# RECOMMENDATIONS FOR WILDFIRE HAZARD REDUCTION

## FOR THE DEVELOPMENT OF Galloway Lands, Fernie, BC



## **PRIVATE AND CONFIDENTIAL**

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Development						

## **COMMONLY USED ACRONYMS**

BEC	Biogeoclimatic Ecosystem Classification
DBH	Diameter at Breast Height
FPZ	Fire Priority Zone
LCR	Live Crown Ratio
NFPA	National Fire Protection Agency
WUI	Wildland Urban Interface

## **EXECUTIVE SUMMARY**

This document intends to provide recommendations with respect to FireSmart guidelines for building compliant materials, access/egress routes, water availability/accessibility and installation of sprinkler systems for the development of Galloway Lands, Fernie. These recommendations are general and aimed to assist the developers and designers to increase the resilience of residential area to wildfire.

# Table 1. Recommendations to reduce wildfire hazard in Wildland Urban Interface for Galloway LandsDevelopment.

Item	Recommendation
Building	envelope and construction materials
<b>Objectiv</b> compliar	<b>e:</b> Reduce the vulnerability of the buildings to wildfire using FireSmart nt materials.
1	Use fire-resistant compliant materials for exterior of the buildings within WUI area.
2	Consider using non-combustible materials for buildings on the mid to upper portion of a slope. Buildings at the crest of a slope should have at least 10m setback from the crest of slope for one-storey buildings or proportionally greater, based upon their height.
3	Adjust local capacity for emergency management and efficient response to wildfire based on the number of residents.
4	Do not use any combustible material or vegetation within 1.5m around a building.
Vegetati	on and fuel management strategies
Objectiv	e: Reduce fuels within 100m FireSmart Priority Zones around the buildings
5	Remove all coniferous hedges, shrubs and surface fuels within 1.5 to 10m (FPZ1) of a building.
6	Within $10 - 30m$ around the building, reduce the stand conifer density to 500sph, reduce the fine and medium surface fuel to 2 kg/m <sup>2</sup> and promote deciduous plants. Coniferous trees should be pruned up to 2m height.
7	Within 30 – 100m of structures, promote deciduous plants, follow thin from below regime, prune coniferous trees to minimum of 2m height and maintain the fine and medium surface fuel to 0.5 kg/m <sup>2</sup> .
8	Avoid coniferous vegetation in the landscaping.
9	Landowners should regularly maintain the landscape and remove the flammable materials to maintain a low fire hazard.
Water a	nd power supply

Item	Recommendation
<b>Objectiv</b> fighters	es: Increasing the availability of water supplies and their availability to fire
10	During the development phase, ensure that reliable water supplies are available and accessible to firefighters during the fire season; and are appropriately located and spaced.
11	In areas where reliable water supply is limited, follow NFPA 1142 guidelines for minimum requirements of water supply.
12	Design the water sources / systems to be capable of supplying enough water for multiple house fire simultaneously.
Sprinkle	r systems
Objectiv	es: Application of sprinkler systems when water supply is scarce.
13	Consider the installation of sprinkler systems where the buildings do not have access to a reliable water source.
14	Between April to the end of October, the sprinkler system should be connected to a water supply (a well or cistern) and tested at the beginning of each fire season.
15	Sprinkler systems and water pumps should be connected to an independent power source in case of power outage.
Access a	nd egress
<b>Objectiv</b> accessib	r <b>es:</b> Facilitating the evacuation of the residents from the area and its ility to firefighters during wildfire.
16	Designate multiple two-way routes with ample turnarounds to provide safe evacuation route for the residents and access to the fire by firefighters during the wildfire.
17	Within a 15m road buffer, maintain crown closure at 30-40% and prune all conifer crown bases to 2m from the ground.
18	Maintain the roads and the vegetation along the roads to allow firefighting trucks and equipment to access the area.
19	Consider the volume of on-street parking cars during the evacuation at subdivision level for the access design.
20	Consider designing on-property roads to access the entire property and to be able to support firefighting equipment.
21	Design on-property roads to provide two exit routes during wildfire.
22	Within the Development area, map the existing trail, identify their use (motorized and non-motorized) and collect their attributes such as width, surface type and clearance to prioritize all the trails for their suitability as

Item	Recommendation
	surface fuelbreaks and points of access. Share this information with agencies who may find it useful for suppression or planning purposes.
23	Prune coniferous trees on the side of the trails up to 2m height and remove the understory conifers within 5m buffer.
24	Remove, burn, or scatter, based on the volume, all the debris resulting from pruning or trail maintenance to avoid the accumulation of fuel.
25	Make individual property easy to be found to reduce response time.

## 1.0 INTRODUCTION

B.A. Blackwell & Associates Ltd. (the Consultant) were retained by Spike Camp L.P. (the Client) to providerecommendations regarding five aspects of the development to reduce the risk of wildfire for the future residential development of Galloway Lands, Fernie. The aspects are:

- 1. Fire smart compliant materials used for residential buildings,
- 2. Creating defensible zones around residential buildings by reducing fuel,
- 3. Water supply and accessibility during wildfire,
- 4. Sprinkler system requirements for residential buildings, and
- 5. Emergency access/egress.

This report includes relevant information in regard to the above-mentioned aspects. This report provides general information only and is not based on a field assessment of the developing area.

#### 1.1 QUALIFICATIONS

Bruce Blackwell, MSc, RPF (#2073) has over 30 years' experience in fire and forest ecology, and fire and fuels management. Mr. Blackwell is a recognized wildfire risk analyst and planning specialist in BC and has managed numerous innovative projects related to fire risk identification and mitigation for the public and private sector on both large and small scales. Mr. Blackwell has also been on the leading edge of developing large urban forest strategies for communities in BC, Alberta, and Ontario. Ali Rahi, RPF, ISA Certified Arboriculture, has more than 10 years of experience in forestry and wildfire. Tove Pashkowski, RPF (#4740), Certified Local FireSmart Representative, with more than 15 years of experience in wildfire.

#### **1.2 SITE DESCRIPTION**

The Galloway Lands Development (Development) includes all or part of parcels with PID #s 011-359-471, 011-359-447, 011-359-404, and 011-359-323 (Figure 1). The area is approximately 185 ha and is located south of the City of Fernie, BC. The Development is designed for a maximum 75 homesites with minimum 1.0 ha lot size. The area will have 128.5 ha (70%) conservation area.

#### 1.3 DEVELOPMENT PLAN

As of the date of this report, the Development isat zoning stage with a preliminary site plan. TheDevelopment plan consists of single-family detached homes in developable polygons intermixed within the forest<sup>1</sup>This type of development scenario is at higher risk for damage from wildfire because of the isolation of the homes, proximity to the forest and the potential for evacuation and egressroutes to become blocked (Figure 1).

<sup>&</sup>lt;sup>1</sup><u>https://gallowaylands.com/</u>.Accessed February 7, 2022.

Increases in human populations along the wildfire-urban interface (WUI) or in intermix developments increase the likelihood for wildfires to spread from human-caused ignitions to the forestand for wildland fires to spread to structures, which increases the wildfire hazard to vulnerable neighbourhoods or communities. Given the proximity to high-use recreation areas / trail systems (Fernie Alpine Resort, Fernie Nordic Center, Mount Fernie Provincial Park), this area is at risk from human ignitions. One of the goals for this development is to manage the forested area under the development to reduce the existing wildfire risk for the residential and the nearby recreational structures.



Figure 1. Illustratedpictureshowing the Galloway Lands wildland urban interface.

#### **1.4 FIRE ENVIRONMENT**

The province of British Columbia uses the Biogeoclimatic Ecosystem Classification (BEC) system to characterize distinct ecological communities based on species composition and climate factors. The Development area is within the Interior Cedar Hemlock Zone moist cool variant (ICH mk4). Within this BEC

zone, July, August, and September have "very high" and "extreme" danger-class days and comprise the period of greatest concern for extreme fire behaviour. The fire season is considered to start in April and extend through October.

Fire behaviour prediction is the science and application of predicting characteristics of wildland fire suchas ignition, spread rate and intensity<sup>2</sup>. The main variables affecting wildland fire behaviour are fuels, weather and topography –characteristics that comprise the fire environment. Contributing factors to a community's exposure to wildfire danger are two attributes that cannot be modified – topography and climate – as they are fixed spatially and temporally.

The term 'fuels' encompassesvegetation and biomass structure, biomass loading, dominant species (especially for treed landscapes), and other characteristics such as forest floor characteristics and forest health issues; such as outbreaks of bark beetles or other insects that affect the flammability and availability of biomass for combustion. The fire hazard of a community is generally dictated by the proximity of fuel to developed areas. Fuels closest to the community pose a higher hazard compared to fuels at a greater distance to communities and infrastructure.

It is important to understand the likelihood of exposure to periods of high fire danger, which can vary from season to season. For a summary of the fuel types of the City of Fernie, refer to "Summary of Relevant Community Wildfire Protection Plans and Publicly Available Data" (2022) by Tove Pashkowski and "City of FernieCommunity Wildfire Protection Plan Update" (2018) by B.A. Blackwell & Associates.

<sup>&</sup>lt;sup>2</sup><u>https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/wildfire-management/fire-fuel-management/bcws\_bc\_provincial\_fuel\_type\_layer\_overview\_2015\_report.pdf</u>

#### FIRESMART STRATEGIES FOR POTENTIAL DEVELOPMENT 2.0

A variety of fuel management strategies are recommended to manage wildfire risk for development within the WUI. For home development, mitigation strategies typically focus on a "building envelope-out" approach using FireSmart standards. This focuses on protecting individual structures and managing the landscape within proximity to developments which determines the ignition potential and is referred to as the Home Ignition Zone (HIZ) (Cohen 2000 and Reinhardt et al. 2008). The HIZ includes the structure itself and fourconcentric, progressively wider Priority Zones. Priority Zones are based upon distance from the structure: 0-1.5m (Non-Combustible Zone), 0-10m (Priority Zone 1), 10-30m (Priority Zone 2), and 30-100m (Priority Zone 3). These zones help to guide risk reduction activities, with Recommended FireSmart Guidelines being most stringent closest to the structure. The likelihood of home ignition is mostly determined by the area within 30m of the structure.

Within the FireSmart Priority Zones (FPZ), mitigation measures typically involve landscaping, vegetation and fuel managementtechniques, and landscape-level fuel breaks, where the goal is to change the fire environment and limit wildfire spread. This is accomplished by reducing hazardous fuels and reducing the amount of fuel that can be burned in a wildfire event, as well as altering how a fire moves throughout the landscape.

In addition to fuel management, increasing resiliency and capacity for fire suppression is of the utmost importance. This would involve building redundancies in power supply systems, development of access/egress routes across the area, improvement to ensure access to sufficient and reliable water supply for fire suppression, and coordination with emergency services. All the homes would be considered within the WUI, as such, the recommendations apply to the entire development. These recommendations can be applied through a building scheme or covenant if the buildings would be constructed by the individual land owners.

#### 2.1 **BUILDING ENVELOPE AND CONSTRUCTION MATERIALS**

The following recommendations should be taken as general guidelines based on the FireSmart standards. A qualified professional should be consulted during the construction to take into account the local characteristics such as topography and forest types for each building.

Multiple studies have shown that the principal factors regarding home loss to wildfire are the structure's characteristics and immediate surroundings. Recommended FireSmart guidelines address a multitude of hazard factors within the HIZ: building materials and design. Examples of compliant materials that can be used for exterior of the buildings are provided in Appendix A – FireSmart Compliant Materials.

Recommendation #1: Use fire-resistant compliant materials for exterior of the buildings within WUI area.

In Spring 2015, the Province passed the *Building Act* as the new legislation to guide building and construction in BC. This Act establishes the province as the sole authority to set building requirements and limits local government authority to set building requirements in their bylaws. The *British Columbia Building Code* does not have any wildfire-specific fire-resistant design components. Until revisions of the Building Code to include requirements specific to prevention of wildfire spread are completed, private developments can build to a higher standard and / or set exterior requirements for wildfire risk mitigation through a building schemes, covenants or guidelines registered on title.

Slope of the groundaffects fire behaviorand the rate of spread. Fire will burn morerapidly uphill than on a flat surface. It is important to consider the location of the building on the slope.Convective heat and firebrands from burningfuels on the slope below the building can readilyignite buildings located on the mid to upperportion or crest of a hill and therefore structures located on a slope must featureentirely non-combustible exteriors and FireSmartdesign principles. Structures located at the crest of ahill can be protected somewhat by setbackprovisions. A single-story building should be setback 10m from the crest of the slope. Taller buildings will need proportionately greatersetback distances.<sup>3</sup>

**Recommendation #2:** Consider using non-combustible materials for buildings on the mid to upper portion of a slope. Buildings at the crest of a slope should have at least 10m setback from the crest of slope for one-storey buildings or proportionally greater, based upon their height.

<sup>&</sup>lt;sup>3</sup><u>https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/for-industry-commercial-operators/hazard-assessment-abatement</u>

#### Increasing Local Capacity

Local capacity for emergency management and efficient response to wildland urban interface fires can be enhanced by addressing the following steps:

- Development and/or maintenance of Structural Protection Units (SPUs)<sup>4</sup> which can be deployed in the event of a WUI fire (e.g., sprinkler systems, Section 2.4);
- Conducting a comprehensive review of Emergency Management BC SPU deployment procedures for the purpose of fighting interface fires;
- Provision of sprinkler kits to community residents (Section 0); and
- Engagement in annual cross-training exercises with adjacent fire departments and/or BCWS in order to increase both local and regional emergency preparedness with regards to structural fire and wildfire training.

**Recommendation #3:** Adjust local capacity for emergency management and efficient response to wildfire based on the number of residents.

#### 2.2 VEGETATION AND FUEL MANAGEMENT STRATEGIES

Fuel treatments for wildfire hazard mitigation are recommended for a 100m buffer around structures and a 50m buffer around access / egress routeswhen potential developments are adjacent to a high hazard fuel type. Fuel treatments around structures follow FireSmart standards and are subdivided into the FPZs of 0-1.5m 1.5-10m, 10-30m, and 30-100m zones (Figure 2). Within these zones, the recommendations are to reduce the potential fire hazard by treating flammable vegetation and/or fuels in close proximity to the planned development. The execution of these recommendations will reduce the likelihood of fire spread. The guidelines for each FPZ are provided below, but recommendations for each property may vary from what is listed here depending on the site context. All forest management decisions should be made by a qualified professional forester.

The following management strategies in FireSmart zones and associated recommendations can be applied through a building scheme or covenant if the properties would be managed by the individual land owners. Site-specific deviations from these guidelines may be appropriate and can be determined by a qualified professional.

The *Non-Combustible Zone* is a 1.5m combustible-free zone around the structure. This zone should be free of any vegetation and flammable materials such as bark mulch. This zone should only include non-flammable landscaping materials such as gravel, brick, or concrete, and must be cleaned regularly to

<sup>&</sup>lt;sup>4</sup>A structure protection unit (SPU) is a cache of equipment stored in a trailer that is used by trained structure protection specialists to set up sprinklers on and around a structure. SPUs can be effective in reducing wildfire threats to some types of buildings, such as houses, cabins, barns or other outbuildings.

https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-response/structural-protectionprogram#:~:text=A%20structure%20protection%20unit%20(SPU,cabins%2C%20barns%20or%20other%20outbuildings.

prevent accumulation of leaf litter or other combustible materials. Items such as construction materials, propane tanks, firewood, and combustible furniture should not be stored here.

**Recommendation #4:** Do not use any combustible material or vegetation within 1.5m around a building.

*Priority Zone 1 (FPZ 1)* is a 10m fuel free zone around structures whichincludes removal of most coniferous vegetation and removal of surface fuels and woody debris from the 10m zone. This ensures that direct flame contact with the building cannot occur, and reduces the potential for radiative heat to ignite the building (Partners in Protection, 2003).<sup>5</sup> Combustible materials such as firewood or lumber should not be stored in this zone. Coniferous vegetation is highly flammable and must not be planted in this zone. Mature coniferous trees can be retained if they are at least5m from buildings, and spaced 3m from other coniferous vegetation.

**Recommendation #5:** Remove all coniferous hedges, shrubs and surface fuels within 1.5 to 10m (FPZ1) of a building.

*Priority Zone 2 (FPZ 2)* extends from 10m to 30m from the structure and thegeneral guidelines for fuel management includes the reduction of stand conifer density to 500 stems per ha (sph) and the reduction of surface fine and medium coarse woody debris to less than 0.5kg/m<sup>2</sup>. In this zone, deciduous species should be favoured over coniferous vegetation as deciduous trees have much lower volatility. Coniferous trees can be planted so long as there will be a minimum of 3m of spacing between their mature crowns and that a 5 m distance between the crown to the building roof is able to be maintained (i.e., mature tree size, crown, and height are considered in plantings). Coniferous trees should be crown raised (pruned) to at least 2m from the ground in order to reduce ladder fuels. Ladder fuels provide a pathway for a ground fire to move into the crown of the tree. Any downed wood or other flammable material should also be cleaned up in this zone to reduce the likelihood of fire moving along the ground.

**Recommendation #6:** Within 10 - 30m around the building, reduce the stand conifer density to 500sph, reduce the fine and medium surface fuel to 2 kg/m<sup>2</sup> and promote deciduous plants. Coniferous trees should be pruned up to 2m height.

*Priority Zone 3 (FPZ 3)* extends from 30m to 100m from the structure deciduous trees should be preferred for retention or planting. Fuel treatments in this zone would follow a "thin from below" silviculture regime, in which small trees are thinned in the understory and surface fuels are removed, and tree crowns are pruned to create space between the forest floor and tree canopies. This consists of the thinning of trees <15cm diameter-at-breast height (DBH), pruning the lower limbs of trees greater than 15cm DBH to a minimum height of 2m above the ground surface, and the removal of fine surface woody

<sup>&</sup>lt;sup>5</sup>https://www.firesmartcanada.ca/wp-content/uploads/2022/01/FireSmart-Protecting-Your-Community.pdf

debris (twigs, branches <12.5 cm DBH) toless than 2 kg/m<sup>2</sup>. Tree crown base height should generally be separated by at least 2m to prevent the initiation of crown fire. These principles are particularly important in sloped areas and along road sides.

**Recommendation #7:** Within 30 - 100m of structures, promote deciduous plants, follow thin from below regime, prune coniferous trees to minimum of 2m height and maintain the fine and medium surface fuel to  $0.5 \text{ kg/m}^2$ .





#### 2.2.1 DEFENSIBLE SPACE

By following FireSmart principles within the Non-Combustible Zone and FPZ 1, property owners can create what is called 'Defensible Space' around their home. Defensible space is a buffer created between a structure and any wildland/flammable vegetation nearby that allows for the following: slowing or stopping the spread of wildfire, reducing the likelihood of the structure catching fire, and providing a safe space for firefighters to work should there be a fire on or near the property<sup>6</sup>. In the event of a wildfire, firefighters may have to choose which houses they do or do not act on. Homes with defensible space are

<sup>&</sup>lt;sup>6</sup> Cal Fire, Defensible Space: <u>https://www.fire.ca.gov/programs/communications/defensible-space-prc-4291/</u>

safer for firefighters to work at and are more likely to survive a fire, and may be prioritized over homes without defensible space as a result.

#### 2.2.2 LANDSCAPING

It is recommended that all landscaping within the development is designed and executed compliant to the FireSmart BC Landscaping Guide.<sup>7</sup>

#### FireSmart Landscaping

Landscaping choices within the FPZ 1 zone (1.5 - 10m from the building) should be limited to plant species with low flammability. Coniferous vegetation such as juniper, cypress, yew, and cedar should not be planted within this zone, as these species are considered highly flammable under extreme fire hazard conditions.



Figure 3. Examples of common coniferous vegetation planted within the urban landscape.

In addition to choosing species with low flammability, other factors such as sun exposure, hardiness zone, available space, water usage, and ease of maintenance should also be considered in the landscaping design and plans.

It is best to discuss options with a professional landscaper, looking together for plants that suit the aesthetics of the landscape design, are suitable for the climate and site, and are fire resistant. Plants that are fire resistant generally have the following characteristics:

• Foliage with high moisture content (moist and supple),

<sup>&</sup>lt;sup>7</sup>https://firesmartbc.ca/resource/landscaping-guide/

- Little dead wood and do not tend to accumulate dry and dead foliage or woody materials, and
- Sap that is water-like and without a strong odour.

The FireSmart BC Landscaping Guide is a great resource with a fairly comprehensive plant list by hardiness zone. For further assistance in creating a FireSmart landscape, refer to the FireSmart Guide to Landscaping at <a href="https://firesmartbc.ca/wp-content/uploads/2021/04/FireSmartBC\_LandscapingGuide\_Web\_v2.pdf">https://firesmartbc.ca/wp-content/uploads/2021/04/FireSmartBC\_LandscapingGuide\_Web\_v2.pdf</a> Other helpful tips for finding fire resistant landscaping options can be found at: <a href="http://www.firefree.org/wp-content/uploads/2016/02/Fire-Resistant-Plants.pdf">http://www.firefree.org/wp-content/uploads/2021/04/FireSmartBC\_LandscapingGuide\_Web\_v2.pdf</a>

Recommendation #8: Avoid coniferous vegetation in the landscaping.

#### Maintenance of property in low fire hazard state

To ensure that a low fire hazard rating is maintained, landscaping should be properly maintained in low hazard conditions. This may require periodic maintenance including crown raising and/or reduction of trees (thinning). Crowns of coniferous trees should be kept a minimum of 2m from the ground or 5m from structures. All pruning should be completed by an ISA Certified Arborist to meet industry standards. The roof and gutters should be kept clean of debris to reduce the potential for spotting to ignite these materials during a wildfire event. Coniferous foliage should not be allowed to accumulate in gutters.

Grass, shrubs, and herbsshould be maintained in a state that reduces fire hazard by maintaining foliar moisture content. This can be accomplished by:

- Choosing plant species that are well-adapted to the site (microclimate and soil conditions of the parcel),
- Incorporating a landscape design where shrubs, herbs, and grasses are planted in discrete units manageable by hand watering, and/or
- Installing irrigation.

It should be recognized that relying on irrigation to maintain landscaping in a healthy state is limiting and may actually increase the fire hazard on the parcel, particularly in times of drought and watering restrictions. Lack of irrigation in times of watering restrictions may create a landscape that is unhealthy and unsightly, as well as dead, dry, and highly flammable.

Dead material should be removed annually. Placement of combustible materials such as firewood or wooden structures (sheds, storage, or other outbuildings) must be a minimum of 10m from the primary building (including neighbouring houses). Any unused firewood that is moved closer to the structure for easy access during the winter season should be removed outside PFZ1 for the fire season. This will limit the potential for these materials to be ignited and spread fire to an adjacent building.

<sup>&</sup>lt;sup>8</sup>A Pacific Northwest Extension Publication: Oregon State University, Washington State University, University of Idaho. August 2006.

**Recommendation #9:** Landowners should regularly maintain the landscape and remove the flammable materials to maintain a low fire hazard.

#### 2.3 WATER AND POWER SUPPLY

Reliable water supply is classified as available when a water source is present and usable during the entire fire season and accessible by firefighters and capable of sustaining water supply during peak demand interface fire events with power outage. High-volume community wells or irrigation systems can be considered available if they are accessible for quick hookup by firefighters. Residential wells and seasonal creeks should not be considered to be reliable water supply, as defined above.

**Recommendation #10:** During the development phase, ensure that reliable water supplies are available and accessible to firefighters during the fire season; and are appropriately located and spaced.

In areas where hydrants are limited or unavailable (or it is otherwise determined that adequate or reliable water supply systems may not exist), the NFPA 1142 (*Standard on Water Supplies for Suburban and Rural Firefighting*)<sup>9</sup>can be used to determine minimum requirements for alternative water supply (natural or artificial). Alternative water sources, such as dry hydrant systems, water usage agreements for accessing water on private land, private wells or cisterns should be reviewed by the planners and the fire department during subdivision phase. Water infrastructure for firefighting (the hydrant network) must be capable to deliver water to multiple house fires (minimum of four and up to six) simultaneously with enough pressure and capacity. Failure to do so has shown to cause serious implications during a multiple-ignition wildfire event.

**Recommendation #11:** In areas where reliable water supply is limited, follow NFPA 1142 guidelines for minimum requirements of water supply.

**Recommendation #12:** Design the water sources / systems to be capable of supplying enough water for multiple house fire simultaneously.

Higher standards for hydro infrastructure also need to be considered. Given the proximity to the forest, traditional electrical infrastructure delivering power to homes with above-ground wood pole lines can potentially cause electrical wildfire ignitions. Power outages can also occur during wildfire. Serious consideration should be given to installing power infrastructure underground within this development.

<sup>&</sup>lt;sup>9</sup><u>https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1142</u>

#### 2.4 SPRINKLER SYSTEMS

In high-hazard forested areawhere buildings do not access to a reliable source of pressurized water or a nearby hydrant, exterior rooftop sprinklers with a coverage to thoroughly wet down FPZ 1 are recommended (Appendix B). Sprinkler systems must include robust sprinkler components (such as Rainbird) with limited plastic materials. Two approaches can be used for sprinkler systems, roof mounted sprinklers on portable mounts or sprinklers incorporated in the roof (Figure 4). In cases where a building relies totally on its own water system, the sprinkler system must be permanent and incorporated into the roof structure. Between April to the end of October, sprinklers must be connected to a water supply (a well or cistern) and tested at the beginning of each fire season. The external sprinkler system must be independent of the internal system to allow for manual use during a wildfire. Also, an operational switch that is accessible from outside would assist firefighters to operate the sprinkler from outside of the building should the homeowner or resident be seasonal or evacuated from the premises.

**Recommendation #13:** Consider the installation of sprinkler systems where the buildings do not have access to a reliable water source.

**Recommendation #14:** Between April to the end of October, the sprinkler system should be connected to a water supply (a well or cistern) and tested at the beginning of each fire season.





Figure 4. Examples of rooftop mounted sprinkler systems: portable (L) and fixed (R).

In the event of a house fire, sprinklers should be turned on (if safe to do so) a minimum of two hours before the fire reaches the residence to wet the roof and adjacent forested vegetation. The use of sprinklers also raises the relative humidity around the residence. This will help reduce fire behaviour adjacent to the home by making fuels less flammable and reduce the probability of spotting igniting adjacent vegetation or structures.

Power supply to the property is vulnerable to disruption during a wildfire which has implications for water supply. To ensure that water supply for fire suppression is available, a designated water source for use during a fire and a system capable of operating sprinklers and water pumps (the water source is the well) during power loss is mandatory.

**Recommendation #15:** Sprinkler systems and water pumps should be connected to an independent power source in case of power outage.

Water storage cisternscan be used as a water source during an emergency. Where gravity systems cannot deliver sufficient pressure to ensure adequate sprinkler coverage, a pump with an independent power source such as a generator must be connected to the rooftop sprinkler system and the water supply. For more details, refer to "*BC Design Guideline and Construction Standards 2019*"<sup>10</sup>

## 2.5 ROAD NETWORK

The development area is situated west of Highway 3 which heads towards east to Alberta border and west via Highway 93. The City of Fernie is served by the Elk Valley / South Country Subregion Evacuation Plan (2008).<sup>11</sup>The City is in the process of developing a City of Fernie evacuation plan and core emergency response plan.

Road networks in a community serve three functions during a wildfire<sup>12</sup>:

- 1- As access routes for emergency responders and their vehicles and equipment. Access routes should be robust enough to cope with large, heavy equipment and vehicles (e.g., 20 tonne firetrucks),
- 2- As escape (or egress) routes for residents, and
- 3- As firebreaks to interrupt or slow the progress of the fire and assist firefighting efforts.

Access and evacuation during a wildfire emergency often must happen simultaneously and road networks should have the capacity to handle both. If wildfire were to block Highway 3 in either direction, evacuation of several communities would be severely limited. Smoke and poor visibility can further complicate

<sup>&</sup>lt;sup>10</sup>https://www.bchousing.org/partner-services/asset-management-redevelopment/construction-standards

<sup>&</sup>lt;sup>11</sup>https://fernie.civicweb.net/document/14493

<sup>&</sup>lt;sup>12</sup>https://nrc-publications.canada.ca/eng/view/ft/?id=3a0b337f-f980-418f-8ad8-6045d1abc3b3

evacuations and hinder safe passage. There is an opportunity for the Galloway Lands Development to design and construct appropriate access and egress for all area under development.

#### 2.5.1 ACCESS AND EGRESS

The Development should designate multiple two-way access points to ensure an appropriate evacuation of all residents and access to the fire by the firefighters. Based on geotechnical and civil engineering feasibility studies by qualified professionals, access roads and evacuation points should be designed based on the number of proposed homes and the number of people that will live in the proposed neighborhoods. Wildfires in Fort McMurray and Williams Lake have highlighted the requirement for orderly and safe evacuation during a wildfire event, and the difficulties of conducting these evacuations during extreme wildfire events. Communities need to develop better neighbourhood plans for evacuation and egress during wildfire events. Alternative routes must be provided by planning for access and egress at two different points within the development sites. Access routes must lead to major arterials (i.e., Highway 3). All access roads should be capable of supporting two-way traffic. Additionally, roads need to have capacity for providing emergency services with ample turnaround space so that the fire truck and equipment can move during the evacuation without road blocks.

**Recommendation #16:** Designate multiple two-way routes with ample turnarounds to provide safe evacuation route for the residents and access to the fire by firefighters during the wildfire.

Within the road buffer's FireSmart zones (15m from the centerline of the road), crown closure should be between 30-40% and crown base heights of trees should be 2m off the ground, with tree crown spacing of at least 2m.

**Recommendation #17:** Within a 15m road buffer, maintain crown closure at 30-40% and prune all conifer crown bases to 2m from the ground.

Vegetation along the roads outside the FireSmart Zonesand the grading of the roads should also be maintained to a degree that allow firefighting trucks and equipment to access the area. The maintenance should follow the following criteria:

- Create a fuelbreak that extends 3m from the centerline of a roadway with substantially reduced ground cover adjacent to the road;
- Provide a minimum vertical clearance of 4m in the driving area to create an unobstructed view for firefighters;
- Provide a minimum horizontal clearing distance of 3.6m in the driving area;
- Thin and prune trees and shrubs adjacent to the road;

- Maintain the grading of the roads periodically to keep the surface in good shape, particularly when used heavily;
- Drainage structures such as water bars, ditches, and culverts should be regularly inspected to be sure they are clear of obstacles and able to function effectively and prevent substantial damage to the road when water flows;
- Road cut-banks may need to be seeded with grass or other vegetation to stabilize the soil, prevent damage to the road from erosion, and minimize movement of sediment into nearby streams. Also, clear downed logs and other obstacles from the roadway and brush from the edges of the road.

**Recommendation #18:** Maintain the roads and the vegetation along the roads to allow firefighting trucks and equipment to access the area.

#### Subdivision Design

On-street parking can contribute to fire hazards on narrow or dead-end roads, which are already unlikely to have a high capacity for vehicle traffic under heavy smoke conditions (Cova 2005). When the time for evacuation is limited, poor access has contributed to deaths associated with entrapments and vehicle collisions during wildfires (De Ronde 2005). Methods for access design at the subdivision level can provide tools that help manage the volume of the cars that need to egress an area within a given period of time and take into account the space that the parked cars may take during the evacuation. These factors should be considered during the development.

**Recommendation #19:** Consider the volume of on-street parking cars during the evacuation at subdivision level for the access design.

#### 2.5.2 ON-PROPERTY ROADS

On-property access roads play important role for evacuation and access of fire trucks to the buildings on the property<sup>13</sup>. Each property should consider, according to the feasibility, to have an appropriate road system that allow the occupants to escape during fire. These roads may also access to all parts of the property and be capable of supporting the firefighting equipment. These criteria can be designed and constructed during the development phase and maintained at good conditions by the landowners. It is also recommended that there are at least two exit roads in case when one road is impassable during fire.

**Recommendation #20:** Consider designing on-property roads to access the entire property and to be able to support firefighting equipment.

<sup>&</sup>lt;sup>13</sup><u>https://catalog.extension.oregonstate.edu/sites/catalog/files/project/supplemental/pnw618/pnw618-chapter5.pdf</u>

**Recommendation #21:** Design on-property roads to provide two exit routes during wildfire.

#### 2.5.3 TRAIL MANAGEMENT

The Development area includes a network of trails. These trails should be mapped and their use (motorized and non-motorized) be identified based on the direction provided by the City trail management in the Fernie Trail Master Plan (2015).<sup>14</sup>It should be recognized that trails can act as effective fuelbreaks for surface fires and, depending on width, clearance, and surfacing, can provide access for equipment and control lines for suppression efforts. Comprehensive mapping of the trail system could include attributes which could also serve for suppression planning purposes, including attributes such as width, surface type, and clearance which could be used to determine accessibility and utility as a surface fire fuel break. Additionally, comprehensive mapping could be useful in the event of trail closures or evacuations in a wildfire event. This information should be available to relevant agencies who may find it useful for suppression or planning purposes (e.g., BCWS, City of Fernie, or RDEK).

**Recommendation #22:** Within the Development area, map the existing trail, identify their use (motorized and non-motorized) and collect their attributes such as width, surface type and clearance to prioritize all the trails for their suitability as surface fuelbreaks and points of access. Share this information with agencies who may find it useful for suppression or planning purposes.

To reduce the chance of fire spread upon ignition and to act as a fuelbreak for surface fires, trail side conifers should be crown raised (pruned) to a minimum of 2 m from the ground, and higher on slopes. Thinning activities (removal of flammable understory and intermediate conifer ladder fuels) should be undertaken on 5 m of either side of the trail centreline. Furthermore, it is neither feasible, nor desirable to convert all trails into surface fuelbreaks and/ or make them accessible by ATVs or other motorized equipment. Trails should be reviewed and prioritized for their suitability to act as surface fuelbreaks and points of access based on their location, use, and current accessibility. It is recommended to engage other trail stakeholders or planners during trail planning.

**Recommendation #23:** Prune coniferous trees on the side of the trails up to 2m height and remove the understory conifers within 5m buffer.

It is important to note that trail building and maintenance should not result in residual fuels and an increase of the fire hazard, especially in very high-use areas where ignition potential is higher. Minor work (pruning or individual tree falling) can usually be mitigated by scattering fuels in a discontinuous manner at a distance of more than 5 m from the trail. Larger volumes of biomass resulting from larger thinning, pruning, or trail building operations should be burned or removed off-site. Small amounts of biomass may

<sup>&</sup>lt;sup>14</sup><u>https://www.fernie.ca/EN/meta/whats-new/news-archives/2015-archive/fernie-trails-master-plan.html</u>

be chipped and spread, but moderate to large accumulations should be burned or removed due to chipping impacts on fuel loading and potential ecological impacts. Fuels, if left to accumulate from trail work, can significantly increase the chance of ignition and increase the potential fire behaviour should an ignition occur, such as from an errant cigarette butt or other human-caused ignition.

**Recommendation #24:** Remove, burn, or scatter, based on the volume, all the debris resulting from pruning or trail maintenance to avoid the accumulation of fuel.

#### 2.5.4 INDIVIDUAL PROPERTY ACCESS

The response time from firefighters to a property is crucial to stop the spread of fire from a building to the forested area. To reduce the response time, make individual properties easy to locate by:

- Using local standard signage
- Post road names on noncombustible stanchions
- Post the building number using materials visible day or night at the beginning of the driveway
- Avoid any duplication of road names (i.e., Fernie Drive and Fernie Way)
- Post road restriction signs such as dead-ends and weight and height limitations
- Provide firefighters with access key to the gate to the property and all points of access

Recommendation #25: Make individual property easy to be found to reduce response time.

## 2.6 CRITICAL INFRASTRUCTURE

The FireSmart Critical Infrastructure (CI) Guide<sup>15</sup> is intended to reduce the vulnerability of essential systems, facilities, technologies, networks, assets and services. It includes five separate sections:

- A- Building
- B- Structure
- C- Non-combustible Zone
- D- Zone 1
- E- Zone 2

Depending on the features of the CI, the Building Section or Structure section may not be applicable; or they may be both applicable. The Non-Combustible Zone, Zone 1 and Zone 2 will apply for all CI assessments.

<sup>15</sup><u>https://firesmartbc.ca/wp-</u>

content/uploads/2020/09/FireSmartBC\_FireSmartCriticalInfrastructureGuideFINAL.pdf

## 3.0 LIMITATIONS

This report was prepared by B.A. Blackwell and Associates Ltd. for Galloway Lands Development, and its contents reflect the best available information and are not based any field assessment. Any use that a third party makes from this report, or any reliance on or decisions made based upon this report, are made at the sole risk of any such third parties. B.A. Blackwell and Associates Ltd. accepts no responsibility for any damages or loss suffered by any third party or by the Client as a result of decisions made or actions based upon the use or reliance of this report by any such party.

Although every effort has been made to ensure that these recommendationsare reasonably accurate, awildfire threat assessment should be conducted to understand the forest covers, fuel types, forest health and topography in the area and the distance of the properties to high-risk fuel types. Periodically reevaluation should also be conducted to gain an understanding of changing forest conditions and the impact of human-caused changes (such as development) potentially impacting forest health and forest stand structure, which in turn affect fire behaviour patterns.

Notwithstanding the recommendations made in this report, B.A. Blackwell and Associates Ltd. accepts no responsibility for the implementation of all or any part of the planned mitigation treatments as outlined in this report. Acceptance of this report and implementation of potential development in no way implies any inspection or supervisory role on the part of B.A. Blackwell and Associates.

This report has **29** pages and shall be considered as a whole; no sections are severable, and the report shall be considered incomplete if any pages are missing. The original report has coloured illustrations. If the reader has a black and white copy the report shall be considered incomplete and any interpretation of the report may be incorrect in the absence of a full colour copy. B.A. Blackwell and Associates Ltd. accepts no responsibility for any such misinterpretations.

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## **APPENDIX A – FIRESMART COMPLIANT MATERIALS**

#### Table 2. Compliant materials for residential buildings and critical infrastructures.

Building Part	Homes	Critical infrastructures	Comments
Roof	Class A or B fire resistance as defined in the current BC Building Code in accordance with ASTM E 108, or equivalent.	Class A UL/ASTM fire rated with no gap or opening.	Examples: asphalt shingles or torch-on asphalt, metal, slate, and clay tile. Wood shake and shingle roofs are not acceptable.
Gutters & downspouts & connections	Metal (aluminum is acceptable) and must be enclosed at the point of attachment with the downspout.	Non-combustible material such as aluminum, metal or copper. No wood, plastic or vinyl	Clear of any debris. Gutters, downspouts, and connectors should be viewed as a location of potential combustible material accumulation.
Eaves &soffits <sup>16</sup>	See siding and walls	Closed using blocking between roof rafters, soffit or sheathing.	All vents in the eaves should be covered with 3mm non-combustible screening, or ASTM rated ember resistant vents.
HVAC & active venting systems	All ventilation openings in exterior walls and vents in roofs must be accessible and covered with a non- combustible, corrosion-resistant wire mesh with a maximum mesh opening size of 3 mm.	Should be shut down to prevent the intake of embers into the venting system and the interior of the building.	Attic ventilation openings shall not be located in the soffits or other overhanging areas. If vents have louvres or flaps, ensure that they self- close when the vents are not expelling air.

<sup>&</sup>lt;sup>16</sup> Maximum allowable wood coverage: no greater than 20% combustible material and non-rated materials (wood, vinyl, and aluminum) can comprise each exterior elevation's surface area. Surface area includes fascia, soffits, trim, windows, and cladding but does not include roofing. Surface area calculations are the responsibility of the designer/builder/developer to conduct, record and make available upon request. Alternatively, up to 30% gross surface area use of combustible material (wood) with ALL wood surfaces to be sealed with a Class A fire-rated, CSA approved retardant finish according to the manufacturer's application and maintenance recommendations. Retardant requires re-application every 4-5 years.



Building Part	Homes	Critical infrastructures	Comments
Siding and walls	Non-combustible materials approved for a minimum of 1-hour fire resistance rated construction on the exterior side. Examples of acceptable materials: stucco, metal siding (aluminum is acceptable if fire rating tests are reviewed and approved), brick, cement shingles or board (such as Hardi board), concrete block, poured concrete, or concrete composites, rock, and logs or heavy timber <sup>17</sup> .	Ignition resistant (cement fibre board, log), or non-combustible construction (stucco, metals, concrete, brick/stone)	Non-combustible siding should be the minimum for buildings in locations where the priority zone standards, or slope set-back standards cannot be achieved. Siding should be free of gaps or holes with a minimum of 15cm ground-to-siding, non-combustible clearance. Vinyl is not an acceptable material due to its propensity to melt and fall away at high temperatures, and exposing underlying combustible materials.
Windows and doors	Exterior doors: non-combustible construction, metal clad (aluminum is acceptable if fire rated), solid core wood, or shall have received a 20- minute fire protection rating. Windows: glazed doors, windows within exterior doors and skylights must be double glazed and preferably made of tempered glass. Window frames must be metal or solid wood.	Tempered or double pane at minimum.	Tempered glass should be the minimum for buildings inlocations where the priority zone standards, or slope set-back standards cannot be achieved All exterior doors must meet the requirements of the North American Fenestration Standard (NAFS) and the current BC Building Code.

<sup>&</sup>lt;sup>17</sup>Heavy timber should be a minimum of 4x4"



Building Part	Homes	Critical infrastructures	Comments
Balconies, Decks and Open Foundations	Heavy timber, ignition resistant materials, or other non- combustible material. Acceptable materials may include, but not be limited to: concrete, clay tile, rock, or Class A fire rated composites.	Should be closed in with non- combustible or ignition resistant skirting that meets the same standards as exterior wall construction, or constructed of heavy timber, non-combustible or fire rated materials.	There should be no combustible debris or material under these features and a non-combustible surface should be maintained under and extending for 1.5m beyond thefurthest extent of the feature. The underfloor of all exposed floors ( <i>i.e.</i> , the underside of balconies, decks, open roof, patio, crawlspaces, etc.) and all exposed structural columns, beams, and supporting walls, <b>must</b> be enclosed or sheathed with a 1 – hour fire resistance rated construction material (such as 5/8" type x gypsum board), ignition resistant material, or non- combustible material. This condition eliminates places for embers to blow underneath and get trapped (common interface ignition point). Vinyl and wood are not acceptable.
Building Set- Back	All buildings situated mid-slope, or at the top of a slope should be set- back at least 10m (30 feet) per story from the crest of the slope	All buildings situated mid-slope, or at the top of a slope should be set-back at least 10m (30 feet) per story from the crest of the slope	-
outdoor burning devices	All outdoor burning devices fueled by materials other than propane or natural gas are not compliant.	-	-



Building Part	Homes	Critical infrastructures	Comments
Fence line	Wooden fences are allowed under FireSmart criteria to acknowledge the lack of cost-effective material choices. As they can create a direct path between surrounding vegetation and the home, consider separating the house from the fence with a metal gate and maintain lawn or grasses along its alignment as they can become flashy fuels if left to mature and dry.	-	-
Sheds & outbuildings	If these are within 10m of the home footprint, their material construction must meet FireSmart guidelines.	-	-



## **APPENDIX B - ROOFTOP SPRINKLER SYSTEM**

Given that trees will be retained in Priority Zone 1 and because of the location of the house in close proximity to extensive areas of flammable forest, installation of exterior rooftop sprinklers is required. Sprinkler systems must include robust sprinklers with limited plastic materials capable of wetting all of Priority Zone 1. Between April to the end of October, sprinklers must be connected to the house water system.

In the event of a house fire, sprinklers should be turned on (if safe to do so) to wet the adjacent forested vegetation. This will reduce the potential of radiative heat emanating from combustibles burning in the residence from igniting the flammable foliage of retained coniferous trees within Fire Priority Zone 1.

In the event of a wildfire, sprinklers should be turned on a minimum of two hours before the fire reaches the residence. Although the exterior building construction components will be made of Class A fire rated materials, combustible materials within the interior of the home could potentially ignite if radiant heat within Fire Priority Zone 1 under high or extreme temperatures. The use of sprinklers in the event of a wildfire is not only to wet down surfaces such as roofs and adjacent vegetation, but to raise the relative humidity around the residence. This will help reduce fire behaviour adjacent to the home by making fuels less flammable and reduce the probability of spotting igniting adjacent vegetation or structures.



Figure 5. Rooftop sprinklers can be highly effective in reducing fire behaviour.

Considering these factors, installation of a minimum of seven rooftop sprinklers with a coverage radius of 12 m is required. Sprinkler systems must include robust sprinklers (such as Rainbird sprinklers) with limited plastic materials. Two approaches can be used for sprinkler systems, roof mounted sprinklers on portable



mounts or sprinklers incorporated in the roof. Between April to the end of October, sprinklers must be connected to the water supply and tested at the beginning of each fire season. The external sprinkler system must be independent of the internal system to allow for manual use during a wildfire.

In order to complete the sign-off of the Wildfire Hazard Report, the rooftop sprinkler system must be installed to the manufacturer's specifications and demonstrated to be in good working order capable of delivering the volume of water at the required pressure to completely wet down all of Fire Priority Zone 1.

The following is a list of suppliers and manufacturers of exterior rooftop sprinkler systems:

- 1. Just in Case Fire Ltd Flash Fire & Safety (Alberta). Fire Caddy and ZoneONE Coverage rooftop sprinkler systems. Contact information <u>www.firecaddy.com</u>. Each unit contains:
  - a. Roof Caddy
  - b. 4 impulse sprinkler heads
  - c. Fire hose
  - d. Fire Caddy manifold connection

Cost: Contact <a href="mailto:sales@firecaddy.com">sales@firecaddy.com</a> 1-844-FLASH-44 (844.352.7444) for pricing

 One Stop Fire <u>www.onestopfire.com/sprinklers.htm</u>. Fascia Mount Sprinkler Assembly. Commercial sprinkler head and mounting bracket for attachment to fascia of a building. Ideal for placement on gable ends of a roof peak. Sprinkler is of brass and stainless steel construction with a performance rating of 18m radius and 17.6gpm at 60 psi. Female garden hose fitting is standard on assembly unit.

Cost: \$300.00 / unit CAD (excludes applicable taxes and shipping / delivery)

3. Wildfire Automated Sprinkler Protection (WASP) <u>www.firerescue1.com</u> and <u>www.waspwildfire.com</u>. Gutter Mounted Sprinkler System. Unit contains fascia bracket, standard pole adapter, Nelson Sprinkler head, all connections and ribbed aluminum pole.

Cost: 250.00 CAD / unit (excludes applicable taxes and shipping / delivery)

- 4. Roof Saver Sprinklers <u>http://roofsaversprinklers.com/.</u> Made in the United States. Kit contains:
  - a. 1-Patented Roof Saver Sprinkler Base with Rainbird Brass Impulse Sprinkler
  - b. 1-3/4" X 50' Never kink Hose
  - c. 1-Ridgeline Hose Holder

Cost: \$249.00 USD / unit (excludes applicable taxes and shipping / delivery)

Requirements:

1- Installation of exterior sprinklers must cover thoroughly wet down Fire Priority Zone 1.



- 2- Sprinkler systems must include robust sprinkler components (such as Rainbird) with limited plastic materials. Two approaches can be used for sprinkler systems, roof mounted sprinklers on portable mounts or sprinklers incorporated in the roof.
- 3- Between April to the end of October, sprinklers must be connected to a water supply (a well or cistern) and tested at the beginning of each fire season. The external sprinkler system must be independent of the internal system to allow for manual use during a wildfire.
- 4- In order for sign-off of the Wildfire Hazard Report, the rooftop sprinkler system must be installed to the manufacturer's specifications, and demonstrated to be in good working order prior to sign-off. This must show that the system is capable of delivering the volume water at the required pressure to completely wet down all of Fire Priority Zone 1.



#### **ALTERNATIVE MATERIALS**

Alternative material choices: If an alternative material is proposed fire rating tests to an applicable recognized standard such as ISO, CSA, CAN-ULC, ASTM, or CSA must be provided. These tests will confirm that the material has been designed and tested in accordance with an applicable test for surface burning characteristics of building materials, specifically:

- The test must be extended for a 30-minute duration
- Exhibits a flame spread index (FSI) of not more than 25
- Shows no evidence of significant progressive combustion
- Flame front does not progress more than 10.5 ft (3.2 m) beyond the centerline of the burn at any time during the test If the manufacturer has paid for and performed these tests than it can be considered an alternative if all the criteria have been met.'