Introduction

The purpose of the FMP is to provide an appropriate level of fire protection for all watershed lands, emphasizing the protection of life, public safety, and property values in interface areas while minimizing environmental impacts of fire suppression and control. The level of fire protection can be enhanced by minimizing potential fire risk or maximizing wildland fire control.

High intensity wildfire is potentially very damaging to watershed biodiversity, reservoir water quality, plant communities, and other natural resources. Fire suppression and pre-suppression activities also contribute to the cumulative immediate and long-term effects of wildland fire management. As it is not feasible or desirable to treat all hazardous fuels which create these conditions, strategic implementation of hazard abatement activities is critical to maximizing the desired level of fire protection while minimizing the negative impacts on watershed values. In addition, management practices and environmental regulations regarding the management of these watershed values is subject to change requiring an approach which is dynamic with flexible alternatives varying by location and treatment type.

The planning goal is to contain fire ignitions to the FMU of origin, reducing the potential spread of catastrophic wildland fire across District watershed lands. Therefore, the primary planning objective of fuel modification activities will be to support or enhance the existing fire control and containment areas around the perimeter of each FMU. Additional fuel modification activities may occur within an individual FMU to enhance wildland fire control or help protect identified watershed resources.

This section discusses approaches for fire hazard reduction and illustrates the interrelationship among fuel modification, fuel treatments, fuel management priorities, interface protection (including recreational areas), and environmental protections (water quality and biodiversity). Section 4 presents strategies and tactics for implementing these approaches.

Fuel Modification Elements

1. *Immediate reduction of fuel hazards on limited areas.*
2. *Periodic fuel treatments or prescribed burning.*
3. *Permanent fuel reduction on areas of strategic importance.*

Fuel Modification Networks

The strategic fuel management direction or recommendations are provided in this FMP through the establishment of Fuel Treatment Areas (FTAs). Each of these treatment areas is designated by the type of fuel modification required based on existing vegetation: Stubble Management, Brush Management, Understory Management, and Watershed Management. The latter treatment designation denotes a plant community or area where low to moderate fire intensity fire is preferable and high intensity wildland fire is to be avoided. This requires a long-term planning approach including the use of prescribed fire to prevent unacceptable accumulations of dead fine fuels.

The protection of life and property is enhanced by strategically locating FTAs where the boundaries of the District watershed lands abut urban interface or rural developments. The protection of life is further enhanced by strategically treating roadside vegetation along key District access roads or recreation areas to ensure "firesafe" ingress and egress.

FTAs located along roadways also enhance wildland fire control and minimize fire ignitions in high fire risk locations such as recreational areas or along transportation corridors. In watershed refugium zones, FTAs are linked to establish Strategic Fuel Modification Networks which are designed to minimize the spread of high intensity wildland fire and its related impacts on water quality or watershed biodiversity. In addition, these FTAs will serve as pre-planned fire containment areas that will also minimize the negative impacts of fire suppression activities.

Fuel modification areas with road access provide safe access for quick deployment along pre-planned fire control lines. Burning out of low volume fuels such as grass will effectively widen the fireline enhancing the holding capacity of the fireline. It can also reduce mop-up and be used to create safety zones.

Fuel modification areas at strategic locations are intended to divide large expanses of woody fuels into smaller units. This facilitates firing operations and reduces fireline intensity as it reaches the fuelbreak, so that the spread of wildland fire is limited. With the exception of "shaded fuelbreak areas," fuel modification areas with road access are designed for the combination of aerial and ground attack. Fuel modification areas are most effective against the lateral spread of wildland fire and are more limited in controlling the forward spread of a wildland fire.

When a fuel modification area is located directly in the expected path of a wildland fire, it should be designed to be effective for firing operations or widened when appropriate. Under high wind conditions, firebrands carried downwind can cause spot fires at distances of a quarter of a mile, or farther, ahead of the main fire front. On District watershed lands, grazing along key ridgetops helps to increase the effectiveness of the Strategic Fuel Modification Networks and will enhance the ability to deploy resources needed for control of wildland fire. The most extreme fire weather conditions typically occur under Foehn wind conditions. Areas should be evaluated for their susceptibility to north or east winds. These areas are often effective at stopping the head or spread of wildlife fire during lulls or changes in the wind direction.

Steeply sloping lateral ridges with grassy vegetation can produce a "fuse effect," which accelerates the spread of wildland fire rapidly uphill towards the main ridgeline, increasing the size and intensity of a fire burning out of control. This possibility can be minimized by effectively reducing fuel loads on lateral ridges.

An obvious limitation of utilizing a Strategic Fuelbreak Network approach is that the remainder of the wildland vegetation may develop heavier, more hazardous fuel loads and reduced accessibility. This may result in more difficult control of wildland fires in these unmanaged areas. As biological, manual, or mechanical treatment of these areas is often not feasible, or even allowable, the minimization of fire intensity in these areas will require the periodic introduction of prescribed fire.

Often when fire weather conditions are most extreme, fire suppression resources are quickly depleted or committed to other wildland fire events. An effective Fuel Modification Network makes the optimum use of limited fire suppression resources.

Fuel modification areas are also very effective in reducing the burning intensity and rate of spread of wildland fire near resources in need of enhanced fire protection such as interface areas, special habitats, or other identified values. This allows for safer and more effective deployment of fire suppression resources to protect these areas.

As the primary purpose of fuel modification is wildland fire control, the common approach is the modification of heavy fuels such as brush or dense woodland areas to provide strategic breaks where fire can be controlled or contained.

When an area is identified as a critical link in the Strategic Fuel Modification Network or would serve to protect and identified watershed value, then the selection of the most appropriate treatment or combination of treatments is critical . The selection of the most appropriate treatment or combination of treatments is based on effectiveness, consistency with natural resource management objectives, priorities for each land management zone, public safety, and cost.

Fuel Treatments

A wide array of fuel modification treatments have been effectively implemented on District watershed lands. These treatments, which are described in more detail in Appendix F, include:

Natural Wildland Fire Barriers
Biological Treatments (livestock grazing, goats, horse grazing)
Manual Treatments (pruning, limbing, thinning, chipping, multi-cutting)
Mechanical Treatments (brush crushing, plowing, disking)
Chemical Treatments (roadside vegetation management, retardants)
Prescribed Fire
Horse Logging
Combination

When implementing fuel management activities in environmentally sensitive areas, site-specific combinations of treatments should be carefully implemented through consultation with District Fisheries and Wildlife staff. Fuel management activities will be designed to establish watershed landscape mosaics in vegetation types, age class, and condition.

As the primary purpose of fuel modification is wildland fire control, the common approach is the modification of heavy fuels such as brush or dense woodland areas to provide strategic breaks where fire can be controlled or contained. These areas typically occur on a small part of the total wildland acreage, often less than ten percent. When breaks in the horizontal continuity of heavy fuels already exist, the maintenance of lighter fuels in strategic locations will be the focus of long term fuel modification activities.

Grazing has been used effectively to maintain annual grasslands and prevent brush encroachment or regrowth on District watershed lands. Therefore, the focus of fuel modification in this FMP is to link grazed grasslands, natural and man-made wildland fire barriers, and the existing road network into Strategic Fuel Modification Networks. Grazing units critical to these networks have been identified and will serve as wide blocks or strips of treated grassland (light fuel) vegetation. Experience has shown that conversion of the vegetation on wide fuelbreak areas to a relatively stable plant cover can greatly reduce maintenance efforts. The conversion of annual grasslands to perennial grasses is an effective method to minimize long term maintenance and reduce the fire intensity in strategic locations of District watershed lands.

Locating these fuel modification activities along the existing fire road network establishes a "Firebreak within a Fuelbreak" concept which enhances wildland fire control and provides pre-planned locations for firing out activities.

Fuel Management Priorities

A priority identification system must properly account for all watershed values. Strategic planning and implementation preserves valuable resources, allowing more priorities to be met. As many of these priorities are based on long-term objectives, monitoring of costs and benefits must adequately reflect the long term values.

A ranking system that reflects hazard levels as well as levels of fire risks and values can be used to effectively set priorities to achieve the maximum level of fire protection. As the protection of life and property always assumes the highest order, the top priority for treatments is providing an adequate level of fire protection for urban interface or intermix areas.

Although 'defensible space' measures are most effective nearest to the structure, the District can increase the level of fire protection by providing strategic locations to retard or stop the spread of wildland fire toward these areas. Additionally, the District can work cooperatively with the responding agencies to ensure that high fire risk areas along transportation corridors are strategically treated. Working cooperatively with homeowners and other agencies will preserve valuable resources for additional priorities.

Fuel Management Priorities

1. *Protect Life and Property.*
2. *Ensure Safety of Watershed Users.*
3. *Protect Natural Resources.*

The recreational areas also represent a high priority for fuel modification. The District fire and fuel management activities must ensure the safety of watershed users. Strategic fuel treatments can reduce the threat of wildland fire to the recreational area and adjacent watershed land.

With the top two priorities met, the District can effectively target activities to protect natural resources, watershed management goals, reservoir water quality, and biodiversity. This can be achieved by establishing watershed fire control areas utilizing the Strategic Fuel Modification Network approach. Impacts and implementation costs can be minimized by utilizing existing natural barriers to wildland fire, low intensity fuels, and the fire road network. FMUs are identified with perimeter fire control features. Fuel treatment activity is focused on enhancing these fire control areas, such as, the treatment of vegetation along perimeter access roads. This will ensure that wildland fires are contained to the FMU of origin.

Interface Protection

The primary objective in urban/wildland interface FTAs is the protection of life and property. However, due to the high ignition potential associated with these areas, any fuel modification activity will also serve as a risk management tool.

Fuel modification activities along the District watershed boundary where it abuts with urban interface or rural intermix will significantly enhance the level of fire protection in terms of life and property. While these activities will significantly reduce the potential of wildland fire spread toward the interface or intermix areas, the actual protection of property is most effective the closer the fuel modification is located to the structure. Therefore, the most appropriate strategy is a cooperative effort between the District and the homeowner.

As the primary strategy of FMU planning is the containment of fire ignitions to the FMU of origin, the potential spread of wildland fire beyond these units is significantly decreased. However, the potential for wildland spread beyond these pre-planned FTAs, while greatly reduced, could still occur under extreme conditions. In some locations, the adjacent non-District lands consist of heavy fuels (primarily north or east facing slope vegetation) that could produce higher intensity wildland fire under extreme fire weather conditions.

From a watershed planning perspective, interface areas should be continually monitored to assess the current level of fire protection. The amount and type of District involvement will vary significantly in different locations of the watershed, as discussed in Section 4.

The protection of life also includes the safety of District and responding personnel while fighting a wildland fire. Pre-planned "firesafe" road treatments increase firefighter safety, while providing logical control lines for indirect attack.

Roadside Treatment

"Firesafe" Roadside Treatments

"Firesafe" roadside treatments occur when vegetation along a road is strategically treated to enhance safety by establishing 'firesafe' ingress and egress. This contributes to wildland fire control by reducing burning intensities and minimizing the potential for fire ignitions. These treatments increase overall effectiveness, while providing responding fire agencies with pre-planned wildland fire control areas.

The fire road network is a series of annually maintained and bladed roads which are opened prior to the fire season to provide administrative and emergency access to strategic or remote locations of the District watershed lands. These roads serve as the existing firebreak inventory for the District watershed lands and are classified as driveable firebreaks. Vegetation treatments along these key roads establish "driveable firebreaks within a fuelbreak."

"Firesafe" roads provide a solid foundation from which wildland fire control and Strategic Fuel Modification Networks are created.

Once the fire access roads are established and annual maintenance and roadside vegetation treatment is complete, responding fire agencies are provided strategic and safe fire containment lines to anchor their fire suppression efforts within the designated FMUs. Utilizing these roads as containment lines will significantly reduce natural resource damage related to fire suppression activities, while providing a higher level of fire protection for identified watershed values and urban interface. The net cost of these treatments will outweigh the costs of fire suppression, habitat restoration, and property loss.

During periods of high or extreme fire danger, local fire suppression resources may be committed to other fire events. Therefore, pre-planned roadside treatments provide a critical tool to limit the spread of wildland fire.

A fuelbreak system consists of large areas of vegetation interconnected by fuelbreaks to form strategic locations for control of fires.

Public vehicular use of the District's fire road network is restricted throughout the watershed lands, although some fire roads serve as trails for watershed users. This policy significantly reduces potential fire risk throughout the watershed lands and provides dedicated ingress for fire suppression resources. Therefore, roadside vegetation treatments along these interior fire roads should be designed and implemented to enhance wildland fire control and provide 'firesafe' ingress for fire suppression resources. Public vehicular access through watershed lands is limited to the wider paved public roads. These transportation corridors often exhibit higher fire risk, and roadside vegetation treatments should be designed primarily for fire risk mitigation.

The District fire road network meets the common definition of a pre-planned fireline which is: a narrow line, 2 to 10 feet wide, from which all vegetation is removed down to mineral soil, by yearly maintenance prior to fire occurrence. The fireline may be a roadway or simply a strip cleared by hand or machine, strictly for fire control purposes. Often it is a line within a wider break, such as a roadway within a fuelbreak. The latter definition describes the roadside vegetation treatments

Fire roads can also meet the minimum definition of a firebreak which is a fireline wider than 10 feet, frequently 20 to 30 feet wide and sometimes wider**,** prepared each year ahead of the time it may be needed for use in controlling a fire. The term firebreak is sometimes applied to relatively narrow, strategically placed breaks maintained each year, or periodically, for possible use in fire control.

While fire roads are too narrow to fit the definition of a fuelbreak, roadside vegetation treatments do meet this criteria which is: a strategically located wide block, or strip, on which a cover of dense, heavy, or flammable vegetation has been permanently changed to one of lower fuel volume or reduced flammability, as an aid to fire control.

Linking roadside vegetation treatments to natural or existing barriers to wildland fire and other fuel modification activities meet the criteria of a fuelbreak system which is: a system of relatively large areas of naturally open vegetation, or converted vegetation cover, all interconnected by fuelbreaks to form strategic locations for control of fires.

The actual type of treatment along the primary roads or District fire road network will be determined by the existing vegetation type and will include stubble management, understory management, or brush management.

Environmental Protections

Environmental Photo

Fuel modification by definition removes or reduces the amount of vegetation on the landscape, thereby reducing the amount of water loss to transpiration, causing increased water runoff. The associated water runoff can have varying effects to reservoir water quality and the watershed landscape. Activities that occur early in the dry season may have reduced negative effects as vegetation and root structures have sufficient recovery time prior to the wet season. Many of these effects can be offset by maintaining a buffer of vegetation for biofiltration. Vegetation removal should be conducted in a manner that does not adversely impact existing natural resources.

With the exception of wider spread application of grazing, the focus of fuel modification in this FMP is to utilize less than ten percent of a FMU for specific fuel modification. Most often, the required acreage is far less than this percentage. This percentage also typically includes natural wildland fire barriers, fuel modification activities, recent burns, and the existing road network. This reduces the overall impact of fuel modification.

The District has developed a set of Biodiversity Guidelines specific to individual species. Within these guidelines is direction pertaining to grazing and other fuel modification techniques based on criteria for each identified species. This direction must be evaluated prior to selection of treatment.

Proper management of a fuel modification activity involves selection of appropriate tools, intensity, time of season, location, and other considerations. The higher the coordination with other resource managers, and the greater the baseline information, the more effective fuel modification management will be. The GIS based database serves to help locate, classify, and spatially depict when fuel modification activities may impact other values. Use of this database for design of fuel modification activities allows the fire manager to be more specific in addressing and protecting sensitive watershed resources.