

**FIRE MANAGEMENT PLAN
SECTION 1**

For

**E.C. MANNING PROVINCIAL PARK
SKAGIT PROVINCIAL PARK
AND
CASCADE RECREATION AREA**

February, 2001

Prepared for:
Judy Millar, Resource Officer
British Columbia Ministry of Environment, Lands and Parks
Okanagan District
Summerland, BC
VOH-1ZO

Prepared by:
Bruce Blackwell, R.P.F., R.P.Bio
Michael Coulthard, R.P.F.
B.A. Blackwell and Associates Ltd.
3087 Hoskins Road
North Vancouver, BC V7J 3B5

Executive Summary

The following plan provides the background and framework to implement a fire management program in Manning Park. The foundation of the plan is a comprehensive Wildfire Threat Analysis that is the basis for designation of three fire management zones within the Protected area. Background information on fire history, vegetation succession, the fire environment, burn planning and monitoring is provided to assist and support plan implementation. The plan describes management and planning requirements for each of the designated fire management zones and calls for the selective re-introduction of fire for the purpose of Park resource management.

To date, Park managers have had a limited role in fire management decision-making and planning within Provincial Parks and Recreation Areas. With increased public concern regarding the conservation mandate of provincial parks it appears that a greater commitment to fire management is necessary. By comparison, B.C. Parks falls far short of the efforts of other jurisdictions. The U.S. National Park and Canadian National Park systems both have been developing fire management plans, for most major parks, for over 20 years. To meet the equivalent level of commitment to fire management B.C. Parks will require the addition of scientific, technical and operational resources within the Parks system.

Fire management plans are developed to guide and to set priorities for responses to wildfires and to guide prescribed burning activities in Parks and Recreation Areas. The plan is made up of prescriptions, management strategies, and implementation activities for a specific management area.

The largest area of concern with regard to vegetation and fuels exists within fire management zone A. This is particularly true in the Manning Park Lodge and Headquarters areas where there is a greater risk of human caused fires. Without some form of intervention fuels in this region of the Park can be expected to increase to levels of extreme hazard in many areas within this management zone. This situation could potentially result in a wildfire of larger size and intensity than would occur under a natural fire cycle. Typically, fires of this nature would be difficult and expensive to control and potentially dangerous to life and property. Given the nature of an unmanaged fuel complex, in the absence of fuel management intervention, it is likely that there will be fewer small fires but an increased risk of larger infrequent fires.

The Manning and Skagit areas are diverse in bird and animal species of all kinds, including mule deer, black bear, grizzly bear, Gray wolf and moose. There is no wildlife inventory for the Park and a only a limited amount of information is available. One of the key recommendations of the Manning Park Master Plan is the development of a wildlife management plan. A wildlife management plan is extremely important to ensure the proper integration of fire and wildlife management.

Disturbance by fire is required to maintain the flow of successional stages both for different seasonal and behavioral needs of individual species, and for the needs of a variety of species. The benefits of fire will be species specific and related to individual food and habitat requirements. It is recommended that wildlife habitat requirements be identified for the key species located within the boundaries of Manning and Skagit Areas. Those species and habitats, which are considered rare and adversely affected by fire, should be identified as part of the wildlife management plan and Park management should seek to reduce the impacts of fire on these areas.

Forest fire management in the Park should aim towards permitting natural fire cycles to occur over the largest possible area of the park. Where such an objective is constrained, active management approaches such as prescribed burning, prescription wildfires, or mechanical treatments will need to be employed to recreate natural disturbance patterns in a relatively controlled manner.

ACKNOWLEDGEMENTS

We thank the following people for their contributions to this project: Judy Millar and Don Gough (BC Parks), John Markila (BCMOF, Vancouver Forest Region) for project materials and advice, Eric Meyer (BCMOF, Protection Branch) for fire weather and lightning data, Judi Beck (BCMOF, Protection Branch) and Brad Hawkes (Canadian Forest Service) for algorithm development and fuel typing. We also thank the following Manning Park staff John Rose and Jim Hilton (BC Parks) for providing their invaluable knowledge and experiences in the Park. Cover photo provided by the National Interagency Fire Center in Boise, Idaho.

TABLE OF CONTENTS

| | |
|--|-----------|
| 1.0 INTRODUCTION | 1 |
| 1.1 THE FIRE MANAGEMENT PLAN | 1 |
| 1.2 PARK POLICY AND MASTER PLANS | 1 |
| 1.3 MANAGEMENT GOALS AND OBJECTIVES | 2 |
| 2.0 FIRE MANAGEMENT | 2 |
| 2.1 FIRE MANAGEMENT ZONE A (FMZ-A) | 4 |
| 2.1.1 Description | 4 |
| 2.1.2 Primary Concerns | 5 |
| 2.1.2.1 Structures at risk | 5 |
| 2.1.2.2 Natural features at risk | 6 |
| 2.1.2.3 Threat to human lives | 6 |
| 2.1.2.4 Risk of Ignition | 6 |
| 2.1.2.5 Fire behaviour | 6 |
| 2.1.2.6 Adjacency concerns | 6 |
| 2.1.2.7 Mountain Pine beetle outbreak | 6 |
| 2.1.2.8 Blowdown | 7 |
| 2.1.3 Proposed Management Strategies in Zone A | 7 |
| 2.2 FIRE MANAGEMENT ZONE B (FMZ-B) | 8 |
| 2.2.1 Description | 8 |
| 2.2.2 Primary Concerns | 9 |
| 2.2.2.1 Structures at risk | 9 |
| 2.2.2.2 Natural features at risk | 9 |
| 2.2.2.3 Threat to human lives | 9 |
| 2.2.2.4 Risk of Ignition | 9 |
| 2.2.2.5 Adjacency concerns | 10 |
| 2.2.2.6 Fire behaviour | 10 |
| 2.2.3 Proposed management strategies in Zone B | 10 |
| 2.3 FIRE MANAGEMENT ZONE C (FMZ-C) | 11 |
| 2.3.1 Description | 11 |
| 2.3.2 Primary Concerns | 12 |
| 2.3.2.1 Fire behaviour | 12 |
| 2.3.2.2 Adjacency concerns | 12 |
| 2.3.3 Proposed management strategies in Zone C | 12 |
| 2.4 GENERAL RECOMMENDATIONS | 12 |
| 2.5 SUPPRESSION PLANNING | 15 |
| 2.5.1 Detection and reporting | 15 |
| 2.5.2 Initial attack preparedness | 15 |
| 2.5.3 Fire suppression constraints | 16 |
| 2.5.4 Fuel breaks | 16 |
| 2.5.5 Water sources | 17 |
| 3.0 EVACUATION PLAN | 17 |
| 3.1 EVACUATION PLANNING AND PREPAREDNESS | 17 |
| 3.2 EVACUATION MAP | 18 |
| 3.2.1 E.C. Manning Park | 20 |
| 3.2.2 Skagit Valley Park | 20 |
| 3.2.3 Cascade Recreation Area | 20 |

LIST OF FIGURES

Figure 1. Fire Management Zones in Manning Park.....3

Figure 2. Overall suppression capability in Manning Park.16

Figure 3. Proximity to water sources in Manning Park.....17

Figure 4. Manning Park evacuation map.....19

LIST OF TABLES

Table 1. Summary of area and threats in each fire management zone.....2

Table 2. Synopsis of management objectives and actions in FMZ-A4

Table 3. Synopsis of management objectives and actions in fire management Zone B (FMZ-B)8

Table 4. Synopsis of management objectives and actions in fire management zone C (FMZ-C).....11

Table 5. Relevant Recommendations from 1993 Draft Fire Management Plan13

1.0 INTRODUCTION

1.1 The Fire Management Plan

Historically, it has been standard policy to suppress all wildfires with the intention of protecting the forest resource. It was believed that the best way to maintain the health of British Columbia's ecosystems was to eliminate all forest fires and forest pests. Numerous studies in the past several decades have found that this policy has in fact resulted in unstable forests, which are increasingly susceptible to physical and biological stresses. These types of instabilities are becoming more common and include conditions such as increases in fire hazard due to the build-up of fuels, and the outbreak of forest pests and diseases. This trend has resulted in catastrophic wildfires such as those experienced by Yellowstone National Park in 1988, the fires in Washington and Idaho in 1994 and the 2000 wildfires which burned extensively throughout the Western United States.

BC Parks has developed a set of conservation management principles aimed at protecting the geographical and biological diversity extant throughout BC. To successfully accomplish this, the natural cycles under which these ecosystems have evolved must be understood. Periodic natural wildfires have historically played a vital role in maintaining the health of BC's ecosystems by ensuring regeneration, pest sanitation, reductions in fuel build-up, and maintaining a diversity of successional stages. As our understanding of these relationships improves, reintroducing fire as a management tool it is becoming more accepted by Park Managers. BC Parks has recognized the importance of this understanding and has taken action to manage wildfire for the restoration and maintenance of natural ecosystems while protecting the natural and cultural resources that exist in British Columbia's Parks.

The fire management plan presented in this document will serve several functions to park managers:

- 1) It will provide guidance on an operational level to decide what actions to take in the event of a wildfire in the parks;
- 2) It will give park managers direction to determine when and where prescribed burns should be considered as an appropriate tool to restore and preserve the existing ecosystems, and;
- 3) It will provide a foundation for making sound management decisions in related aspects of park management by presenting many of the critical natural and cultural resources that exist in these protected areas.

1.2 Park Policy and Master Plans

BC Parks Conservation Program Policies include:

- Conserving and managing representative examples of British Columbia's ecosystems within the provincial protected area system designated by government.
- Maintaining essential ecological processes and variety in nature through the conservation and management of complete functioning ecosystems.
- Conserving variety in nature (biological diversity) at all levels, giving rare, threatened, and endangered species special management attention.

<http://www.elp.gov.bc.ca/bcparks/conserves/consprin.htm>

The conservation goals of BC Parks for E.C. Manning Park, Skagit Valley Provincial Parks and Cascades Recreational area are as follows:

- to represent the Northwest Cascade Ranges and the Leeward Pacific Ranges eco-sections
- to protect outstanding natural, historic and recreational features of the province including:
 - 1) rare and endangered species and critical habitats;
 - 2) outstanding or unique botanical, zoological, geological and palaeontological features;
 - 3) outstanding or fragile cultural heritage features and outstanding recreational resources.

The vegetation management objective for these parks is:

- to preserve, in a natural state, the variety of native vegetation communities within E.C. Manning Park and Cascade Recreational Area.

The wildlife management objective for these parks is:

- to preserve viable examples of the wildlife species associated with the Lower Mainland-Skagit Mountains and Coast Cascade Dry Belt regional landscapes

1.3 Management goals and objectives

The objectives set out by BC Parks for this plan include:

- to make scientific determination regarding re-introduction of fire (including fire management prescriptions and strategies).
- to have suppression responses readily available to make quick decisions on wildfire starts.
- to present to Protection Branch our intentions for wildfire management including, but not limited to ensuring to the greatest degree possible, the prevention of damages to resources within and outside of the park
- to ensure that all ecological, economic, recreational and social values are considered during decision making involving wildfire and prescribed fire.
- to ensure the safe evacuation of public in the event of a wildfire
- to meet the above objectives in a way which is consistent with parks policy and master plans

2.0 FIRE MANAGEMENT

Forest fire management in the Park should aim towards permitting natural fire cycles to occur over the largest possible area of the park. Where such an objective is constrained, active management approaches such as prescribed burning, prescription wildfire, or mechanical treatments will need to be employed to recreate natural disturbance patterns in a relatively controlled manner. The application of the fire management approaches outlined in the report will require considerable expertise for successful implementation of the plan.

Through analysis of the Wildfire Threat Rating System, three broad fire management zones were delineated. Each of these areas is characterized by distinct hazards and constraints, which have directed the development of specific management objectives and guidelines. These zones are designed to form the basis for more site-specific prescriptions. The location of these zones is illustrated on the Fire Management Zones Map in Figure 1.

Table 1. Summary of area and threats in each fire management zone

| Management zone | Area (ha) | Fire Behaviour ¹ | Values at Risk | Fire Risk | Suppression Hazard |
|-----------------|-----------|-----------------------------|----------------|-----------|--------------------|
| A | 37,457 | M-E | H-E | H | E |
| B | 35,569 | H-E | L-M | H | M-E |
| C1 | 27,817 | H-E | L-M | L-M | M-H |
| C2 | 1,732 | E | L-M | L-M | H |
| C3 | 4,242 | E | L | L-M | H |
| C4 | 10,965 | E | L | L-M | H-E |

¹fire behavior is based on 70th percentile weather conditions

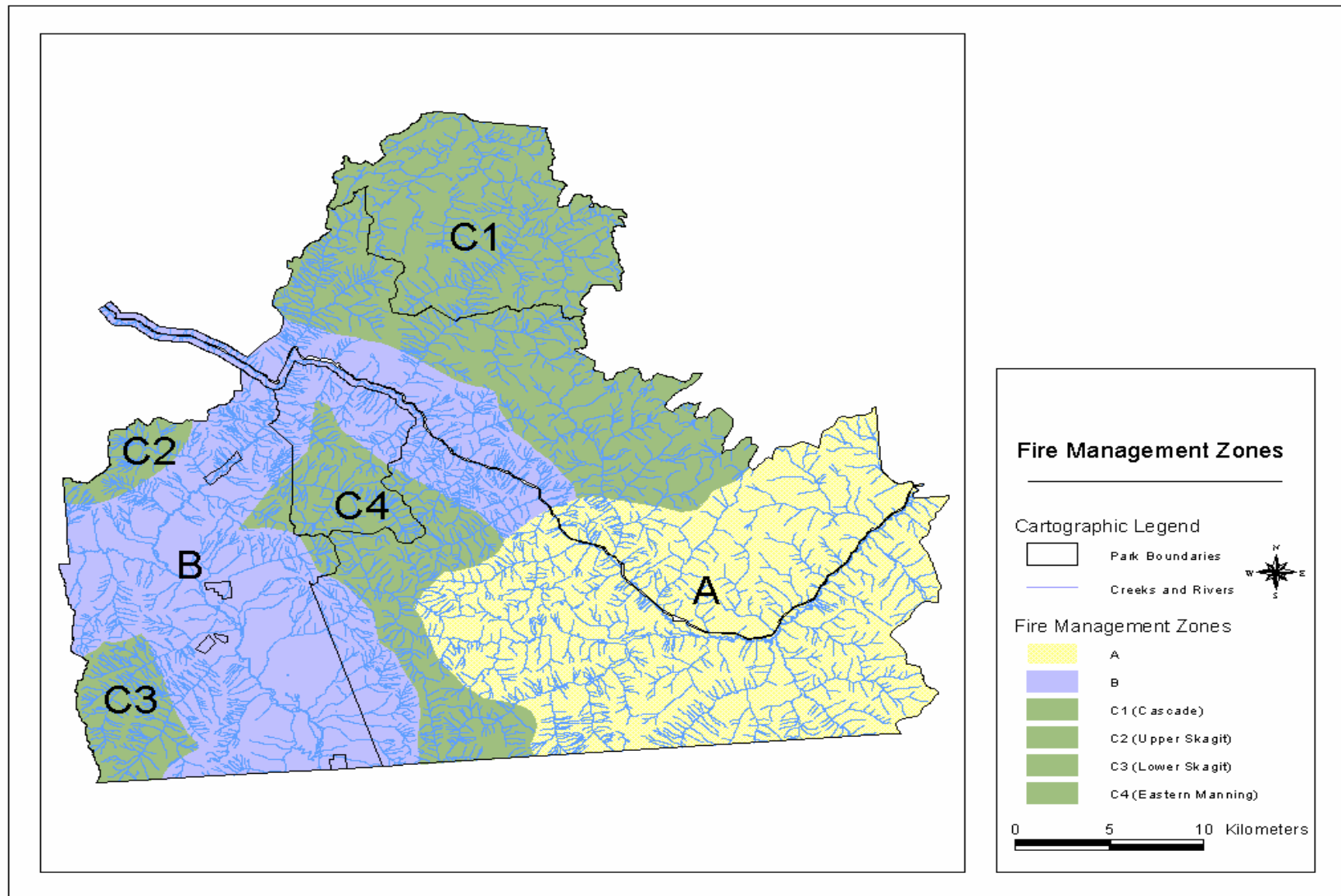


Figure 1. Fire Management Zones in Manning Park.

2.1 Fire management Zone A (FMZ-A)

2.1.1 Description

Fire management zone A encompasses about 37,500 ha and is located in the southeast portion of the park. The east boundary follows the eastern park boundary from the USA border up to Big Buck Mountain. The north and west boundaries follow topographical high points, circumnavigating the Blackwall peak and Lightning Lakes Area. The southern boundary is the Canada/USA international border.

This zone is characterized by the continental climate that dominates the interior east of the Cascade Mountains. Four biogeoclimatic zones are found in this area. The eastern portion of this area changes from IDFdk2 along the lower highway corridor to MSdm2 and then to ESSFdc with increasing elevation. The western portion of this area is predominantly classified as ESSFmw.

The climate in this area varies from a warm, dry climatic regime in the IDFdk2 to long cold winters and short cool summers in the high elevation ESSF. The IDFdk2 and MSdm2 are dominated by Interior Douglas-fir (*Pseudotsuga menziesii*) and Lodgepole pine (*Pinus contorta*). With increasing elevation Engelmann spruce (*Picea Engelmannii*) and sub-alpine fir (*Abies lasiocarpa*) gradually become the dominant species.

Table 2. Synopsis of management objectives and actions in FMZ-A

| Management Issue | Objectives | Recommended Action | Section Reference |
|------------------|--|---|------------------------|
| Fire | 1. Prevent fire from endangering Park visitors | <ul style="list-style-type: none"> • Suppression planning • Risk Reduction • All non-prescription fires will be suppressed within this zone • Institute plans to reduce hazard and risk associated with high fuel loading | 2.1.2.3; 2.1.3; 2.5 |
| | 2. Reduce the probability of fire damage to important Park developments and facilities | <ul style="list-style-type: none"> • Suppression planning • Risk Reduction • Mechanical fuel treatments should be considered in stands surrounding valuable structures where prescribed fire is not considered operationally feasible to implement • Park management should initiate a program to identify all hazard areas within FMZ –A. Site specific prescriptions should be developed to reduce fuel accumulations or fire-proof stands for all areas of concern within this vicinity. The Manning Park Lodge and Headquarters area should receive a high priority in this plan. An ecologically sound, aesthetically planned effort, carried out over a number of years should be made to reduce fuel loadings in and around structures in the Park and Recreation areas. Prescriptions can be designed to take immediate remedial action or can be developed as a long term strategy to manipulate stand structure or species composition. | 2.1.2.1; 2.1.3; 2.5 |

| Management Issue | Objectives | Recommended Action | Section Reference |
|------------------|--|--|--|
| 3. | Prevent fire from escaping Park boundaries | <ul style="list-style-type: none"> • Suppression planning • Fire threatening to breach Park boundaries should be suppressed • Consideration should be given to developing or enhancing natural fire breaks within FMZ-A. This could include road side removal of fuel accumulations, ensuring that already established cleared areas do not revegetate, and planting hardwoods such as aspen (<i>Populus tremuloides</i>) and black cottonwood (<i>Populus trichocarpa</i>) wherever possible within the exclusion zone to break up the fuel complex. | 2.1.2.6; 2.1.3; 2.5 |
| 4. | Re-introduction of fire, including fire management prescriptions and strategies. | <ul style="list-style-type: none"> • Develop a prescribed burning plan within this zone to deal with large scale, high hazard fuel accumulations • Form an independent study area to identify and plan a series of prescribed fires and mechanical fuel treatments to reduce fuel accumulations associated with beetle attack and blowdown. Areas should be strategically placed to create fuel breaks and to protect the values at risk. Initial focus areas should be the large blowdown in the vicinity of the Bonnevier trail and the beetle infested stands located along Highway #3 running from Park Headquarters through to East Gate. • In order to increase knowledge on the effects of prescribed burns in the park, permanent vegetation plots should be established. | 2.1.2.5; 2.1.2.7; 2.1.2.8; 2.1.3; Section 2_ 5.0; 6.0; 8.0 |
| 5. | Improve public safety related to fire in high visitation areas | <ul style="list-style-type: none"> • Institute the proposed evacuation plan • Public Education | 3.0; Section 2_ 7.0 |

2.1.2 Primary Concerns

2.1.2.1 Structures at risk

Management zone A contains the greatest concentration of the most valuable structures in the study area, including the Park Visitors center and the Manning Park Resort and ski area. There are also numerous day use areas and campgrounds. Additionally there is the East Gate residential community, which borders the eastern side of this zone. A fire in this portion of the park poses the greatest risk to human life, safety and values within the park and therefore management should be focused on risk reduction strategies within this portion of the park.

2.1.2.2 Natural features at risk

This area also contains a number of unique natural features. There is a high concentration of red and blue listed species that occur in and around the Lightning Lakes area, and a large area of blue listed ecosystems adjacent to the Similkameen River. Mount Frosty contains a stand of western larch, which is growing at the very northwestern end of its native range.

2.1.2.3 Threat to human lives

The Lightning Lakes area is the most highly visited portion of the park. There are staff permanently residing in this area and a number of permanent residences living just outside of the East Gate Area. Highway #3 is a major travel corridor through the park and receives a large amount of traffic during periods of high use, most notably in the summer. For these reasons, human safety associated with wildfire management must be made a top priority.

2.1.2.4 Risk of Ignition

As the number of people who use this area increases, the risk of human caused ignition increases. This area receives the greatest use by visitors and travelers, and as such there is a high risk of human caused ignition within this management zone. Additionally, lightning activity within this region of the Park is high relative to the western portion.

2.1.2.5 Fire behaviour

According to the Canadian fuel classification system the eastern portion of this zone is dominated by fuel type C3, whereas the western portion and higher elevations are classified as M2. According to the Canadian Fire Behavior Prediction System (FPB97), the C3 fuel types found in the eastern portion of this zone would not produce a crown fire. The rates of spread and fire intensity of the C3 fuel type would also be lower compared to the M2 fuel types found in the western portions of the zone. These results do not reflect the true potential of these stands, as there are areas with high fuel accumulation due to mountain pine beetle outbreaks and blowdown events. This anomaly is the result of converting forest cover attributes to fuel types that were not designed for these forests. Although they provide a relative measure of the different fuels within the park, they may not accurately represent the true potential of fire behavior within this area.

FPB97 predicts that a wildfire under 70th percentile weather conditions in the western portion of FMZ-A would burn a significant portion of the crown and have a high to extreme fire intensity and rate of spread.

2.1.2.6 Adjacency concerns

Commercial forest activities bordering all boundaries of the park are considered substantial. These commercial areas pose a significant risk of ignition and fire spread into the park as well as a liability to parks if fires are ignited within the park boundary and spread outward. As well, the south boundary of the study area follows the Canada/USA international border. Any fire burning near the park boundaries in this zone would threaten these commercial forests to the east and the US border to the south.

2.1.2.7 Mountain Pine beetle outbreak

In the absence of wildfire, which has historically controlled mountain pine beetle outbreaks, infestations have led to severe mortality in the eastern highway corridor. Adjacent to the Park a large-scale salvage operation has been undertaken by Weyerhaeuser to reduce the loss of timber from similar pine beetle outbreaks. This outbreak started to become a concern in 1970. Since this time, management activities to control the outbreak have included removing infested trees, placing pheromone lures, falling and burning infected trees and MSMA. The result of these activities has been to stall the outbreak and delay the onset of the large current attack. Current beetle populations are beyond control through the use of single tree or patch treatments. The

infestation is moving west along the highway corridor and has resulted in stands with high fuel accumulations and significant fire hazard.

2.1.2.8 Blowdown

A significant blowdown event occurred in the northern portion of this zone near Buckhorn camp. This storm resulted in significant fuel accumulations, which increases the fire behavior risk in this area. This blowdown is wide spread along the East Gate boundary of the Park. These accumulations have been on the ground for some time (>5 years) and regeneration is now established. As time continues to pass and the regeneration advances the risk of ignition declines. However if a fire occurs within this region of the park, fire behavior is expected to be severe resulting in negative ecological impacts.

2.1.3 Proposed Management Strategies in Zone A

This zone is the most hazardous area in terms of wildfire threat due to the combination of factors outlined above. Given the values and risks outlined above the only appropriate management strategy is develop a prescribed burning plan within this zone to deal with large scale, high hazard fuel accumulations. Fuel accumulations resulting from blowdown and mountain pine beetle infestation leaves this portion of the Park in a condition of unacceptable risk that must be treated to reduce some of hazard and risk within this important region of the Park. Continued suppression of fires within this area in the absence of fuel treatments has the potential to result in a significant fire event that could impact the ecological integrity and infrastructure of the Park.

Prescribed burning in combination with mechanical fuel treatments are the only tools available to management to deal with the current fuels problem. FMZ-A should form an independent study area to identify and plan a series of prescribed fires and mechanical fuel treatments to reduce fuel accumulations associated with beetle attack and blowdown. This planning process will require two stages of planning which include an aerial photographic review followed by detailed field reconnaissance to confirm burn areas delineated from aerial photographs. These areas should be planned to reduce fuel accumulations and be strategically placed to create fuel breaks to protect the values at risk identified in this portion of the Park. The initial focus areas should be the large blowdown in the vicinity of the Bonnevier trail and the beetle infested stands located along Highway #3 running from Park Headquarters through to East Gate.

Mechanical fuel treatments should also be considered in stands surrounding valuable structures where prescribed fire is not considered operationally feasible to implement. Many buildings and developments within FMZ-A are within or adjacent to forested areas. The fuel loading in some of these areas is high with a large component of dead or dying fuel. The spatial distribution and condition of fuels make these structures extremely vulnerable to fire. Management to reduce fire hazard in areas adjacent to developments is required. Management can include changing the type or successional stage of vegetation next to structures or reducing the fuel loading by:

- 1) reducing the total amount of fuel present;
- 2) spacing the vegetation (both horizontally and vertically) so flames have to reach farther to continue their spread, and;
- 3) reducing flammability of fuels.

The 1988 fires in and around Yellowstone provided some textbook examples of problems that can develop when buildings are surrounded by forest fuels. The 1988 fires threatened almost every major facility in the park. The cost of protecting these facilities was extremely high because of a complete lack of fuel management in and around the structures (Wakamoto 1990).

It is recommended that a fuel management plan be developed for structural developments within this zone. The Manning Park Lodge and Headquarters area should receive a high priority in this plan. A careful, aesthetically planned effort, carried out over a number of years should be made to reduce fuel loadings in and around structures in the Park and Recreation areas. The reduction of hazardous fuels around structural

developments enhances the ability to protect these values at risk and reduces costs of wildfire suppression and prescribed fire.

2.2 Fire management Zone B (FMZ-B)

2.2.1 Description

Fire management zone B is about 35,500 ha in size and includes the remaining highway #3 corridor (not within FMZ-A) and the slopes adjacent to the Skagit River. The boundary generally follows the height of land along both sides of the road and river systems. The southern most boundary runs along the Canada/USA international border.

This zone contains a wide variety of climatic conditions. In the southern Skagit Valley, there is an isolated pocket of IDFww. The higher slopes are classified as CWHms1 and CWHds1 with ESSFmw at the highest elevations. The upper Skagit River and Highway #3 corridor contain predominantly CWHds1 on the valley floor with CWHms1 on side slopes and ESSFmw at high elevations.

The lower elevations of the Skagit Valley have a continental climate with warm and dry summers and cool and relatively moist winters. Douglas-fir (*Pseudotsuga Menziesii*) is dominant tree species with less abundant western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja Plicata*). Warm, dry summers and moist, cool winters characterise the lower elevations of Highway #3. Forests are dominated by Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) with less abundant western redcedar (*Thuja plicata*). With increasing elevation, Engelmann spruce, sub-alpine fir (*Abies lasiocarpa*), amabilis fire (*Abies amabilis*) and western hemlock (*Tsuga heterophylla*) gradually become the dominant species.

Table 3. Synopsis of management objectives and actions in fire management Zone B (FMZ-B)

| Management Issue | Objective | Action | Section Reference |
|------------------|--|--|----------------------------------|
| Fire | 1. Prevent fire from endangering Park visitors | <ul style="list-style-type: none"> • Suppression Planning • All non-prescription, human caused fires will be suppressed within FMZ-B. • Wildfires in this zone should be extinguished as quickly as possible except under conditions that will allow objective 4 to be met. • Improve access in and out of the Skagit Valley | 2.2.2.3; 2.2.3; 2.5 |
| | 2. Reduce the probability of fire damage to important Park developments and facilities | <ul style="list-style-type: none"> • Suppression planning • Fires considered to pose a significant threat to developments should be suppressed | 2.2.2.1; 2.2.3; 2.5 |
| | 3. Prevent fire from escaping Park boundaries | <ul style="list-style-type: none"> • Suppression planning • Fire burning within FMZ-B that is moving in the direction of the Park boundary should be suppressed | 2.2.2.5; 2.2.3; 2.5 |
| | 4. Re-introduction of fire, including fire management prescriptions and strategies. | <ul style="list-style-type: none"> • Wildfires, which ignited on the valley mid-slopes and that are moving into FMZ-C should be allowed to burn where fire weather and hazard conditions permit • Fires, which are allowed to burn, will be either lightning caused or prescribed burns designated by Park management | 2.2.3; Section 2_ 5.0; 6.0 |

| Management Issue | Objective | Action | Section Reference |
|------------------|---|--|---|
| | 5. Maintenance of ecosystem processes, biodiversity and wildlife habitat through fire management. | <ul style="list-style-type: none"> • Within the FMZ-B fires should be allowed to burn under pre-established prescription guidelines. The Parks Zone Manager in consultation with the District Manager will independently evaluate each fire and determine if the conservation goals and objectives can be met • The ecological relationships, which exist between fire and the red and blue listed plant associations and the ecological reserves, should be carefully studied. Fire effects on individual species should be documented through field study and literature review. • In order to increase knowledge on the effects of prescribed burns in the park, permanent vegetation plots should be established. | 2.2.3; Section 2_ 4.0; 5.0; 6.0; 8.0 |
| | 6. Improve public safety related to fire in high visitation areas | <ul style="list-style-type: none"> • Institute the proposed evacuation plan • Public education | 3.0; Section 2_ 7.0 |

2.2.2 Primary Concerns

2.2.2.1 Structures at risk

There are a number of significant structures located primarily in the lower half of the Skagit Valley. These include a number of day use areas and campgrounds. Additionally, Sumallo Lodge is located just outside of the West Gate.

2.2.2.2 Natural features at risk

As this zone follows a major river system, there are a number of unique natural features, which require protection. There is a high concentration of red and blue listed species occurrences and plant associations, which occur adjacent to the Skagit and Sumallo rivers. There are also three ecological reserves in the Skagit Valley.

2.2.2.3 Threat to human lives

Highway #3 experiences a large volume of travelers every year. The Skagit Valley is not a main travel corridor but experiences extensive use by recreationists. The access in and out of the Skagit Valley is limited to a single gravel road. Access within this valley is considered a major management concern in this area. Access to and from this valley would be difficult in a large fire situation. Vehicle and air access could be significantly impeded by smoke, which would hamper evacuation efforts. This valley therefore poses a significant risk to human lives and safety in the event of a large fire.

2.2.2.4 Risk of Ignition

Due to the concentration of human activity in these valleys there is a significant risk of fire ignition.

2.2.2.5 Adjacency concerns

The south end of the Skagit Valley follows the Canada/USA international border. The western portion of this zone is adjacent to commercial forestland. A fire that is burning out of control within this zone potentially threatens areas both adjacent to and within the Park.

2.2.2.6 Fire behaviour

Fuels typing using forest cover attributes resulted in classification of this portion of the Park as fuel type M2 with patches of C2 and C3. Fire behavior modeling use the FBP system 70th percentile weather conditions resulted in consumption of >90% of the crowns with the exception of the lower Skagit valley where anywhere from 0 to 89% would be consumed depending primarily on wind conditions. Similar trends were predicted for rate of spread and fire intensity where the lower Skagit Valley would experience moderate to high fire behaviour with the remainder of the zone experiencing extreme fire behavior.

2.2.3 Proposed management strategies in Zone B

This FMZ forms the second most hazardous area in terms of wildfire threat when compared to FMZ-A. High visitation increases the threat to human lives and the risk associated with human caused ignition. Additionally there are numerous natural and cultural features at risk located predominantly along the valley bottoms. The risk of hazardous fire behavior is considered high. Since the majority of wildfire threat within this zone lies along the valley bottoms, wildfires threatening this area should be extinguished as quickly as possible. Wildfires, which ignited on the valley mid-slopes and that are moving into FMZ-C should be allowed to burn where fire weather and hazard conditions permit.

Within the FMZ-B fires will be allowed to burn under pre-established prescription guidelines. The Parks Zone Manager in consultation with the District Manager will independently evaluate each fire and determine if the conservation goals and objectives can be met. After August 31 at the discretion of the Zone Manager and District Manager, fires may be allowed to burn under conditions, which exceed the upper prescription limit if the risk is acceptable and weather forecast conditions permit.

Under certain circumstances prescribed fires may be necessary to meet specific conservation goals and objectives within this zone. This may be for the purpose of preserving specific wildlife habitat, unique flora, fauna, and/or unique ecosystems within the Park as deemed necessary by the District Manager. Where fire suppression has negatively impacted a specific area prescribed fire may be used as a tool to reduce fuel accumulations or restore ecological processes.

All non-prescription, human caused fires will be suppressed within this zone. Fires, which are allowed to burn, will be either lightning caused or prescribed burns designated by Park management. All fires within this zone will be subject to strict prescription guidelines based on codes and indices of the Canadian Forest Fire Weather Index System. Fires within this zone are not considered to pose a significant threat to human safety, developments, adjacent land jurisdictions, and unique ecosystems where fire is considered undesirable.

Upper prescription limit at which fires will be allowed to burn based on Historical Analysis:

FFMC-88 DMC 50 DC 300 ISI 10 (to be refined)

Field reconnaissance within FMZ-B indicated that maintenance of ecosystem processes, biodiversity and wildlife habitat are the focus of fire management within these zones. The fire management strategy in FMZ-B allows natural wildfires to burn under the most unrestricted conditions feasible. The climate and biophysical characteristics of this region of the park are considered suitable for this type of approach given the steep topographic boundaries, rivers and wetlands that divide the corridor, and values at risk in this zone. The ecological relationships, which exist between fire and the red and blue listed plant associations and the ecological reserves, should be carefully studied. Fire effects on individual species should be documented through field study and literature review.

2.3 Fire management Zone C (FMZ-C)

2.3.1 Description

FMZ-C is divided into four areas separated by FMZ-B. These areas are labeled FMZ-C1-4 (Cascade, Upper Skagit, Lower Skagit and Eastern Manning) on the Fire Management Zones map (Figure 1). The largest area is FMZ-C1 (Cascade), which covers the entire Cascade Recreation Area and the northeastern edge of E.C. Manning Provincial Park. Two small areas, FMZ-C2 (Upper Skagit) and FMZ-C3 (Lower Skagit), are located along the western boundary of Skagit Valley Provincial Park. FMZ-C4 (Eastern Manning) is located between FMZ-A and FMZ-B in the center of the study area.

This zone consists of predominantly high elevation stands classified as ESSFmw. These areas are characterised by long cold winters and short cool summers. The dominant trees found in this subzone are Engelmann spruce (*Picea Engelmannii*) and sub-alpine fir (*Abies lasiocarpa*) with less abundant amabilis fir (*Abies amabilis*) and mountain hemlock (*Tsuga mertensiana*).

Table 4. Synopsis of management objectives and actions in fire management zone C (FMZ-C)

| Management Issue | Objectives | Actions | Section Reference |
|------------------|--|---|-------------------------------------|
| Fire | 1. Prevent fire from endangering Park visitors | <ul style="list-style-type: none"> • Suppression planning • Within this zone, all human caused fires will be suppressed. • Non-human caused fires considered to pose significant threat to human safety, will be suppressed. | 2.3.3; 2.5 |
| | 2. Reduce the probability of fire damage to important Park developments and facilities | <ul style="list-style-type: none"> • Suppression planning • Fires considered to pose a significant threat to developments will be suppressed. | 2.3.3; 2.5 |
| | 3. Prevent fire from escaping Park boundaries | <ul style="list-style-type: none"> • Suppression planning • Fires threatening to escape Park boundaries will be suppressed. | 2.3.3; 2.5 |
| | 4. Re-introduction of fire, including fire management prescriptions and strategies. | <ul style="list-style-type: none"> • No suppression activities will be conducted within this zone unless fires are a threat to objectives 1., 2. and 3. and unique ecosystems. • No upper prescription limit will be established. Fires will be individually evaluated based on risk to other resources, location, and current fire weather conditions by the Park Zone Manager in consultation with the District Manager to determine if the fire meets conservation goals and objectives. | 2.3.3; 2.5; Section 2_5.0; 6.0; 8.0 |
| | 5. Improve public safety related to fire in high visitation areas | <ul style="list-style-type: none"> • Institute the proposed evacuation plan. • Public education. | 3.0; Section 2_7.0 |

2.3.2 Primary Concerns

2.3.2.1 Fire behaviour

The stands in these areas are generally mature to old growth stands classified as predominantly M2 fuel type. Fire behavior outputs are more severe in FMZ-C2-4 when compared to FMZ-C1. According to FPB97 >90% of the crowns would be burned and the fire intensity and rate of spread would be high to extreme in FMZ C2-4 under 70th percentile weather conditions. In FMZ-C1, fires have the potential to burn between 0 and >90% of the crowns with moderate to high fire intensity and rate of spread under these same conditions.

2.3.2.2 Adjacency concerns

FMZ-C1 through C3 are all adjacent to commercial forests. A small portion of FMZ- C4 borders the USA/Canada international border. Adjacency issues are of less concern in these Fire Management Zones given that these four areas are all dominated by high elevation forests which, burn infrequently.

2.3.3 Proposed management strategies in Zone C

The area contained within these four management zones are the most remote and include the lowest number of natural and man made features at risk in the Park. They are the least frequently visited reducing the risk to human lives and the risk of ignition.

No suppression activities will be conducted within this zone unless fires are considered to pose a significant risk to adjacent areas within and outside of the park, or if a fire poses a significant threat to human safety, developments, and unique ecosystems. No upper prescription limit will be established. Fires will be individually evaluated based on risk to other resources, location, and current fire weather conditions by the Park Zone Manager in consultation with the District Manager to determine if the fire meets conservation goals and objectives.

Under certain circumstances prescribed fires may be necessary to meet specific conservation goals and objectives within this zone. This may be for the purpose of preserving specific wildlife habitat, unique flora, fauna, and/or unique ecosystems within the Park as deemed necessary by the District Manager. Within this zone, all human caused fires will be suppressed. These areas are generally higher in elevation and contain more numerous fuel breaks such as open alpine and rock therefore containment should not be a significant issue.

2.4 General recommendations

In 1993 a draft Fire Management Plan was produced for the Park. Many of the recommendations that were outlined in the original draft plan are still relevant today. These recommendations are included Table 5.

Table 5. Relevant Recommendations from 1993 Draft Fire Management Plan

| Management Issues | Objectives | Recommendation |
|--------------------------|---|---|
| Fire | <ol style="list-style-type: none"> 1. To make scientific determination regarding re-introduction of fire (including fire management prescriptions and strategies) 2. Prevent fire escaping Park boundaries. 3. Ensure all ecological values are considered during decision making involving wildfire and prescribed fire | <ul style="list-style-type: none"> • Develop fire prevention programs, prescribed fire prescriptions and a complete compilation of historical fire records. Fire history data is only available from the Ministry of Forests and is based on forest protection compartment maps. This type of database needs to be expanded to include a number of retrievable attributes. From the vegetation management point of view, the most important attributes are i) the cause, ii) the location within biogeoclimatic subzone iii) the time of year iv) the site association and successional stage (vuel type) v) the area burned vi) the Canadian Forest Fire Weather Index (FWI) System codes and indexes. It is recommended that Parks either at the District or Regional level compile this information. • The reintroduction of fire at the landscape level should be based on the prescribed fire cycles discussed in Blackwell (1993). • Both managed wildfires and prescribed fires which meet specific prescription criteria should be used in combination to achieve the prescribed fire cycle within a specific area and ecosystem of Manning and Skagit. • Apply both managed wildfires and prescribed fire in such a manner as to approximate the long-term historical fire regimes identified in Manning and Skagit. • BC Parks should enter into negotiations with the BC Ministry of Forests to develop an interagency fire analysis team. This group would be responsible for the assessment, planning and decision-making when a fire has the potential to cross the Park boundary. • These agreements will also include agreement on processes and criteria to be used to make decisions on prescribed vs. wildfire and suppression strategies and tactics. • Independent studies should be undertaken to quantify the role of fire in the Rhododendron, Ponderosa Pine and Cottonwood Reserves. Our current understanding of the Rhododendron ecosystems suggests that in the absence of disturbance by fire, the occurrence and vigour of moderately shade-tolerant rhododendron will decrease in relation to decrease of Douglas-fir and lodgepole pine in the forest canopy. The rate of decrease will increase with decreasing water deficit, and will correspond with the rate of replacement of Douglas-fir and lodgepole pine by western hemlock and other shade-tolerant species. |

| Management Issues | Objectives | Recommendation |
|-------------------|--|--|
| | | <ul style="list-style-type: none"> • A study examining the status (decreasing or increasing) and dynamics of rhododendron communities is recommended. • To maintain integrity and reduce fire hazard of forest stands in the Strawberry Flats area The control of coarse woody debris to lower fire hazard should be carried out along with systematic efforts to regenerate lodgepole pine over an extended period of time (e.g. tuned to the occurrence of mortality). It is recommended that a small trial be designed and implemented. • Similar efforts should be considered on similar (water- deficient) sites along the road, however, in addition to lodgepole pine, some other tree species might be considered, depending on site and stand dynamics. |
| | 4. Reduce the probability of fire damage to Park developments and facilities | <ul style="list-style-type: none"> • That a fuel management plan be developed for structural developments within the Skagit and Manning areas. The Manning Park Lodge and Headquarters area should receive a high priority in this plan. • The pinegrass/lodgepole pine communities adjacent to headquarters are considered a fire high risk given the stand’s susceptibility to surface fire and large number of visitors moving through this area. It is recommended that a small trial be designed, implemented and combined with a study to examine the effect of fire on mortality of the overstory and on regeneration patterns in the understory. |
| | 5. Reduce the risk of human-caused fire | <ul style="list-style-type: none"> • That a policy on public use restrictions based on Canadian Fire Weather codes and indices should be developed within Parks to standardise and remove subjectivity in the decision-making process. |
| | 6. Improve monitoring of fire weather and fire information record keeping | <ul style="list-style-type: none"> • That four permanent fire weather stations be established within the boundaries of Manning Park and that additional two weather stations be establish within the boundaries of the Skagit Valley Recreation Area. Daily information from the time of snow melt is needed to monitor the following fire weather parameters: maximum temperature, 1200 standard time readings of temperature, relative humidity, daily precipitation and wind. • Key staff positions including the Zone Manager should be trained to understand and interpret the Canadian Fire Weather Index System. It is of critical importance that Park Managers understand the codes and indices of this system. The Fire Weather Index System forms the foundation of all fire management operations within the Park. |

| Management Issues | Objectives | Recommendation |
|-------------------|--|---|
| | 7. Have suppression responses readily available to make quick decisions on wildfire starts | <ul style="list-style-type: none"> • The Zone Manager or appropriate designate, with the co-operation of the Forest Service, attend an overhead team training session to gain an appreciation for co-ordination and suppression of large project fires and a better understanding of prescribed fire. • That all BC Parks vehicles be equipped with a standard set of fire tools during the fire season. This set of fire tools should include all tools detailed in the Ministry of Forests regulations. |

2.5 Suppression Planning

When a significant natural event such as a catastrophic wildfire occurs, lack of preparation can quickly lead to poor decisions. This greatly increases the risk to human lives and properties. Therefore preparation is critical to the successful control of all unwanted fire starts within the Park.

2.5.1 Detection and reporting

The BC Ministry of Forests is the agency responsible for fire detection. This is facilitated through the use of the provincial lightning locator system, aerial observation, and public observation. Detection capabilities are greatly increased in the study area due to the number of visitors who use the park during the fire season. Park staff are another valuable source of fire detection as they patrol high hazard areas regularly, are familiar with the topography and are trained to recognise wildfires.

2.5.2 Initial attack preparedness

In provincial parks, fire management planning has been the responsibility of the Regional Resource Officer. It is our recommendation that BC Parks establish a fire management team who are trained and educated to recognise the role of fire in different ecosystems and implement ecologically suitable control strategies within the restrictions outlined in this plan.

Park staff should be assigned roles within the fire management team and trained accordingly. In many situations Parks staff will provide an initial attack response. It is crucial that a core of staff members be trained in basic fire suppression to provincial standards of the Ministry of Forests.

After a fire has been detected it should be evaluated as quickly as possible. All human caused fires and fires within fire exclusion zones will be subject to aggressive initial attack, by both initial attack crews and unit crews. Fire suppression should be conducted in a way that will minimize the impact on the parks natural and cultural resources without compromising safety or suppression effectiveness.

The advantage of a well-developed park is that many areas are easily accessed for fire suppression and evacuation. There are numerous roads through these areas including Highway #3, which bisects Manning Park, a gravel road runs into the Gibson pass ski area, into Blackwall peak and east of Silverdaisy Mountain. As well Skagit valley is accessed through the gravel Silver/Skagit road which follows the Klesikawa River and Skagit River. Another gravel road runs adjacent to the west boundary outside of Skagit Provincial Park. Cascade Recreation Area has no road access although there is an extensive network of logging roads to the north and east. Also there are numerous horse trails extending through the area.

The primary initial attack base is Haag camp near Hope. At peak times when they are on red alert, a helicopter and initial attack crew will be off the ground in 5 minutes. When not on red alert, marshalling takes

about 20 min. The helicopter flies at an average speed of 100 miles/hr and is the quickest means of reaching a fire in the backcountry.

2.5.3 Fire suppression constraints

Steep and mountainous terrain, which exists across much of the area, will hinder suppression efforts by ground crews. In the case of a catastrophic wildfire, the primary suppression tool will likely be from the air. Conventional suppression tactics will be limited to some extent in order to minimize the impacts on the park. Line construction of fuel breaks should be minimized and existing natural and man made fuel breaks should be used whenever possible. Preferred techniques that minimize impacts on the park include backfiring or burning out techniques from these fire breaks, and the use of wetlines whenever possible. Additionally the use of water should be favoured over fire retardant.

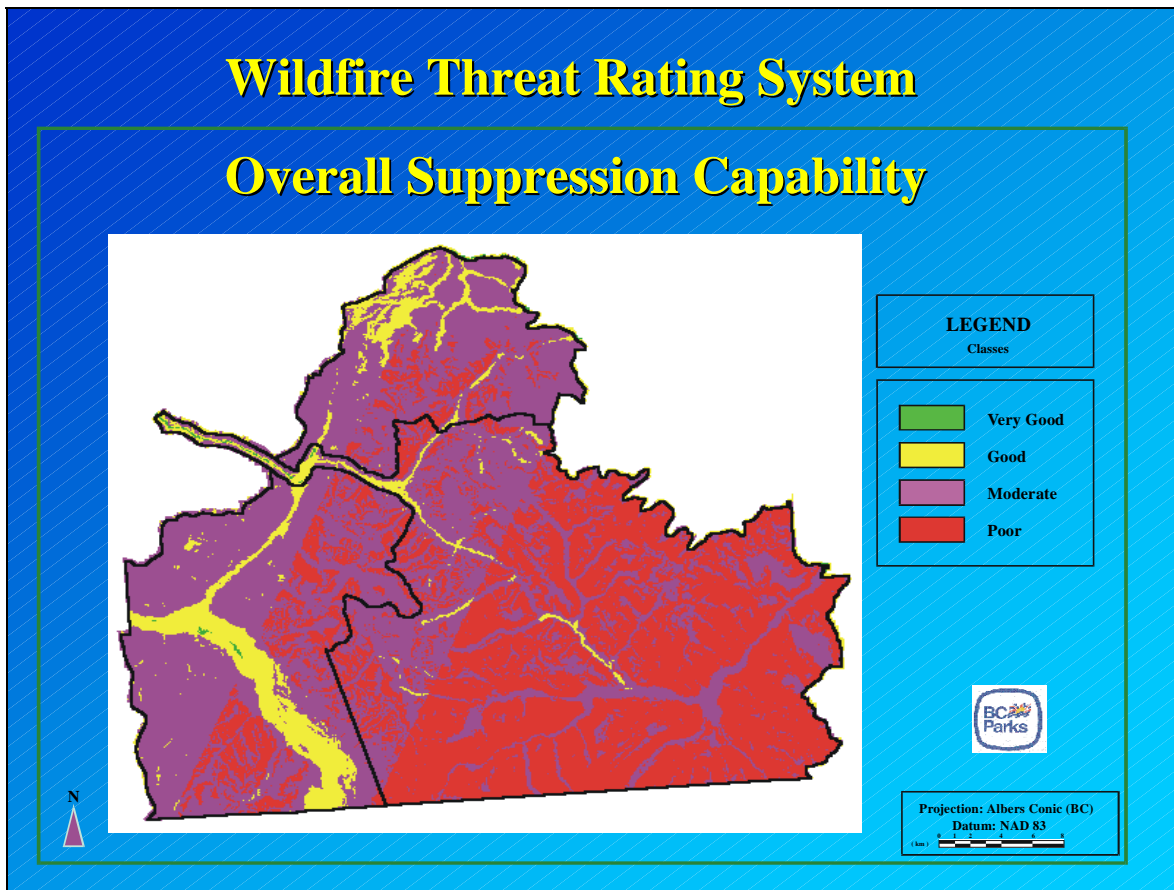


Figure 2. Overall suppression capability in Manning Park.

2.5.4 Fuel breaks

As a result of the mountainous terrain and extensive river systems throughout the park, numerous natural fuel breaks exist. Rivers and creeks run throughout the study area. As well there are many open alpine areas which have limited or no forest cover. There are also a number of effective human fuel breaks such as Highway #3, which bisects the park. The highway follows the Skagit and the Simikameen Rivers, which increase the effectiveness of this specific fuel break. The Silver/Skagit road also creates an effective fuel break as it bisects the Skagit valley along the Klesilkwa and Skagit rivers.

2.5.5 Water sources

Water sources for fire suppression are available throughout the park from the numerous rivers, creeks and lakes. Figure 3 shows the water sources from the wildfire threat rating system. On this map the water sources which are available 12 months of the year are highlighted. Lakes can be used for helicopter bucket drops and the rivers and creeks can be used to feed water pumps for unit crews.

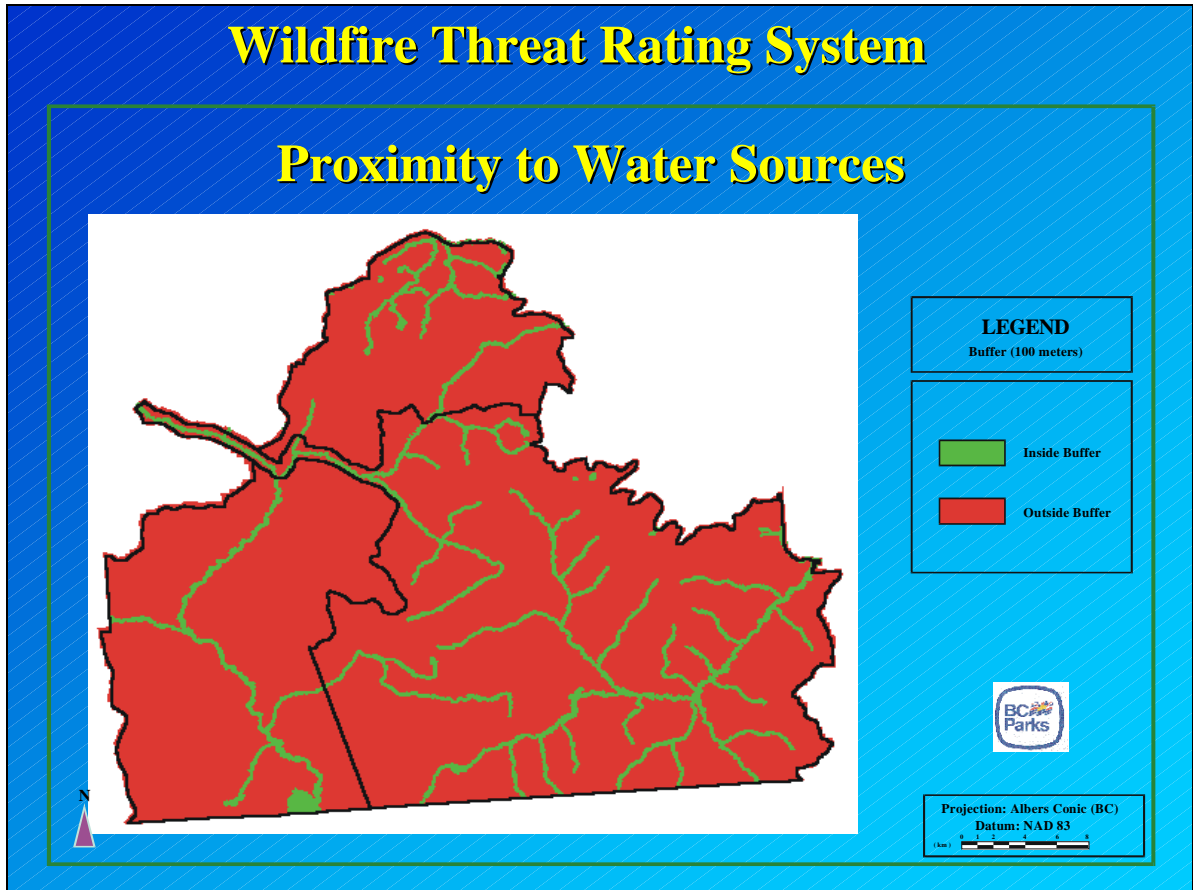


Figure 3. Proximity to water sources in Manning Park.

3.0 EVACUATION PLAN

The primary concern when dealing with a wildfire is public safety. After a wildfire is detected within the park, the threat that it poses to staff and visitors should be evaluated quickly. The location, direction and rate of spread of the fire will indicate where public safety is at risk. Park staff should have an idea of how many people are in the park and where they are located so that the appropriate measures are taken to remove these people from any danger.

The District Manager on recommendation from the Zone Manager and the Area Supervisor will determine closures and restrictions to public travel and access. If it is determined that there is a significant threat to public safety, evacuation of the endangered area should begin immediately.

3.1 Evacuation planning and preparedness

In preparation for an emergency such as wildfire there are four general tasks recommended by the Justice Institute of BC Emergency Evacuations Manual.

- 1) Have a regular comprehensive preparedness program. In order that public evacuation proceeds as quickly and efficiently as possible it is critical to have an evacuation plan in place and which the park staff are familiar. This plan should be reviewed and updated regularly. As well there should be emergency training for all staff so that they are familiar with the plan.
- 2) Appoint a co-ordinator that will develop an active program with clearly defined duties and responsibilities.
- 3) Establish an emergency operations centre with full communication capability. The co-ordination of evacuation and suppression efforts will be the responsibility of the forest service.
- 4) Place a high priority on public education.

In order to be prepared for an evacuation of any size it is critical that the organizers know:

- The number of visitors in the park.
- The type of visitors in the park, i.e. physical conditioning, age, language barriers
- The location of visitors in the park

Once this has been determined, the issue of notification must be addressed. Locating and notifying the public can be a difficult task when dealing with remote areas. The quickest way of locating and notifying the public is by Helicopter. Other resources may include the use of all terrain vehicles and horses or Park staff on foot.

Once the public has been notified they must be evacuated via the quickest and safest routes possible. A critical part of preparation is to become familiar with the most efficient escape routes from all regions in the park. Staff should direct visitors away from the fire by the quickest and safest route. In order for the evacuation to proceed efficiently, proper communication between staff and visitors is essential. Staff should be in constant radio communication to ensure total area coverage and complete evacuation of the endangered areas.

3.2 Evacuation map

Figure 4 is a map that will facilitate decision making when evacuating certain areas during a fire. This map shows the two main access corridors for Manning Park and Skagit Valley. These are highway #3, which bisects Manning Park, and the Silver/Skagit road that runs through Skagit Park. Additionally travel times are displayed along the main backcountry trails. These times indicate how fast it would take for someone to move by foot along the individual trails to reach one of the two main access corridors. These times are based on hiking trail descriptions obtained from the Manning Park visitor's centre. Most of the travel times are based on a hiking speed of 3-5 km per hour. In the event of an emergency individual group fitness must be considered when determining evacuation times. The abilities of the slowest individuals or groups will determine the best evacuation method. Areas, which are farther than 3 hours hiking time away from the highway should be considered for, helicopter evacuation during an emergency.

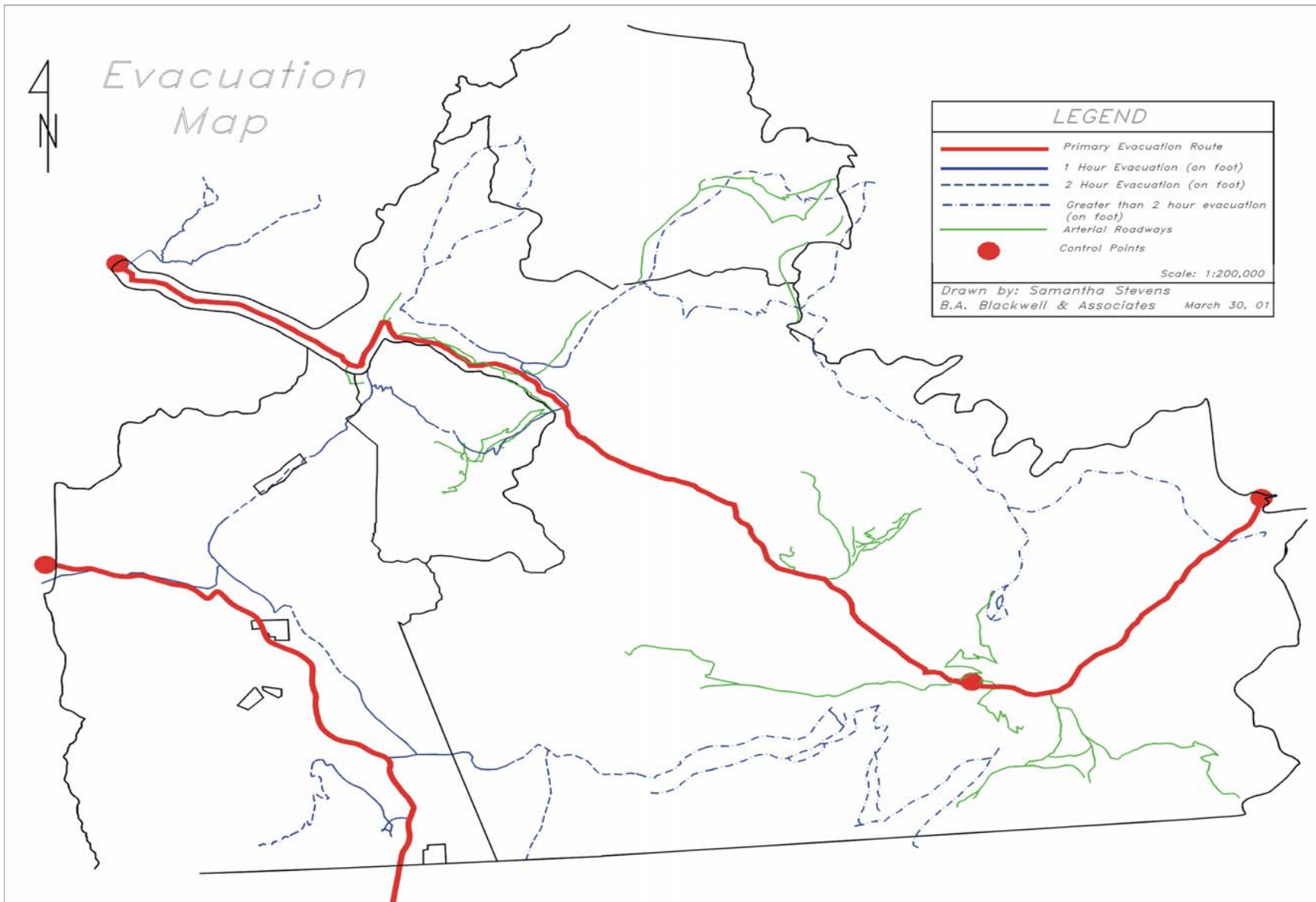


Figure 4. Manning Park evacuation map

The public should be directed to the closest and safest location for helicopter evacuation.

The trail hiking times are colour coded as follows:

- Solid blue for areas that would take from 0 to 1 hour to hike out of.
- Dashed blue for areas that would take 1 to 2 hours to hike out of
- Dash-dot blue for areas that would take 2 to 3 hours to hike out of.

Remaining areas require more than a 3 hour to hike out. These areas should be considered for helicopter evacuation in the event of a threatening fire.

There are also four “control points” located on the map. These are areas from where the evacuation plan will be conducted and co-ordinated. The primary control point will be the Park headquarters where co-ordination of the evacuation plan will be based. The other three control points are at the exits from the park. From these areas, traffic in and out of the park will be controlled.

3.2.1 E.C. Manning Park

The level of development of this park has created access through much of the area. Highway #3 is a well developed highway, which provides quick evacuation, from both the east and west. It also runs directly through the middle of Manning Park and thus represents the quickest escape route. As well, the majority of park visitors remain within the highway corridor. Depending on the location and direction of a given fire, evacuation should be directed by the safest route to Highway #3 and then to the closest exit from the park. Traffic should be directed in the quickest and safest fashion possible without hampering the access of fire suppression resources.

3.2.2 Skagit Valley Park

This Park also has road access, which will facilitate evacuation efforts. The Silver/Skagit road is gravel surfaced and intersects highway #1 just west of Hope. It runs south through Skagit valley into Ross Lake National Recreational area in the United States.

3.2.3 Cascade Recreation Area

There is no road access into this area although there are numerous logging roads and trails to the north and east from commercial forestland surrounding the park. Additionally, there is a well-developed system of horse trails, which may be accessed with 4wd quads or dirt bikes to quickly evacuate people.

About [B. A. Blackwell & Associates Ltd.](#)

We are Canadian forestry consultants dedicated to providing high quality, cost-efficient professional forestry and [environmental management](#) services. We have diverse experience in a range of [forest management](#) disciplines and are at the forefront of Canadian forestry and forestry practice in BC.

We are based in North Vancouver and Williams Lake, BC. For more information about us please visit <http://www.bablackwell.com>.

[Sustainable Forest Management](#)

We have diverse experience in a range of forest management disciplines. Services include: [Forest Fire Management](#), [Forest Engineering](#), [Silviculture](#), [Bioenergy](#), [Forest Health](#), [Pine Beetle](#), [Danger Tree and Windthrow Management](#), [Timber Valuation](#), [Forest Practices Audits](#), [Forestry Research](#).

[Wildfires and Forest Fire Management](#)

We have helped develop [BC forest fire](#) threat analysis and its application within various regions. Our Wildfire Risk Management System has been applied by local and regional governments, BC Parks, forest companies in BC and Alberta, and the U.S. Fish & Wildlife Service in Alaska.

[Forest Ecology & Ecological Restoration](#)

Our foundation is forest ecology. Our strength is the application of this knowledge to natural resource management and ecological restoration. We have planned and implemented ecological restoration activities for degraded ecosystems and environments across BC. We provide services in Terrestrial Ecosystem Mapping (TEM), forest ecological assessment and forest ecosystem based management applications to support forest and environmental management and stewardship.