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## **Wildfire Interface Management Report for Crystal Mountain Ski Resort Expansion**

### 1.0 INTRODUCTION

This report prescribes actions to be undertaken in order to make the proposed expansion of the existing facilities at Crystal Mountain Ski Resort compliant with the FireSmart Manual objective of protecting the lives and property of future landowners.

There are two components to a Wildfire Hazard Assessment. A detailed Area Hazard Assessment of the proposed development site will be completed once the snow has melted. This area is defined as Priority Zone 3 and is located 30 meters away from buildings. The assessment will stratify the property into distinct polygons that will have similar topographical features (slope and aspect), vegetative cover (timbered vs. non-timbered) and density (crown closure), and presence of ladder fuels. Each polygon will be assigned a Fire Danger Rating that ranges from Low to Extreme.

Strict adherence to the vegetative management prescriptions can be expected to reduce the risk of a wildfire entering or leaving the Controlled Recreation Area (CRA) by reducing the fire hazard to a low or moderate rating. Managing the surrounding timber resource will also greatly reduce the demands of a water supply system.

The other component of a Wildfire Hazard Assessment is a Structure and Site Hazard Assessment that will evaluate the risk posed by construction techniques and building materials of individual structures. The Site hazard area is defined as Priority Zones 1 and 2, which extend in concentric circles up to 10 meters from a building and up to 30 meters away, respectively.

This report will concentrate on the latter component. It is the intention of the forestry consultant that the developer will be better informed to implement fire hazard mitigation in the design and planning stages of the proposed expansion once they are made aware of the hazards inherent in their conceptual plans.

The Fire Hazard Mitigation Prescription for the property, to be completed later this Spring, will incorporate the guidelines of the FireSmart Manual which can then be integrated into Section 219 Restrictive Covenants. Architectural designs can be modified on a site specific basis for areas with a Low or Moderate hazard rating, allowing for amendments to Development Permits.

## CRYSTAL MOUNTAIN SKI RESORT EXPANSION FIRESMART GUIDELINES

Appendix 1 provides a thorough description of the actions that should be implemented by individual homeowners to control the vegetation around their homes. Appendix 2 discusses the FireSmart building code that further reduces the demands on a water supply system.

Appendix 3 specifies the developer's intention to provide for access routes that meet the requirements of the FireSmart Manual. The designation of an emergency escape road in Appendix 4 also contributes to protecting the lives of residents and tourists lodging in the onsite facilities.

A water supply plan cannot be designed until the size of each proposed structure is known. Once the building permit has been submitted, a professional engineer specializing in groundwater hydrology should be consulted to fulfill this obligation. Appendix 5 offers guidelines that the developer can consider in consultation with Fire Officials and engineers.

### 1.1 Description of Property :

The CRA is bounded by Powers Creek Canyon to the east, the Trepanier Creek Trench to the west, Highway 97C Okanagan Connector to the south, and a tributary to Powers Creek to the north. Jack Creek, Law Creek and Fern Creek are main drainages within the CRA.

However, these drainages may not be practical sources of water for fire suppression activities. Pennask Lake, approximately 33 kms to the northwest, would likely be the nearest practical source of water at this elevation for air tankers. Lambly (Bear) Lake and Jackpine Lake would be suitable for helicopters to refill monsoon buckets and for tanker trucks to refill.

A preliminary assessment of Exhibit IV-1 and IV-3 maps provided in the Master Plan Proposal confirms that while the CRA is highly susceptible to a wildfire entering from several directions, the most obvious path for a fire to reach the CRA would be from the west or northwest. The BC Hydro right-of-way from Brenda Mines to Glenrosa is an effective firebreak for a wildfire from the south. The Crystal Mountain road and the Last Mountain FSR serve as buffers along the eastern boundary.

The topography of the CRA has been identified in the Master Plan as rolling terrain, but neglects to point out that this plateau is relatively high above Okanagan Lake. This will also have a significant bearing on the use of water bombers for wildfire suppression.

The topographic attributes that make Mount Last desirable for development as a destination ski resort are also the primary reason for the area's high susceptibility to a wildfire from outside the CRA. Namely, it is the highest point of land between Westbank and the Connector

As experienced in the Okanagan Mountain Park fire of 2003, the winds shift around 4:30 PM every day and draw downhill. This phenomenon is attributed in part to the atmospheric changes occurring on the Okanagan Connector that funnel down the Trepanier Creek Trench. An accidental fire initiated along the Connector could therefore

## CRYSTAL MOUNTAIN SKI RESORT EXPANSION FIRESMART GUIDELINES

be expected to spread quickly up the steep slopes and into the watersheds within the CRA.

Ski hills are classified by terms such as “vertical drop.” The Master Plan expects the proposed ski hill will have a vertical drop of approximately 700 metres. In combination with a generally southern exposure, this area can be expected to suffer drought conditions during the hot, dry summer months characteristic of the Okanagan Valley. An accidental fire initiated within the resort area during the summer would generally spread uphill during morning and early afternoon hours. A late afternoon fire may escape downhill, threatening houses in the Glenrosa area. If the fire was funneled down Powers Creek it could even endanger houses in the Jim Smith Creek subdivision to the southeast of the resort.

Armed with this knowledge of fire behavior, an initial fire prescription would incorporate a firebreak around the susceptible areas of the CRA. Reviewing Exhibits I-9 and IV-1, it is apparent that there are existing roads along the western and eastern flanks that can be integrated into a fire mitigation prescription. The Jack Creek road and the Last Mountain Forest Service Road (FSR) would also serve as initial attack access for tanker trucks and fire suppression crews.

The field assessments scheduled for later this Spring will clarify the actual risk and present mitigation prescriptions where required. For now, RDCO officials and the Fire Chief should be aware that the prescription for firebreaks will be similar to the treatment of Priority Zones 1, 2 and 3.

## 2.0 BACKGROUND

Crystal Mountain has received conditional approval from the Provincial Government agencies responsible for administration of the Commercial Alpine Skiing Policy to apply for an expansion of the existing ski runs and infrastructure as per the Master Plan Proposal submitted by Pheidias Development Management Corporation, and approved by the Province in August 2003 with a Master Development Agreement for the operation and expansion of Crystal Mountain.

Crystal Mountain recognizes recognizes that the Fire Smart Manual guidelines have been introduced subsequent to the date that the Master Plan Proposal was submitted.

Clarification will be required in the following sections of the Master Plan Proposal in order to be consistent with the application of the Fire Smart Manual guidelines:

SECTION	TITLE	PAGE No.
2(b)(iii)(C)	Single Family Dwelling Requirements	IV-17
2(b)(iv)(A,B &G)	Resort Fire Prevention and Control	IV-20
2(c)(iii)	Single Family Chalets	IV-25, 26
2(h)(i)	Landscaping Concept	IV-36
2(h)(ii)	Parking, Road and Pedestrian System	IV-36
2(i)(iii)(l)	Non-Combustible Building Construction ...	IV-55
2(i)(iii)(l)	Landscape Efficiency	IV-55, 56
2(i)(xviii)	Fire Protection Services	IV-72
3(d)(i)(F)	Forest Fires	IV-80, 81, 82

### 2.1 Revisions to the Master Plan Proposal

#### 2.1.1 Single Family Dwelling Requirements (2(b)(iii)(C))

The intent expressed in this section is to nestle the homes into the forest with minimal landscaping. No regard is given to the hazard rating of the site. Crystal Mountain will be better informed once the proposed resort base area has been classified by the forestry consultant this Summer. The relative size of a “Large lot” can be quantified once the planning department incorporates the hazard assessment prescription into their subdivision design and layout.

## CRYSTAL MOUNTAIN SKI RESORT EXPANSION FIRESMART GUIDELINES

### 2.1.2 Resort Fire Prevention and Control (2(b)(iv)A,B,G) and Single Family Chalets (2(c)(iii))

Section 2(b)(iv)(A) recommends creating a buffer around each building. This is referred to as Priority Zone 1 and extends for 10 meters on flat ground. Section 2(c)(iii) envisages that the single family chalets will be distributed “among the trees.” It should be pointed out that chalets located closer than 20 meters between each other will be cleared of all trees if they are located in High or Extreme hazard rating areas. Forest stands that are 10 to 30 meters away from a chalet are in Priority Zone 2 and must be thinned so that there is a minimum of 3 meters between the crowns of adjacent trees. This means that the stems of trees may be 10 meters apart on flat ground. This may significantly impact the density of chalets per hectare or require the chalets to be restricted to lower hazard rated areas. Crystal Mountain can make these decisions at the planning stage.

Section 2(b)(iv)(B), Building locations, does not recognize that structures located on a slope and built of entirely non-combustible exteriors to FireSmart design standards can be exempted on a site specific basis. This would be appropriate on slopes above irrigated fairways or paved roads where there is a low or moderate fire danger rating.

Section 2(b)(iv)(G) may be excessive for a low-risk structure in a low-hazard area. It may be appropriate where other risk reduction strategies are impractical but it seems that water sources are at a premium on the hillside and may be inadequate to reliably supply enough volume if an interface fire rages through a neighborhood.

### 2.1.3 Landscaping Concept

Section 2(h)(i) needs to clarify that Priority Zone 1 will only be retained in a natural vegetative state if the structure meets strict exemption requirements. The most significant criteria for exemption is that the structure has been built to Fire Smart standards and the area is in a low or moderate hazard rating. Vegetative Management strategies are provided in Appendix 1.1 and 1.2 of this report for the Landscape designers.

### 2.1.4 Parking, Road and Pedestrian System

Section 2(h)(ii) does not recognize the guidelines proposed in the Fire Smart manual. They are provided in Appendix 3 of this report for the benefit of the infrastructure planners. The Fire Chief may authorize amendments to these guidelines.

### 2.1.5 Non-combustible Building Construction Where Possible

Section 2(i)(iii)(l) recommends that the single family and bed and breakfast buildings have sprinklers, mainly because they are expected to be constructed of combustible materials. If the Fire Smart construction guidelines are enforced, the use of sprinklers may become an optional feature at the discretion of the Fire Chief.

### 2.1.6 Landscape Efficiency

## CRYSTAL MOUNTAIN SKI RESORT EXPANSION FIRESMART GUIDELINES

Section 2(i)(iii)(l) dwells more on the concept of single family chalets and houses being “landscaped to blend in with the natural forest setting and avoid a city-type grass lawn landscaping”. While the Crystal Mountain should be given credit for their serious consideration for water conservation, commitments cannot be made until a fire hazard assessment of the proposed structure and site have been completed. The structural fire hazard assessment can only be completed once architectural plans have been submitted for Development Permit. If the design conforms to Fire Smart construction guidelines it will only be a formality to approve them. Landscaping standards are presented in Appendix 1 of this report.

The initial detailed assessment planned to be completed this Summer will be for the entire CRA. This macro overview will enable Crystal Mountain to define suitable subdivision sites that are either in naturally low or moderate fire hazard areas or will become such after fuel modification strategies have been employed or due to infrastructure development.

### 2.1.7 Fire Protection Services

Section 2(i)(xviii) discusses volunteer firefighters. The Fire Smart manual deals extensively with incorporating the design of roads with the needs of emergency fire fighting vehicles. The manual also provides options for individual homeowners that the developer may include in Section 219 Restrictive Covenants.

### 2.1.8 Forest Fires

Section 3(d)(i)(F) deals with prevention measures to reduce the fire hazard on the CRA. Four options are presented in the Master Plan Proposal. The first option, vegetation management, recommends treating the forested areas between the existing and proposed ski runs. Without the benefit of a risk assessment, removing all dead and down debris, then spacing and pruning the retained living trees may be unnecessary. A firebreak around the perimeter of the CRA that incorporates the edges of ski runs and existing and proposed roads would be more practical. The hazard assessment report to be submitted in the Spring will offer specific prescription options based on actual hazard ratings.

Construction materials should follow the Fire Smart guidelines. The architects and planners for Crystal Mountain have extensive experience in mountain architecture and are aware that Hardy planks simulate the look of cedar siding but are an approved Fire Smart exterior siding. Exposed large timber beams are also acceptable if properly treated chemically. It is significant to note that contrary to the Master Plan Proposal, “sprinklering buildings” is not “an acceptable alternative to many of the above noted measures.” Sprinkler systems do not provide reliable structure protection where there is wildfire exposure and can become unserviceable for a number of reasons (Reference page 3-36, Fire Smart manual). However, sprinklering is the most effective way to protect buildings and occupants from internal fires according to insurance and fire protection experts and is a recommended practice for many building code building classifications, especially when there is no full fire department on site.

### 3.0 CONCLUSION

The Master Plan Proposal was developed prior to the publication of the FireSmart manual. This manual has been readily accepted by the Kelowna, Vernon and Sicamous Fire Departments, as well as the North Okanagan Regional District Fire Commissioner.

The Okanagan Mountain Park fire provided the first opportunity to complete a post-fire evaluation of a fire reduction prescription. The Cantina Court and Arrowleaf Lane greenspaces in the Dilworth Homes subdivision on the South Slopes were barely singed while the Rank 6 firestorm devastated adjoining areas that had not been treated yet, even though a prescription had been authorized. Pictures of the minimal scarring of tree trunks and ground fire damage within the greenspaces have been used by the Alberta department of Sustainable Resource Development and the Natural Resource department of the Canadian Forestry Service for training sessions across Western Canada.

In order for second-generation and subsequent homeowners in this resort development to be made aware of their obligations to maintain the Fire Smart guidelines, I recommend that the Fire Hazard Reduction Prescription to be submitted this Summer be included by Crystal Mountain in the proposed Section 219 Restrictive Covenants for the entire area.

Submitted by

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## APPENDIX 1 Vegetation Management Strategies

The first step in mitigating a fire in the interface area is to control the vegetation. NFPA 1144, the Standard for Protection of Life and Property from Wildfire, offers guidelines recommended by numerous fire protection agencies.

The goal of a vegetation management strategy is to prevent a low-intensity ground fire from escalating into an uncontrollable crown fire. This is usually accomplished by either removing or reducing strategies (1.1.1) or converting the fuels (1.1.2) on a particular property. The intensity of a strategy's application has been correlated with the distance around a building. Two concentric Priority Zones are recommended for this development, each with their own unique vegetation management strategy.

### 1.1 Recommended guidelines for Priority Zone 1:

This zone covers the first 10 meters in all directions from a structure built on flat ground. The zone increases proportionately as the slope increases. The strategy here is to remove the fuels to create a firebreak immediately adjacent to a structure.

#### 1.1.1 Fire Hazard Reduction Prescription :

- Remove all conifers within 10 meters of any building on flat ground, increasing this distance as slopes increase.
- Dispose of accumulations of small branches and needles on the ground annually to prevent the spreading of fire on the ground or up the trees.
- Remove standing dead and dying trees, and large, sound logs on the ground.
- Keep leaves, needles, and moss accumulations from roofs and gutters at all times.
- Store firewood and other flammable materials at least 10 meters away from the house, not under decks or soffits.
- Retention of conifers within Zone 1 should be evaluated by a Registered Professional Forester on a site-specific basis.

#### 1.1.2 Comply with Fire-Safe Landscaping :

- Use pea-gravel or non-flammable types of ground cover rather than bark mulch.
- Build a rock-type garden.
- Plant low-growing (<0.5m. tall) shrubs only around the house. Deciduous trees are favored for landscape plantings. Replace highly flammable trees such as Western Red Cedar, hemlocks, spruces and firs with deciduous trees, or larches.
- Maintain an irrigated lawn within Zone 1.

### 1.2 Recommended guidelines for Priority Zone 2:

This zone surrounds Zone 1 and extends outward in concentric circles for another 20 meters. If the lots are less than 200 meters wide, apply the Zone 2 prescription to the property line. The goal of vegetation management in Zone 2 is to further extend the fuel modified area by thinning the forest cover and pruning lower conifer branches.

## CRYSTAL MOUNTAIN SKI RESORT EXPANSION FIRESMART GUIDELINES

### 1.2.1 Fire Hazard Reduction Prescription for Priority Zone 2:

- ◆ Space trees so that there is a minimum of 3 meters between the crowns of trees. Select the larger trees for retention. Priority is given to Aspen, poplar, maples and birches over conifers.
- ◆ Prune all branches that are within 3 meters of the ground and remove this debris.
- ◆ Remove all sound-woody debris on the ground and maintain annually
- ◆ Remove standing dead and dying trees.
- Maintain the prescribed spacing between trees as they continue to grow.

## APPENDIX 2.0 FireSmart Building Code

The demands of a fire fighting water supply can be partially reduced by using FireSmart design standards for all interface residence construction. The goal here is to reduce the ignition hazard of a structure while a fire is passing through the property.

- Use fire resistive materials for roofs and exterior walls.
- Use fire resistive materials for exterior window shutters, vent openings, and awnings.
- Build balconies and decks of non-combustible or fire-resistant materials.
- Ensure the house address is visible so fire fighters can find you quickly.
- Have a pre-planned escape route out of the area in case of emergency forest fire evacuations.
- Have a garden hose available that can reach at least 30m from the house and be prepared to place a sprinkler on the roof if needed.
- Houses without pressurized water systems should have a minimum 45-gallon water barrel close to each house with a two gallon pail attached.
- Paint the handles of fire fighting shovels and mattocks with red paint so that they are not used for regular gardening chores. Perform annual maintenance checks on these tools during the winter months.
- Keep a ladder available that will provide access to the roof.

## APPENDIX 3 Access Routes

Developments in the interface area must be designed to provide both public and emergency vehicle access. Any road systems proposed in the Master Plan will incorporate the design parameters endorsed in the FireSmart Manual. RDCO may grant a Development Permit exemption to these standards if written approval is received by the developer from the Westbank Fire Chief

Section 2(h)(ii) of The Master Plan can be augmented with the following FireSmart guidelines concerning roads and driveways (Sections 3.1 – 3.3) and be incorporated directly into engineering designs;

## CRYSTAL MOUNTAIN SKI RESORT EXPANSION FIRESMART GUIDELINES

### 3.1 FireSmart Guidelines for the layout, design, construction, and maintenance of proposed subdivision roadways :

- ◆ Roads should provide safe simultaneous access for emergency vehicles and public evacuation with a traveled way of not less than 6.1 meters horizontally and 4.1 meters vertical (overhead) clearance.
- ◆ Road curvature radius should be at least 30 meters, measured from the centerline.
- ◆ Dead-end roads more than 90 meters in length should be provided with a turnaround at the terminus having no less than 36 meters outside diameter of traveled way. Fire officials may authorize a “hammerhead T” turn-around to provide three point turnaround ability. Dead-end roads should have their non-through traffic status posted on fire-resistant signs.
- ◆ Road gradient should not exceed 10 %, unless negotiated with fire officials.
- ◆ All gates should be located at least 9 meters from the public right of way and should not open outward. Gate openings should provide a clear opening of not less than 0.6 meters wider than the traveled way.
- ◆ Fire service personnel shall be provided with keys for locks on any gates restricting fire service access.
- ◆ Roads should have a hard all-weather surface capable of supporting any fire apparatus likely to be operated on the road.

### 3.2 FireSmart Guidelines for the layout, design, construction, and maintenance of fire service access driveways in addition to the last four guidelines listed above for roads :

The FireSmart manual also provides recommended guidelines for driveway standards. Fire trucks must be capable of turning around at the end of a driveway that is more than 45 meters from a main road. Shorter roads without a turnaround should be marked at the entrance as such.

- ◆ Driveways more than 45 meters in length should be a minimum of 3.7 meters wide and provide 4.1 meters of overhead clearance. Fire officials may specify additional widths and clearances.
- ◆ Turnouts shall be spaced so that drivers can see from one turnout to the next. Turnout requirement is waived where the fire service access width is at least 6.1 meters. Driveways more than 90 meters long should be provided with turnouts at locations approved by fire officials.
- ◆ Driveway turns should not restrict the access of the largest emergency vehicle likely to be operated on the driveway. Fire officials will specify local emergency response agency requirements.
- ◆ Dead-end driveways more than 91 meters in length shall be provided with a turnaround at the terminus having no less than 15 meters outside diameter of traveled way. Fire officials may authorize a “hammerhead T” turnaround to provide three point turnaround ability. Dead-end roads should have signs warning of their no-through-traffic status.

### 3.3 FireSmart Guidelines for road, driveway and address signs:

- ◆ Signs should be clearly visible and legible from the road and use a consistent system that provides for sequenced or patterned numbering and non-duplicated naming.
- ◆ Signs should be built of non-combustible materials and mounted 2 meters above the road surface.
- ◆ Roads will be identified as “Dead-end” by fire officials. Directions to and the type of water source will also be signed.
- ◆ Letters, numbers, and symbols used on all signs should be at least 10 centimeters high with a 12 mm stroke, contrast with the background color of the sign, and be reflective.

## APPENDIX 4           Emergency Escape Road

The logical Emergency Evacuation Route would be down the Crystal Mountain Road to Glenrosa and Highway 97. Alternatively, the Last Mountain FSR would be used to evacuate vehicles to Kelowna via the Bear Main FSR if a wildfire was coming up Powers Creek towards the resort.

While the paved access road to Crystal Resort is presently under the authority of BC Highways Dept., the Last Mountain FSR is a gazetted road. Industrial users pay the Crown a maintenance fee when using it for log hauling. The Developer should communicate annually with the Ministry of Forests office in Vernon to enquire about the scheduling of road maintenance activities to ensure the road is suitable for an alternate emergency evacuation route and not undergoing road repairs during summer months.

## APPENDIX 5           FireSmart Water Supply Guidelines:

Wildfire suppression needs substantial volumes of water from a dependable source. Since this proposed development will not have a public water system supplying fire hydrants it will be the responsibility of both the developer and the homeowner to ensure their properties are adequately protected. The minimum standards recommended in the FireSmart Manual include:

- ◆ Dig a separate well to supply fire fighting water or ensure there is an alternative power source on the household well in the event an electrical power supply is interrupted during a wildfire.
- ◆ Any fire fighting water storage systems should be equipped for forestry-type hose connections.
- ◆ Consider the addition of firefighting foam concentrates, gels and wetting agents to the water supply.

## CRYSTAL MOUNTAIN SKI RESORT EXPANSION FIRESMART GUIDELINES

### 5.1 Developer's Responsibilities.

The developer will be required to install a water reservoir. The location and capacity of the reservoir should be calculated in consultation with the local fire officials. A portable water tanker may be considered a viable alternative to a reservoir. As well as being mobile, an enclosed tank will not be depleted by evaporation

### 5.2 Homeowner's Responsibilities:

The homeowner will be required to design and install a firefighting water delivery system that will meet the requirements of the NFPA 1231 code, Standard on Water Supplies for Suburban and Rural Fire Fighting. The water supply requirements can often be relaxed in proportion to other precautions the homeowner has implemented. Strict adherence to a fire-safe building code, landscaping code and maintenance code will all contribute to a more efficient fire suppression plan.

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## **Establishment of a Volunteer Fire Department at Crystal Mountain Resort**

Crystal Mountain (the Proponent) stated numerous goals in the Crystal Mountain Ski Area Master Plan (the 'Plan') Expansion Proposal. One of these goals was the establishment of a volunteer fire department (Part IV Section 2b(iv) and 2i(xviii)).

This report will provide a framework based on the manual from the Office of the Fire Commissioner entitled, "Establishing and Operating a Fire Department" (the Manual).

## Basic Fire Department Requirements

### 1.0 Communications

Effective fire protection begins with a good communications system. The objective of the fire department will be to quickly respond to all emergency calls. This will ensure that the goal of minimizing loss of life and property due to fires from any source will be achieved on a consistent basis.

#### 1.1 Public to Fire department

Most fire alarms are transmitted and received via the telephone. The alarm should be received on a single dedicated line for fire emergencies only. The system should electronically record the time, date and contents of the call for future reference. Services can be provided 24 hours a day by utilizing an answering service during off-duty times.

Locating the scene of an emergency within the Base Area Boundary will be greatly enhanced if an area wide numbering system is used to assign a distinct number to every building. Occupants should be instructed of the significance of this number,

which should be posted near the telephone, when reporting an emergency. These numbers must be plainly posted so as to be visible from the road.

#### 1.2 Fire department to volunteers

There must be a reliable method of alerting and dispatching the volunteers and fire fighting equipment. Personal pagers are a reliable means of contacting the volunteers. The dispatch centre will need to obtain a radio frequency from

## Crystal Mountain Resort Volunteer Fire Department

Industry Canada in order for fire fighters to talk to each other and equipment operators once at a scene. Every mobile equipment operator and fire officer should be issued a hand-held portable radio.

### 1.3 Fire department to Mutual Aid Agreement holders

Effective communications are especially vital to fire ground operations during mutual aid. A province-wide Command and Control frequency is available from the Office of the Fire Commissioner. This provides each fire department with a recognized common radio frequency that will ensure efficient and rapid placement of apparatus, assignment of responsibilities and regular status updates.

### 1.4 Fire department to other agencies (eg. MOF, RDCO)

While communication with the governing agency will be important, the emphasis here will be communication during emergency situations. Wildfires may require co-operation with the Ministry of Forests Protection division fire fighting crews under two scenarios. When a wildfire within the Controlled Recreation Area (CRA) boundary prompts the local government to request assistance from the Forest Service and when the Forest Service asks for assistance for fighting wildfires adjacent to the CRA. The portable radios carried by the senior volunteer fire department officers must be programmed with the Forest Service frequencies to coordinate the efficient deployment of manpower and equipment resources.

## 2.0 Emergency Core Services

The Master Plan Proposal makes a commitment to organize a volunteer fire department commensurate with the growth of the proposed development. As such, the emergency services offered initially can be expected to grow as the resort development progresses. For example, the Sun Peaks Fire and Rescue department just recently purchased a \$145,000 vehicle capable of providing efficient first responder services to motor vehicle accidents, medical emergencies and bush fires. The volunteers are ecstatic as now they don't have to drive their personal vehicles to the scene of an emergency and are not jeopardizing their safety driving to night-time calls.

### 2.1 Fire fighting equipment and apparatus

An entire section of the Manual is devoted to the purchase of fire apparatus. Traditional fire apparatus includes, the triple combination engine, the ladder truck, aerial devices, mini pumpers for initial attack, the tender, and an auxiliary truck for rescue and specialized services. Standards for the minimum requirements of fire fighting apparatus have been developed by the Underwriters' Laboratories of Canada (ULC).

While an engine and a tender are recommended for a new rural fire department that doesn't have a water distribution system, consideration should be given to the topography of the resort when designing the purchase tenders. Steep grades in excess of 6% will require vehicles with more horsepower and improved braking systems, which will be more expensive. The standards are designed for apparatus operating below 600m above sea level (ASL). The resort village is situated at an elevation of 1173 metres. Compounding the apparatus requirements is the

## Crystal Mountain Resort Volunteer Fire Department

proposal to develop chalets in a natural setting and minimize the width of road right of ways. This may require highly maneuverable apparatus, which may limit the options available and increase capital costs.

The implementation of FireSmart building codes and the installation of sprinkler systems as proposed in the Master Plan will undoubtedly have a significant impact on the size of apparatus ultimately required for the ski resort.

Appendix 5 of the Manual specifies the minimum equipment required for mobile water tenders and engines.

### 2.2 Training requirements

The National Fire Protection Association (NFPA) has developed standards for fire service training which have been adopted throughout British Columbia. The training program should be designed with the actual fire problems expected in the resort area in mind. The International Fire Service Training Association (IFSTA) at Oklahoma State University has developed a manual specifically for volunteer fire departments.

As the resort is developed, the pool of volunteers will likely increase as full-time residents relocate to the resort. The initial recruitment will be restricted to ski resort and golf course personnel. Due to the seasonal nature of these activities, there should not be a deficit of volunteers, although a Mutual Aid Agreement may provide more stability of trained and experienced fire fighters.

### 2.3 Design of Fire Station

The Manual dedicates an entire section to the locating and design of the fire station. The site should be level and provide for entry through at least one rear door that permits drive through traffic in the apparatus room. A functional design will centre around the apparatus room. A single truck station should be at least 25 ft. wide, whereas a multi-truck station will need at least 20 ft per truck. The Manual recommends situating the station on a secondary road, away from heavily traveled roads or one-way streets.

### 2.4 Financial budgeting

The Master Plan proposes three fire service models, namely, contracting to the Glenrosa fire department, amalgamating the resort into the Regional District of the Central Okanagan, or creating an independent Mountain Resort Improvement District. In each case, taxation of commercial and residential occupants is the preferred method of funding the fire services. The level of fire services provided will be determined by the risk that the taxpayers are willing to assume personally. A Community Fire Protection Master Plan will be useful for identifying when specific resources will be required as the resort progresses through each development stage.

### 2.5 First Responder Program

As the resort develops into a community, the need for an emergency medical response team may emerge. The Sun Peaks Improvement District recently ordered a custom designed vehicle that provides motor vehicle accident coverage, thus reducing the demand on limited highway rescue services from Kamloops. With the increased destination traffic over the Coquihalla Connector, the time

## Crystal Mountain Resort Volunteer Fire Department

may come when a First Responder vehicle will be considered a valuable asset at Crystal Mountain Resort. With FireSmart building codes and reduced risk of wildfires, this type of program may become a priority for the volunteer fire department. The ski patrol staff may already have much of the specialized training required, only requiring the specialized equipment.

### 2.6 Staffing

#### 2.6.1 Risk management

The Workers' Compensation Board has standards for the personal protective equipment required for fire fighters under Part 31 of the Occupational Health and Safety Regulations. The Fire Chief will be responsible for full compliance with these regulations.

Life and disability insurance should be offered for volunteers.

#### 2.6.2 Compensation

The trend in the industry has been for volunteers to be "paid on call". Sun Peaks resort pays their semi-volunteers \$15 per call out. This compensates them for wear and tear on their personal clothing and vehicles. It also enables them to collect WCB if they are injured while on call and cannot perform their regular occupational duties.

### 3.0 Organization

In order to be classified as "recognized", a fire department should operate as an agency under a local government. The Provincial Government has endorsed the creation of a Mountain Resort Improvement District, although the Proponents prefer to be associated with the Regional District of the Central Okanagan (RDCO).

3.1 RDCO, establish under Local Government Act, Part 24

3.2 Improvement District, Local Government Act, Part 23

3.3 Features and benefits of each option

Crystal Mountain is currently pursuing an application to the Regional District of the Central Okanagan for an Official Community Plan to cover the Community Plan Area (the Village) which will allow for the necessary rezoning (Part IV Section 2d).

### 4.0 Water Supply

The definition of a "recognized" fire department, requires there to be an adequate water supply for fire suppression purposes.

#### 4.1 Source

Water can be supplied from natural sources, such as ponds, lakes, rivers and streams, or from man-made structures like fire hydrants, cisterns, reservoirs, tenders, and tanks.

#### 4.2 Reliability

Natural water sources should be studied during dry periods and cold weather to determine their reliability.

## Crystal Mountain Resort Volunteer Fire Department

### 4.3 Water tenders

Methods of refilling a tanker should be confirmed. Accessibility may change during the seasons. Pumps and large diameter hoses may be required to relay water from nearby sources.

A legal Mutual Aid Agreements should be entered into with Glenrosa.

## 5.0 Resort Population

The local fire risk is partly dependent upon the people using the resort facilities. The Master Plan Part IV Section 2f(viii) anticipates that about 30 staff members will be residents and there will be approximately 3890 beds for visitors, with a bed unit occupancy average in the 40% to 50% range, according to industry standards. While it is impractical to expect anyone to accurately determine the servicing needs of this number of people, recent trends show that it is largely the Baby-boomer generation that is purchasing resort properties in BC. It is therefore possible that a number of the vacation homes may be used by permanent or seasonal residents as they reach retirement. Retirees will typically progress through three stages of retirement. The first stage is when they are healthy and relatively active. The second phase will see them becoming more home-bodies. The final stage is when they will require daily living assistance. This potential demographic shift will require careful monitoring by the Fire Chief and local government administrators.

### 5.1 Initial development (Phase I Stage 1 & 2)

Assuming that all the single family chalets, townhouses and condominiums planned in the two stages of Phase 1, as projected in Table IV-7 of the Master Plan, are habituated in the first five years, then there could potentially be 220 units built, housing a maximum of 440 people, depending on occupancy. An additional 50 units of First Nations condos and chalets and bed and breakfast retreats would contribute another 100 residents. Refer to TABLE 1 below for an itemized summary of projected resident population growth.

### 5.2 5 – 10 years development (Phase II)

An additional 190 people may appear at the completion of the second phase of development. The population could be at 730 by the end of Phase II.

### 5.3 100% Build-out (Phase III)

By the end of the last phase, in about 20 years, there could be 959 permanent or part-time occupants of the residential units.

TABLE 1 PROJECTED RESIDENT POPULATION GROWTH BY PHASE

PHASE	B & B	CONDO	TOWNHOUSE	CHALET	FIRST NATIONS		OCCUPANTS
					CONDO	CHALET	
1 -1	0	0	65	42	25	0	264
1 – 2	3	55	0	58	0	22	276
2	3	0	74	113	0	0	190

Crystal Mountain Resort Volunteer Fire Department

3	2	80	0	147	0	0	229
TOTAL BEDS	8	135	139	360	25	22	959

5.4 Seasonal fluctuations

The incidence of fires and emergencies can be expected to have some kind of relationship to the number of people on site. So the needs of a volunteer fire department should be assessed based on full capacity. Seasonal fluctuations will impact not only the availability of volunteers but also the frequency of occurrences.

5.4.1 Residents

Without firm numbers from a census, it will be impractical to speculate on how many residents will be on site at any one time. The statistics provided in the Master Plan Proposal however, give a rough idea of the potential number of residents that should be budgeted for. Communication with the Fire Chief at other similar-sized resorts such as Sun Peaks and Silver Star is encouraged to compare their experiences during winter and summer operations.

5.4.2 Tourists

If there is 100% occupancy of all available rental bed units, TABLE 2 below shows that the level of emergency services will need to roughly double once Phase II is completed in order to keep up with the increased influx of tourists. There will be another 50% increase as Phase III nears completion. A 100% occupancy is a theoretical number. Even on peak days it is never attained. Average occupancy per bed unit is in the 40% to 50% range. Average occupancy per room is in the 50% to 60% range.

TABLE 2 PROJECTED TOURIST\* POPULATION GROWTH BY PHASE

PHASE	B & B	CONDO	TOWNHOUSE	CHALET	FIRST NATIONS		TOURISTS
	x 6	x 1	x 2	x 4	CONDO x 1	CHALET x 2	
1 -1	0	0	130	168	25	0	323
1 -2	18	55	0	232	0	44	349
2	18	0	148	452	0	0	618
3	12	80	0	588	0	0	680
TOTAL BEDS	48	135	278	1440	25	44	1970

\* The tourist numbers are derived from TABLE IV-6 in the Master Plan Proposal by subtracting two bed units from each capacity to account for two residents in each type of accommodation.

## Crystal Mountain Resort Volunteer Fire Department

Table 3 below, shows that the most significant increase in tourists will occur once the two proposed hotels are built during Phase II. There will be an additional 30% more visitors to the ski hill due to the hotels in Phase II. By the time the resort is totally built-out, there will be over 1,000 additional guests using the winter facilities.

It must be emphasized that the ratio of employees to guests will probably decrease from winter to summer activities. This will coincide with the time of year that poses the greatest risk of a wildfire occurring.

TABLE 3 PROJECTED EMPLOYEE & TOURIST POPULATION GROWTH BY PHASE PER COMMERCIAL OPERATIONS.

PHASE	HOTEL GUESTS	EMPLOYEE HOUSING		RESIDENT EMPLOYEES	TOTAL
		FIRST NATIONS	HOTEL		
1 -1	0	0	0	0	0
1 -2	0	0	0	0	0
2	400	0	0	0	400
3	200	0	0	30	230
TOTAL BEDS	600	0	0	30	630

### 5.4.3 Employees

Seasonal fluctuations of employees will have the greatest impact during the summer months, when the risk of a wildfire will be the greatest, if they are deemed to constitute the majority of the volunteers for the fire department. Also, there may be a significant difference in the degree of emergency medical training between summer and winter-time employees. Having to conduct annual training sessions twice a year for new recruits could considerably increase the operational expenses.

Table 3 shows that the greatest risk will be during the first phase of development when there will not be almost any resident employees available for evening shifts. This may be the opportune time to make arrangements with the Glenrosa fire department for paid services. The ski hill operator will not want to intentionally jeopardize the safety of their customers in the event that the ski patrol staff that are trained in emergency first aid are called off site to attend to a motor vehicle accident under the contractual terms of a Mutual Aid Agreement.

## 6.0 Fire Prevention Program

The Master Plan recognizes the importance of meeting the British Columbia Building Code and Fire Code requirements. Crystal Mountain will further reduce the probability of a wildfire entering or leaving the property by implementing the FireSmart guidelines to be prepared by a Registered Professional Forester this Summer.

### 6.1 Enforcement

## Crystal Mountain Resort Volunteer Fire Department

The Crystal Mountain will be relying on the experienced staff at the RDCO for building and occupancy permits.

### 6.2 Public Education

It is far more beneficial to prevent or reduce fires through fire safety education than to depend solely on the fire suppression capabilities of the volunteer fire department. All residents of the resort should be provided with a FireSmart booklet. Visitors should have emergency numbers provided and be familiar with their street and location.

## 7.0 Mutual Aid Agreements

Mutual aid occurs when an emergency exceeds the available resources of the department requesting the aid from one or more fire departments. Mutual aid agreements take precedence over Fire Protection Agreements.

### 7.1 Glenrosa and Westbank Fire Departments

An extension of Mutual Aid is called Automatic Aid. By enrolling with the Provincial Emergency Plan, dispatchers could send the closest available apparatus and personnel to the scene of an emergency. The responding department gets paid for their time until the home fire department arrives at the scene, when the incident would revert to a mutual aid call. There is a one hour minimum charge billed directly to the governing jurisdiction.

## 8.0 Legal

### 8.1 Fire Bylaws

The local government will need a fire bylaw before it has the authority to create a fire department at Crystal Mountain Resort. The bylaw also gives the authority for the fire department to function. Authority to enter a premise must be stipulated under the bylaw. The Fire Chief gets the authority to enforce the Standing Orders from the bylaw.

## 9.0 Funding

The local government and fire department administrators must determine how much the people receiving fire protection are willing to pay. They will also ascertain the amount of risk that the people are willing to assume, which will give the administrators direction on which services are desired. Base services should be funded through a property assessment tax. Sun Peaks fire department purchased their Mountain Rescue Vehicle with money that had been donated through a fundraising campaign.

### 9.1 Range of Services

It can be expected that the ski patrol staff will be providing the initial services during Phase 1 construction. Once the resort base area has been completely built-out and the taxation base has stabilized, the local government administrators will be able to assess the needs of the resort community and make budgets for sustainable levels of service.

## Crystal Mountain Resort Volunteer Fire Department

### 9.2 Capital budget

Budget planning should be at least five years into the future, with 10, 15 and 20 year capital expenditure projections. These budgets should be reviewed annually and revised according to current and proposed community trends.

### 9.3 Operational budget

Categories of operational budgets include administration, fire suppression, First Responder program, fire prevention program, training, support services, discretionary fund, and an equipment reserve. Some operations may initially be considered for contracting out. Maintenance, training, master planning, communications, and fee-for-fire suppression services may be more affordable initially until the tax base can support hiring these staff.

## 10.0 Land Use

The Master Plan Proposal defines the Controlled Recreation Area to encompass approximately 2900 hectares. The majority of this land will be used for the downhill ski runs and golf course. The smaller, developed area within the CRA is referred to in the Master Plan (Part IV Section 2g) as the Community Plan Area (CPA).

Within the CPA, Part IV Section 2h(iii) of the Plan describes various types of Permitted Uses for the resort. Accommodation will be available in :

- i) Residential housing ranging from high density condominiums to low density single family chalets, as well as multi-family townhouses and duplexes and
- ii) Commercial structures such as hotels and bed and breakfast establishments.

Commercial buildings will include :

- i) Restaurants and retail stores
- ii) Service areas for maintenance shops, an ambulance and the fire department station.

Open spaces will include :

- i) Downhill ski runs
- ii) Cross-country ski trails
- iii) Greenspaces and parks
- iv) Golf course

### 10.1 Resort

The fire apparatus and training of the volunteers must be matched to the commercial structures expected to be built in the resort village area. Strict adherence to the building codes will definitely alleviate some of the potential emergencies within the village area.

### 10.2 Residential

The single family chalets, townhouses, duplexes, and bed and breakfast facilities will be designed to Fire Smart standards. Landscaping will also conform to these guidelines. This too will greatly reduce the severity of loss of property or life.

## Crystal Mountain Resort Volunteer Fire Department

### 11.0 Commercial Building Design

The Master Plan (Part IV Section 2b(iv)) indicates that all structures will be designed according to the BC Building Code and Fire Code, which are provincial requirements. The Proponent has amended the Master Plan to include Fire Smart building and landscaping guidelines. The probability of a wildfire entering or leaving the CRA and Base Area will be greatly reduced once the Fire Hazard Mitigation Prescription, to be developed this Summer by a professional forester, is implemented.

#### 11.1 Fire Department Apparatus requirements

The Fire Chief and the local government administrators will be able to specify the type and size of fire apparatus and equipment required for a volunteer fire department once building permits are issued for the hotels, day lodge, retail stores, and condominiums.

### 12.0 Fire Hazard Mitigation Prescription

The Proponent has amended the Master Plan with the addition of a commitment to develop and implement a fire hazard mitigation prescription. This report is delayed temporarily until the area is free of snow and permits an assessment of existing risks by a professional forester.

#### 12.1 Fire Smart guidelines

Crystal Mountain agrees to abide by the recommendations of the fire hazard report which will incorporate the guidelines of the Fire Smart Manual.

### 13.0 Master Plan

The fire department should use a Master Plan to guide its activities. The plan should cover a period of three to five years, be continuously updated and published regularly. It should be an integral part of the budget and approved by the local governing body.

#### 13.1 Programs

One basic premise of a comprehensive fire protection plan is that it is far more beneficial to prevent or reduce fires through fire safety education and built-in fire protection features for buildings, rather than to rely entirely on the fire suppression capabilities of the fire department.

#### 13.2 Costs

Effective planning will aid the accuracy of financial forecasting and identify present service levels and future demands.

### 14.0 Operational Guideline Manual

A fire department requires a set of Operational Guidelines to provide the framework for expected performance standards of the fire department members. It is expected that liability claims will be significantly reduced if an operational guideline manual is implemented as part of the department's risk management strategy.

Areas that could be covered in an operational guideline manual include; conduct, obedience of orders, attendance, training, emergency response standards, safety

## Crystal Mountain Resort Volunteer Fire Department

procedures, personal protective equipment, dangerous goods, maintenance of equipment, fire prevention, promotional policies, and appointment of staff and officers. All personnel should be familiar with this manual.

Learning how to complete a task for the first time should never be experienced by a volunteer under stressful conditions, so practices must follow a regular regime every month.

The manual should also contain a Respiratory Protection Program, which includes a Self Contained Breathing Apparatus Program and information on introducing an Occupational Safety and Health Plan.

14.1 Further information on the Fire Department Operational Guidelines manual prepared by the Cowichan Valley Regional District is available online at [www.fcabc.bc.ca/](http://www.fcabc.bc.ca/)

## 15.0 Pre-fire Plans

Pre-fire planning is simply knowing about specific areas and buildings within Crystal Mountain's jurisdiction if a fire occurs. Premises can be stratified into groups according to their occupancy and building size.

Crystal Mountain should review NFPA 1420, Recommended Practice for Pre-Incident Planning for Warehouse Occupancies in order to look at a standard pre-fire plan. A pre-fire plan would include information about any exposure hazards, hazardous material storage, water main sizes, hydrant locations, alternate sources of water, location of utilities, street name and address. The map of the building should highlight normal and forcible entry points.

Submitted by

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