will include the burn name, the name of the fire manager in charge of the prescribed burn, and the fire manager's certification number. Reporting is necessary for maintaining the fire manager's certification with the State of Ohio.

6.0 Monitoring and Evaluation

Prescribed burn and wildland fire burn areas will be monitored in the year following the burn. Data collected will be used to evaluate the effectiveness of the burn and to determine if objectives have been accomplished. At a minimum, monitoring will consist of observation of the area. The following questions will be addressed in post-burn walk downs:

- Has there been a complete burn?
- What areas inside the burn perimeter did not burn?
- Were target species burned?
- What species are sprouting after the burn?

If necessary, a post-burn evaluation will include the collection of data on plant species and distribution at random locations within the burn boundary. A sampling plan for the burn areas will be developed and data evaluated through the monitoring program established in the Natural Resource Restoration Plan (DOE 2002). Any information gained can provide valuable information for improving future burns of the area.

7.0 References

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NFPA (National Fire Protection Association) Standards
Wildland Fire Management, Standard 1143, 2005
Protection of Life and Property from Wildfire, Standard 1144, 2008

NIFC (National Interagency Fire Center), 2001, *Federal Wildland Fire Management Policy and Implementing Actions*

OAC 3745-19, *Ohio Administrative Code*, "Open Burning Standards," July 7, 2006.

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Appendix A

Fernald Preserve Prescribed Fire Burn Plan

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Fernald Preserve Prescribed Fire Burn Plan

7400 Willey Road, Harrison, Ohio 45030

Burn Name _____ **Burn Manager** _____

Burn Location

County ☐ Butler (Ross Township) ☐ Hamilton (Crosby Township) **State** Ohio

Burn Size

Site Description

Fuel Types		
		% of Unit Area
		% of Unit Area
		% of Unit Area
		% of Unit Area

Purpose of Burn

Burn Objectives

Permits	**Submittal Date**	**Receipt Date**
State Burn Ban Waiver		
State Air Quality Permit		

Smoke Sensitive Areas	**Direction**	**Distance**

Wind Factors	**Optimal Range**	**Predicted**	**Actual**
Surface Winds			
Speed			
Direction			
Transport Winds			
Speed			
Direction			
Minimum mixing height			
Dispersion index			

Date of fire_____

Fernald Preserve Prescribed Fire Burn Plan

7400 Willey Road, Harrison, Ohio 45030

Burn Name _____ **Burn Manager** _____

Weather Factors	Optimal Range	Predicted	Actual
Minimum relative humidity			
Maximum temperature			
Fine fuel moisture			
Days since rain			
Rain amount			

Fire Behavior	Optimal Range	Actual
Type fire		
Head-fire flame length		
Head-fire rate of spread		
Back-fire flame length		
Back-fire rate of spread		
Date of Burn		
Time of Burn		

Line of Responsibility

Name of Crew Member	Responsibility	Report

Equipment	Location	Crew Size

Site Preparation/Fire Breaks

Date of fire_____

Fernald Preserve Prescribed Fire Burn Plan

7400 Willey Road, Harrison, Ohio 45030

Burn Name _____ **Burn Manager** _____

Site Restoration Work

Stakeholders / Neighbors to Notify	Contact Number	Date	Time

Emergency Contacts	Phone	Cell
Medical / Fire / Law Enforcement	911	
Stoller Site Manager	513-648-5294	513-910-6107
LM Site Manager	513-648-3148	513-910-4009

Contact List	Contact Number	Pre-Fire Date/Time	Post-Fire Date/Time
Hamilton County Sheriff's Office	513-825-2280		
Butler County Sheriff's Office	513-887-3010		
Crosby Township Fire Department	513-825-2260		
Ross Fire Department	513-863-3410		
Ross Police Department	513-863-2337		
Ohio State Highway Patrol	513-863-4606		

Site Mop-Up

Final Fireline Condition :

Burn Manager		Date:		Time:	

Date of fire_____

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Appendix B

Roles and Responsibilities

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Roles and Responsibilities

The Fernald Preserve restoration ecologist will:

- Prepare Prescribed Fire Burn Plans.
- Obtain DOE approval to conduct the prescribed burns.
- Obtain all necessary permits and approvals.
- Prepare the site for the burn (i.e., install fire breaks, buffers, and any required safety zones).
- Perform a readiness review of all activities prior to the burn.
- Evaluate the effectiveness of the prescribed burn and report findings.

Fernald Preserve Public Affairs personnel will:

- Notify local residents and stakeholders of prescribed burns, through a press release, directed mailings, a public briefing, or some combination of the three.
- Ensure that an effective interface is established with all stakeholders.

The burn manager will:

- Ensure full compliance with the Prescribed Fire Burn Plan.
- Conduct a pre-job briefing to the Prescribed Fire Burn Plan and Daily Safety Briefing.
- Ensure that conditions are monitored before and during the burn.
- Determine if conditions are suitable for conducting the prescribed burn.
- Walk down all fire breaks, buffer areas, and safety zones on the day of the burn prior to burn.
- Notify local authorities, identified on the plan's contact list, of the prescribed burn before and after it occurs.
- Provide instruction on the safe use of the ignition source.
- Direct all activities associated with the burn crew.
- Conduct a post-burn critique.
- Initiate an emergency call if fire suppression is required.

The burn crew will:

- Wear required PPE.
- Maintain communications with the burn manager.
- Know and observe all H&S requirements in Prescribed Fire Burn Plan.
- Follow the burn manager's directions.
- Man vehicles transporting a water tank and pump; water-down fire breaks and control fire along fire breaks.
- Carry ignition sources and set the fire within the burn area.

- Monitor the perimeter of the fire to ensure the fire does not spread to unwanted areas during the burn.
- Control fire within the burn area.
- Extinguish the fire pursuant to the direction of the burn manager.
- Walk down the burn area following the burn to confirm that all flames and smoke have been extinguished.

Environmental Compliance personnel will:

- Support the development of Prescribed Fire Burn Plans.
- Review Prescribe Fire Burn Plans to ensure that they comply with laws and regulations.
- Monitor burn activities, and ensure that they comply with laws and regulations.

H&S personnel will:

- Review the Prescribed Fire Burn Plan, and ensure that it contains appropriate safety controls for each hazard.
- Ensure compliance with H&S requirements.
- Be a liaison to emergency response entities.

The site manager will:

- Review the Go/No-Go Checklist to ensure that all components have been accomplished.
- Authorize the burn manager to proceed with the prescribed burn based on a review of the Go/No-Go Checklist and consultation with the Ecological Restoration lead and the burn manager.

Appendix C

Fire Weather Websites

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Fire Weather Planning Forecast for the Middle Ohio Valley National Weather Service Wilmington, Ohio:
http://fire.boi.noaa.gov/FIREWX/CLEFWFILN.html

National Fire Danger Rating System and Rocky Mountain Center Interactive Weather Planner:
http://www.fs.fed.us/rmc/

Storm Prediction Center Fire Weather Forecast:
http://www.spc.noaa.gov/products/fire_wx/

Eastern Area Coordination Center:
http://gacc.nifc.gov/eacc/predictive/weather/weather.htm

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Appendix D

Fire Behavior Calculation Tables

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Table D-1. Reference Fuel Moisture
Day Time 0800 -1959

	Relative Humidity (Percent)																				
Dry Bulb	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	
Temperature	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	100
(°F)	4	9	14	19	24	29	34	39	44	49	54	59	64	69	74	79	84	89	94	99	
10-29	1	2	2	3	4	5	5	6	7	8	8	8	9	9	10	11	12	12	13	13	14
30-49	1	2	2	3	4	5	5	6	7	7	7	8	9	9	10	10	11	12	13	13	13
50-69	1	2	2	3	4	5	5	6	6	7	7	8	8	9	9	10	11	12	12	12	13
70-89	1	1	2	2	3	4	5	5	6	7	7	8	8	8	9	10	10	11	12	12	13
90-109	1	1	2	2	3	4	4	5	6	7	7	8	8	8	9	10	10	11	12	12	13
109+	1	1	2	2	3	4	4	5	6	7	7	8	8	8	9	10	10	11	12	12	12

Table D-2. Dead Fuel Moisture Content Corrections
Day Time 0800 -1959
May June July

	Time⇒	0800⇒			1000⇒			1200⇒			1400⇒			1600⇒			1800⇒		
		B	L	A	B	L	A	B	L	A	B	L	A	B	L	A	B	L	A
	Exposed—Less Than 50% Shading of Surface Fuels																		
N	0-30%	2	3	4	1	1	1	0	0	1	0	0	1	1	1	1	2	3	4
	31%+	3	4	4	1	2	2	1	1	2	1	1	2	1	2	2	3	4	4
E	0-30%	2	2	3	1	1	1	0	0	1	0	0	1	1	1	2	3	4	4
	31%+	1	2	2	0	0	1	0	0	1	1	1	2	2	3	4	4	5	6
S	0-30%	2	3	3	1	1	1	0	0	1	0	0	1	1	1	1	2	3	3
	31%+	2	3	3	1	1	2	0	1	1	0	1	1	1	1	2	2	3	3
W	0-30%	2	3	4	1	1	2	0	0	1	0	0	1	0	1	1	2	3	3
	31%+	4	5	6	2	3	4	1	1	2	0	0	1	0	0	1	1	2	2
	Shaded—Greater Than or Equal to 50% Shading of Surface Fuels																		
N	0% +	4	5	5	3	4	5	3	3	4	3	3	4	3	4	5	4	5	5
E	0% +	4	4	5	3	4	5	3	3	4	3	4	4	3	4	5	4	5	6
S	0% +	4	4	5	3	4	5	3	3	4	3	3	4	3	4	5	4	5	5
W	0% +	4	5	6	3	4	5	3	3	4	3	3	4	3	4	5	4	4	5

Note: A = 1,000 feet-2,000 feet above site
L = ±1,000 feet of site location
B = 1,000 feet-2,000 feet below site

Table D-3. Dead Fuel Moisture Content Corrections
Day Time 0800 -1959
February, March, April / August, September, October

	Time⇒	0800⇒			1000⇒			1200⇒			1400⇒			1600⇒			1800⇒		
		B	L	A	B	L	A	B	L	A	B	L	A	B	L	A	B	L	A
	Exposed—Less Than 50% Shading of Surface Fuels																		
N	0-30%	3	4	5	1	2	3	1	1	2	1	1	2	1	2	3	3	4	5
	31%+	3	4	5	3	3	4	2	3	4	2	3	4	3	3	4	3	4	5
E	0-30%	3	4	5	1	2	3	1	1	1	1	1	2	1	2	3	3	4	5
	31%+	3	3	4	1	1	1	1	1	1	1	2	3	3	4	5	4	5	6
S	0-30%	3	4	5	1	2	2	1	1	1	1	1	1	1	2	3	3	4	5
	31%+	3	4	5	1	2	2	0	1	1	0	1	1	1	2	2	3	4	5
W	0-30%	3	4	5	1	2	3	1	1	1	1	1	1	1	2	3	3	4	5
	31%+	4	5	6	3	4	5	1	2	3	1	1	1	1	1	1	3	3	4
	Shaded—Greater Than or Equal to 50% Shading of Surface Fuels																		
N	0% +	4	5	6	4	5	5	3	4	5	3	4	5	4	5	5	4	5	6
E	0% +	4	5	6	3	4	5	3	4	5	3	4	5	4	5	6	4	5	6
S	0% +	4	5	6	3	4	5	3	4	5	3	4	5	3	4	5	4	5	6
W	0% +	4	5	6	4	5	6	3	4	5	3	4	5	3	4	5	4	5	6

Note: A = 1,000 feet-2,000 feet above site
L = ±1,000 feet of site location
B = 1,000 feet-2,000 feet below site

Table D-4. Dead Fuel Moisture Content Corrections
Day Time 0800 -1959
November, December, January

	Time⇒	0800⇒			1000⇒			1200⇒			1400⇒			1600⇒			1800⇒		
		B	L	A	B	L	A	B	L	A	B	L	A	B	L	A	B	L	A
	Exposed—Less Than 50% Shading of Surface Fuels																		
N	0-30%	4	5	6	3	4	5	2	3	4	2	3	4	3	4	5	4	5	6
	31%+	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6
E	0-30%	4	5	6	3	4	4	2	3	3	2	3	3	3	4	5	4	5	6
	31%+	4	5	6	2	3	4	2	2	3	3	4	4	4	5	6	4	5	6
S	0-30%	4	5	6	3	4	5	2	3	3	2	2	3	3	4	4	4	5	6
	31%+	4	5	6	2	3	3	1	2	2	1	1	2	2	3	3	4	5	6
W	0-30%	4	5	6	3	4	5	2	3	3	2	3	3	3	4	4	4	5	6
	31%+	4	5	6	1	5	6	3	4	4	2	2	3	2	3	4	4	5	6
	Shaded—Greater Than or Equal to 50% Shading of Surface Fuels																		
N	0% +	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6
E	0% +	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6
S	0% +	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6
W	0% +	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6

Note: A = 1,000 feet-2,000 feet above site
L = ±1,000 feet of site location
B = 1,000 feet-2,000 feet below site

Table D-5. Fuel Models, Rate of Spread/Flame

Fuel Model 1							
0% Slope							
Rate of Spread, CH/H							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
2.0	6	26	90	201	360	568	666*
4.0	5	20	69	154	275	345*	345*
6.0	4	18	61	135	242	270*	270*
8.0	4	15	52	117	199*	199*	199*
10.0	2	10	35	65*	65*	65*	65*
12.0	0	0	0	0	0	0	0

* Means you hit the wind limit
CH/H – chains per hour

Flame Length, ft							
1 Hour Moisture	Mid-Flame Wind; miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
2.0	1.5	2.9	5.1	7.3	9.5	11.8	12.7*
4.0	1.2	2.3	4.1	5.9	7.7	8.6*	8.6*
6.0	1.1	2.1	3.8	5.4	7.1	7.5*	7.5*
8.0	1.0	1.9	3.4	4.9	6.3*	6.3*	6.3*
10.0	0.7	1.3	2.4	3.2*	3.2*	3.2*	3.2*
12.0	0	0	0	0	0	0	0

* Means you hit the wind limit

Table D-5 (continued). Fuel Models, Rate of Spread/Flame

Fuel Model 1							
15% Slope							
Rate of Spread, CH/H							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
2.0	12	32	96	207	366	573	666*
4.0	9	24	74	158	279	345*	345*
6.0	8	22	65	139	246	270*	270*
8.0	7	19	56	120	199*	199*	199*
10.0	5	12	37	65*	65*	65*	65*
12.0	0	0	0	0	0	0	0

* Means you hit the wind limit
CH/H – chains per hour

Flame Length, ft							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
2.0	2.0	3.1	5.2	7.4	9.6	11.8	12.7*
4.0	1.6	2.5	4.2	6.0	7.8	8.6*	8.6*
6.0	1.5	2.3	3.9	5.5	7.1	7.5*	7.5*
8.0	1.3	2.1	3.5	5.0	6.3*	6.3*	6.3*
10.0	0.9	1.5	2.5	3.2*	3.2*	3.2*	3.2*
12.0	0	0	0	0	0	0	0

* Means you hit the wind limit

Table D-5 (continued). Fuel Models, Rate of Spread/Flame

Fuel Model 1							
30% Slope							
Rate of Spread, CH/H							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
2.0	29	49	113	224	383	591	666*
4.0	22	38	87	171	293	345*	345*
6.0	20	33	76	151	257	270*	270*
8.0	17	29	66	130	199*	199*	199*
10.0	11	19	43	65*	65*	65*	65*
12.0	0	0	0	0	0	0	0

* Means you hit the wind limit
CH/H – chains per hour

Flame Length, ft							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
2.0	3.0	3.8	5.6	7.7	9.8	12.0	12.7*
4.0	2.4	3.1	4.5	6.2	8.0	8.6*	8.6*
6.0	2.2	2.8	4.2	5.7	7.3	7.5*	7.5*
8.0	2.0	2.6	3.8	5.1	6.3*	6.3*	6.3*
10.0	1.4	1.8	2.6	3.2*	3.2*	3.2*	3.2*
12.0	0	0	0	0	0	0	0

* Means you hit the wind limit

Table D-5 (continued). Fuel Models, Rate of Spread/Flame

Fuel Model 3							
0% Slope							
Rate of Spread, CH/H							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	6	52	121	201	290	387	490
6.0	5	39	89	148	214	286	361
9.0	4	32	73	122	176	234	296
12.0	3	28	64	107	154	206	260
15.0	3	25	57	95	137	182	231
18.0	2	20	47	79	11	151	191
21.0	2	14	32	53	77	103	130

CH/H – chains per hour

Flame Length, ft							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	3.8	10.1	14.8	18.7	22.2	25.3	28.2
6.0	3.0	8.0	11.8	14.9	17.7	20.2	22.5
9.0	2.6	7.0	10.3	13.0	15.7	17.6	19.6
12.0	2.4	6.5	9.5	12.1	14.3	16.3	18.2
15.0	2.2	6.0	8.9	11.2	13.3	15.2	16.9
18.0	2.0	5.3	7.7	9.8	11.6	13.2	14.7
21.0	1.4	3.8	5.6	7.1	8.4	9.6	10.7

Table D-5 (continued). Fuel Models, Rate of Spread/Flame

Fuel Model 3							
15% Slope							
Rate of Spread, CH/H							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	11	57	126	206	295	392	495
6.0	8	42	93	152	218	289	365
9.0	7	35	76	125	178	237	299
12.0	6	30	67	110	157	208	263
15.0	5	27	59	97	139	185	233
18.0	4	22	49	81	115	153	193
21.0	3	15	33	55	79	104	132

CH/H – chains per hour

Flame Length, ft							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	4.9	10.5	15.1	19.0	22.4	25.5	28.4
6.0	3.9	8.4	12.0	15.1	17.8	20.3	22.6
9.0	3.4	7.3	10.5	13.2	15.5	17.7	19.7
12.0	3.2	6.8	9.7	12.2	14.4	16.4	18.2
15.0	2.9	6.3	9.0	11.3	13.4	15.2	17.0
18.0	2.6	5.5	7.9	9.9	11.7	13.3	14.8
21.0	1.9	4.0	5.7	7.2	8.5	9.6	10.7

Table D-5 (continued). Fuel Models, Rate of Spread/Flame

Fuel Model 3							
30% Slope							
Rate of Spread, CH/H							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	26	72	140	221	310	407	510
6.0	19	53	103	163	229	300	376
9.0	16	43	85	133	187	246	308
12.0	14	38	7	117	165	216	271
15.0	12	34	66	104	146	192	240
18.0	10	28	55	86	121	159	199
21.0	7	19	37	59	82	108	135

CH/H – chains per hour

Flame Length, ft							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	7.3	11.7	15.9	19.6	22.9	25.9	28.7
6.0	5.8	9.3	12.6	15.6	18.2	20.6	22.9
9.0	5.0	8.1	11.0	13.6	15.9	18.0	19.9
12.0	4.7	7.5	10.2	12.6	14.7	16.7	18.5
15.0	4.4	7.0	9.5	11.7	13.7	15.5	17.2
18.0	3.8	6.1	8.3	10.2	11.9	13.5	15.0
21.0	2.7	4.4	6.0	7.4	8.6	9.8	10.9

Table D-5 (continued). Fuel Models, Rate of Spread/Flame

Fuel Model 3							
45% Slope							
Rate of Spread, CH/H							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	50	96	165	245	334	431	534
6.0	37	71	122	181	247	318	394
9.0	30	58	100	148	202	261	323
12.0	27	51	88	130	178	229	284
15.0	24	45	78	116	158	203	252
18.0	20	38	64	96	131	168	209
21.0	13	26	44	65	89	115	142

CH/H – chains per hour

Flame Length, ft							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	9.9	13.4	17.1	20.5	23.7	26.6	29.4
6.0	7.9	10.6	13.6	16.3	18.8	21.2	23.4
9.0	6.9	9.3	11.9	14.2	16.4	18.5	20.4
12.0	6.4	8.6	11.0	13.2	15.2	17.1	18.9
15.0	5.9	8.0	10.2	12.3	14.2	15.9	17.6
18.0	5.2	7.0	8.9	10.7	12.4	13.9	15.3
21.0	3.7	5.1	6.5	7.8	9.0	10.1	11.1

Table D-5 (continued). Fuel Models, Rate of Spread/Flame

Fuel Model 9							
0% Slope							
Rate of Spread, CH/H							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	1	3	8	16	25	36	49
6.0	1	2	6	12	19	27	37
9.0	1	2	5	10	15	22	30
12.0	1	2	4	8	13	19	26
15.0	1	2	4	7	12	17	23
18.0	0	1	3	6	10	14	19
21.0	0	1	2	4	7	10	13

CH/H – chains per hour

Flame Length, ft							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	1.3	2.1	3.2	4.2	5.2	6.2	7.1
6.0	1.0	1.6	2.5	3.4	4.2	4.9	5.7
9.0	0.9	1.4	2.2	2.9	3.6	4.3	5.
12.0	0.8	1.3	2.0	2.7	3.4	4.0	4.6
15.0	0.8	1.2	1.9	2.5	3.1	3.7	4.3
18.0	0.7	1.1	1.7	2.2	2.7	3.2	3.7
21.0	0.5	0.8	1.2	1.6	2.0	2.4	2.7

Table D-5 (continued). Fuel Models, Rate of Spread/Flame

Fuel Model 9							
15% Slope							
Rate of Spread, CH/H							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	2	4	9	16	26	37	50
6.0	1	3	7	12	19	27	37
9.0	1	2	5	10	16	22	30
12.0	1	2	5	9	14	20	27
15.0	1	2	4	8	12	17	24
18.0	1	1	3	6	10	14	20
21.0	0	1	2	4	7	10	13

CH/H – chains per hour

Flame Length, ft							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	1.4	2.2	3.2	4.3	5.3	6.2	7.1
6.0	1.2	1.7	2.6	3.4	4.2	5.0	5.7
9.0	1.0	1.5	2.2	3.0	3.7	4.3	5.0
12.0	0.9	1.4	2.1	2.7	3.4	4.0	4.6
15.0	0.9	1.3	1.9	2.6	3.2	3.7	4.3
18.0	0.8	1.1	1.7	2.2	2.8	3.3	3.8
21.0	0.6	0.8	1.2	1.6	2.0	2.4	2.7

Table D-5 (continued). Fuel Models, Rate of Spread/Flame

Fuel Model 9							
30% Slope							
Rate of Spread, CH/H							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	3	5	10	17	27	38	51
6.0	2	4	7	13	20	28	38
9.0	2	3	6	11	16	23	31
12.0	1	3	5	9	14	20	27
15.0	1	2	5	8	13	18	24
18.0	1	2	4	7	11	15	20
21.0	1	1	3	5	7	10	14

CH/H – chains per hour

Flame Length, ft							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	1.9	2.5	3.4	4.4	5.4	6.3	7.2
6.0	1.5	2.0	2.7	3.5	4.3	5.0	5.8
9.0	1.3	1.7	2.4	3.1	3.7	4.4	5.0
12.0	1.2	1.6	2.2	2.8	3.5	4.1	4.7
15.0	1.1	1.5	2.1	2.6	3.2	3.8	4.3
18.0	1.0	1.3	1.8	2.3	2.8	3.3	3.8
21.0	0.7	1.0	1.3	1.7	2.1	2.4	2.8

Table D-5 (continued). Fuel Models, Rate of Spread/Flame

Fuel Model 9							
45% Slope							
Rate of Spread, CH/H							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	5	7	12	19	29	40	53
6.0	4	5	9	14	21	30	39
9.0	3	4	7	12	17	24	32
12.0	3	4	6	10	15	21	28
15.0	2	3	6	9	14	19	25
18.0	2	3	5	8	11	16	21
21.0	1	2	3	5	8	11	14

CH/H – chains per hour

Flame Length, ft							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	2.4	2.9	3.7	4.6	5.6	6.5	7.4
6.0	1.9	2.3	3.0	3.7	4.4	5.2	5.9
9.0	1.7	2.0	2.6	3.2	3.9	4.5	5.1
12.0	1.6	1.9	2.4	3.0	3.6	4.2	4.7
15.0	1.5	1.7	2.2	2.8	3.3	3.9	4.4
18.0	1.3	1.5	2.0	2.4	2.9	3.4	3.9
21.0	0.9	1.1	1.7	1.8	2.1	2.5	2.8

Table D-5 (continued). Fuel Models, Rate of Spread/Flame

Fuel Model 9							
60% Slope							
Rate of Spread, CH/H							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	8	10	15	22	32	43	56
6.0	6	7	11	16	23	32	41
9.0	5	6	9	14	19	26	34
12.0	4	5	8	12	17	23	30
15.0	4	5	7	11	15	20	26
18.0	3	4	6	9	12	17	22
21.0	2	3	4	6	9	12	15

CH/H – chains per hour

Flame Length, ft							
1 Hour Moisture	Mid-Flame Wind, miles per hour						
(%)	0.0	2.0	4.0	6.0	8.0	10.0	12.0
3.0	3.0	3.4	4.1	4.9	5.8	6.7	7.5
6.0	2.4	2.7	3.3	3.9	4.6	5.3	6.0
9.0	2.1	2.4	2.9	3.4	4.0	4.6	5.2
12.0	1.9	2.2	2.6	3.2	3.7	4.3	4.9
15.0	1.8	2.0	2.5	3.0	3.5	4.0	4.5
18.0	1.6	1.8	2.2	2.6	3.0	3.5	4.0
21.0	1.2	1.3	1.6	1.9	2.2	2.6	2.9

Table D-6. Probability of Ignition

Shading	Dry-Bulb	Fine Dead Fuel Moisture (Percent)															
(%)	Temp (°F)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Unshaded <50%	110+	100	100	80	70	60	60	50	40	40	30	30	20	20	20	20	10
	100–109	100	90	80	70	60	60	50	40	40	30	30	20	20	20	10	10
	90–99	10	90	80	70	60	50	40	40	30	30	30	20	20	20	10	10
	80–89	10	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10
	70–79	100	80	70	60	60	50	40	40	30	30	20	20	20	10	10	10
	60–69	90	80	70	60	50	50	40	30	30	20	20	20	20	10	10	10
	50–59	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	40–49	90	81	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	30–39	80	70	60	50	50	40	30	30	20	20	20	10	10	10	10	10
Shaded >50%	110+	100	90	80	70	60	50	50	40	40	30	30	20	20	20	10	10
	100–109	100	90	80	70	60	50	50	40	30	30	30	20	20	20	10	10
	90–99	100	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10
	80–89	100	80	70	60	60	50	40	40	30	30	20	20	20	10	10	10
	70–79	90	80	70	60	50	50	40	30	30	30	20	20	20	10	10	10
	60–69	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	50–59	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	40–49	90	80	60	50	50	40	30	30	30	20	20	20	10	10	10	10
	30–39	80	80	60	50	50	40	30	30	20	20	20	10	10	10	10	10

Table D-7. Wind Adjustment

Find the appropriate adjustment factor and multiply it by 20-foot wind speed. Use the result as the midflame wind speed.

Fuel Exposure	Fuel Model		Adjustment Factor
Unsheltered Fuels			
Fuel exposed directly to the wind-no overstory or sparse overstory	4		0.6
Fuel beneath timber that has lost its foliage	13		0.5
Fuel beneath timber near clearings or clearcuts	1,3,5,6,11,12		0.4
Fuel on high ridges where trees offer little shelter from wind	(2,7)[a]		0.4
	(8,9,10)[b]		0.4
Partially Sheltered Fuels			
Fuel beneath patch timber where it is not well sheltered	All fuel models		0.3*
Fuel beneath standing timber at midslope or higher on mountain with wind blowing directly at the slope			
Fully Sheltered Fuels			
Fuel sheltered beneath standing timber on flat or gentle slope or near base of mountain with steep slopes	All fuel models	Open Stands	0.2
		Dense Stands	0.1

[a]Fuels usually partially sheltered
[b]Fuels usually fully sheltered

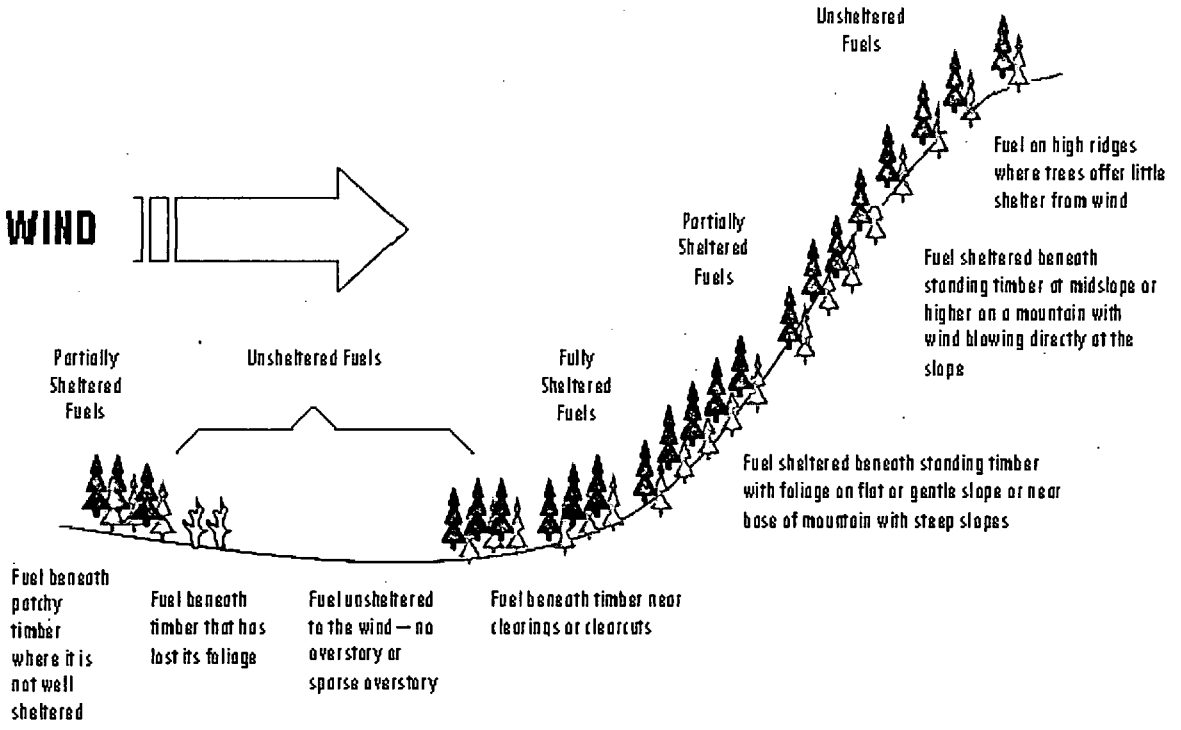

Table D-8. Relationship of Dispersion Index to On-the Ground Burning Conditions

Dispersion Index	Burning Conditions
>100	Very good—Burning conditions may be so good that fires may be hazardous and present fire control problems. Reassess decision to burn.
61-100	Good—preferred range for prescription burns.
41-60	Generally OK—climatological afternoon values in most inland forested areas fall in this range.
21-40	Fair—stagnation may be indicated if accompanied by low wind speeds. Reassess decision to burn.
13-20	Generally poor— do not burn. Stagnant if persistent, although better than average for a night value.
7-12	Poor—do not burn. Stagnant during the day, but near or above average at night.
1-6	Very poor—represents the majority of nights at many locations.

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Appendix E

Safety Zone Calculations

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Radius of Area = 4 (max flame height) + (50 ft^2) (No. firefighters)

Length of Area = 2 (Radius of Area) (50 ft^2) = 4 ft radius

Safety Zone for Crew of Five

Flame Height	Distance Separation (firefighters to flame)	Area in Acres
5 ft	40 ft	80 ft × 80 ft ≈ 0.15 acre
10 ft	60 ft	120 ft × 120 ft ≈ 0.3 acre
15 ft	80 ft	160 ft × 160 ft ≈ 0.6 acre
20 ft	100 ft	200 ft × 200 ft ≈ 0.9 acre
30 ft	140 ft	280 ft × 280 ft ≈ 1.8 acres
40 ft	180 ft	360 ft × 360 ft ≈ 3.0 acres
50 ft	220 ft	440 ft × 440 ft ≈ 4.4 acres

ft = feet

Safety Zone for Crew of Ten

Flame Height	Distance Separation (firefighters to flame)	Area in Acres
5 ft	60 ft	120 ft × 120 ft ≈ 0.3 acre
10 ft	80 ft	160 ft × 160 ft ≈ 0.6 acre
15 ft	100 ft	200 ft × 200 ft ≈ 0.9 acre
20 ft	120 ft	240 ft × 240 ft ≈ 1.3 acre
30 ft	160 ft	320 ft × 320 ft ≈ 2.3 acres
40 ft	200 ft	400 ft × 400 ft ≈ 3.7 acres
50 ft	240 ft	480 ft × 480 ft ≈ 5.3 acres

ft = feet

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Appendix F

Go/No-Go Checklist

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Go/No-Go Checklist
(TYPICAL)

Yes	No	Item	Date	Time	Initial
		Have all permits and waivers been obtained?			
		Have all pre-burn site preparations identified in the plan been completed or addressed?			
		Have all current and projected fire weather forecast been obtained, and are they within optimal ranges? (Visit http://www.fs.fed.us/rmc/ or http://fire.boi.noaa.gov/FIREWX/CLEFWFILN.html.)			
		Have all smoke management specifications been met?			
		Are all planned operations personnel on site?			
		Have all personnel been briefed on the project objectives, their assignments, safety hazards, escape routes, and safety zones?			
		Are all planned pieces of operations equipment on site and operational?			
		Has all equipment to be used been inspected and the inspection documented?			
		Have all the required notifications been made?			
		Are contingency resources available if needed?			
		Have all Prescribed Fire Burn Plan elements been met?			
		Can the burn be carried out according to the Prescribed Fire Burn Plan, and will it meet the planned objectives?			

I concur that this prescribed burn may take place.

Ecological Restoration Manager: _____ Date: _____
(Signature)

Fire Manager: _____ Date: _____
(Signature)

Fernald Preserve Site Manager: _____ Date: _____
(Signature)

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