Kaleden Fire District

FIRESMART COMMUNITY ASSESSMENT REPORT

Prepared for

KALEDEN FIRESMART BOARD

&

REGIONAL DISTRICT OF OKANAGAN-SIMILKAMEEN

January 2019

Summary of Recommendations - Abbreviated

The FireSmart program provides detailed guidelines and recommendations to reduce home ignition potential during a wildfire. The recommendations made in this report must be considered *in addition* to those contained in the FireSmart *Protecting Your Community from Wildfire* manual. The following summary of recommendations is taken from Section 7 of this report, where additional detail and rationale is provided. These recommendations are specific for the residents of the Kaleden fire district and the Regional District of Okanagan-Similkameen.

Recommendations for Residents

1. Substantially reduce the amount of highly combustible plants used in landscaping, such as cedar and juniper shrubs and hedges within Zone 1 (<10 m from the home).
2. Remove completely any combustible ground cover, such as bark mulch within five feet of a home and any attachments, such as decks, porches and stairs.
3. Remove highly-combustible plants and landscaping materials at the crest between a home and slope.
4. Stop dumping yard waste into gullies or over the edge of slopes, as this practice increases fuel loading in some of the worst possible places.
5. Where grass is used as a cover crop in alleyways between grape vines, and the cover crop goes dormant during the dry season, ensure that the cover crop won't allow fire to spread into or out of vineyards.
6. Abandoned or fallow agricultural fields should be managed to prevent fire from spreading into or out of the field and posing a threat to adjacent properties.

Recommendations for Local Government

7. Loosen the restrictions contained in the burning bylaw to enable more proactive debris disposal.
8. Develop or improve the means to identify and mitigate wildfire fuel hazards on private

property.

9. Consider the Crown land between Kaleden and St. Andrews for inclusion in a Forest Enhancement Society (FES) project to manage fuel conditions, while preserving or enhancing forage.
10. Establish a vegetation maintenance standard jointly with the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) for the KVR trail.
11. Establish a memorandum of understanding with the Ministry of Transportation and Infrastructure to establish best practices for shoulder mowing in the Kaleden fire district for the purpose of mitigating roadside fine fuel hazards.

Contents

List of Tables

List of Figures

1.0 Introduction

As with many communities in the Okanagan and throughout British Columbia, the Kaleden fire district has had recent experience with destructive wildland urban interface fires. Most recently, on July 4, 2017 a small wildfire ignited within Kaleden, growing to 6.5 hectares (ha) and destroying one home and several outbuildings. This experience demonstrated the speed at which a wildfire can impact a community, regardless of the fire size. Energized by this and past experience, a group of concerned residents and the Kaleden Volunteer Fire Department embarked on an effort to make their community more resilient to wildfire.

Thanks to the efforts on this committed group of people, the community started down the path towards becoming FireSmart. On November 29, 2017 a community meeting was held to discuss the July 4 wildfire and to chart a course for wildfire mitigation efforts. On May 4 the following spring, a community mitigation event was held, whereby a chipper was made available near Pioneer Park for residents to dispose of their various pruning and thinning waste. A demonstration project was also held at Lakehill Road and Sumac Avenue where residents could participate in a mitigation project. These efforts have all contributed to the demonstrated resolve of concerned residents to pursue FireSmart Community Recognition.

The FireSmart Canada Community Recognition Program is designed to provide an effective management approach for preserving wildland living aesthetics while reducing community ignition potential during a wildland-urban interface (WUI) fire. The program can be tailored for adoption by any community and/or neighborhood association that is committed to ensuring its citizens maximum preparation for wildland fire. The following Community Assessment Report (CAR) is intended to be a resource for residents within the Kaleden fire district (which includes St. Andrews) for carrying out the recommendations and actions contained in the Kaleden FireSmart Community Plan (FCP).

Although this FireSmart project is referred to as the *Kaleden* FireSmart project for simplicity, the project area includes the entirety of the Kaleden fire district depicted in Figure 1, which includes St.

Andrews. Although this particular project encompasses a larger area than is typical of other FireSmart projects, the basis for this decision was to provide the Kaleden Volunteer Fire Department (VFD) with a consistent assessment and recommendations for residents across their entire service area.

Both the CAR and FCP have been developed by a trained Local FireSmart Representative (LFR), in conjunction with the Kaleden FireSmart Board. This CAR builds on the template required by FireSmart Canada and contains a number of elements not found in other CARs, including a description of the Kaleden fire environment. The rationale for the broad scope of this CAR was that this report needed to provide context to the residents reading it. Rather than simply presenting an abstract "to do" list of recommended actions that homeowners should take, this report aims to provide the reader with a working knowledge of their fire environment so that mitigation efforts can be more meaningful, understood and ideally, successful.

Funding for the Kaleden FireSmart project was provided by the Union of BC Municipalities (UBCM) Strategic Wildfire Prevention Initiative program (now called the Community Resiliency Investment program) in the form of a FireSmart Planning Grant to the Regional District of Okanagan-Similkameen (RDOS). The grant enabled the RDOS to retain the services of Davies Wildfire Management Inc. to manage the project, in collaboration with the Kaleden FireSmart Board.

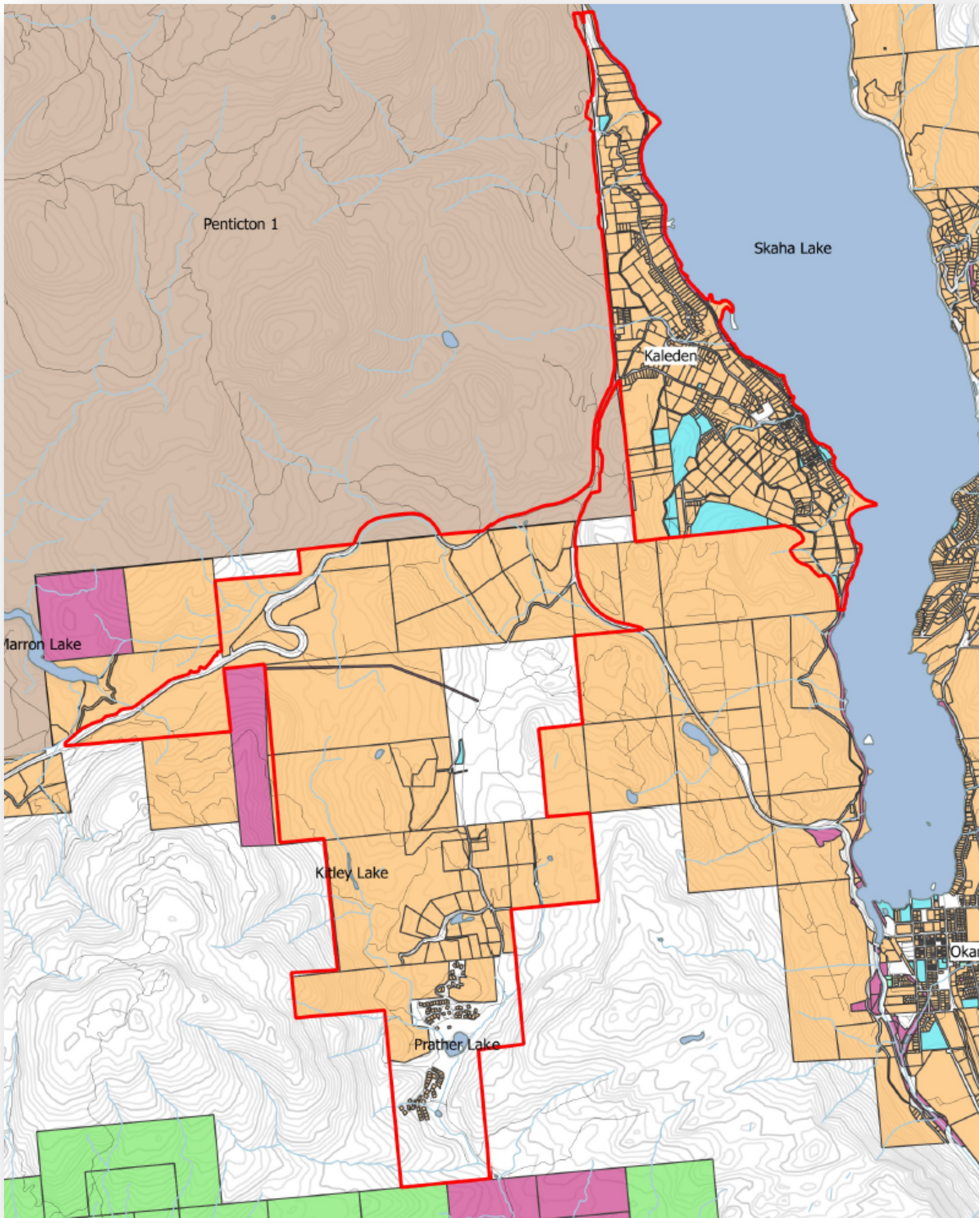


Figure 1 The Kaleden FireSmart project area is comprised of the entirety of the Kaleden Fire District (outlined in red), served by the Kaleden Volunteer Fire Department. A full-size map is provided as an appendix.

2.0 Definition of the Ignition Zone

Kaleden is situated in a wildfire environment. The wildland areas surrounding the community are typical of ecosystems that have developed with historically frequent low intensity fires. With the advent of modern forest protection policies, the typical fire cycle has been interrupted, contributing to a host of cascading ecological effects, including a buildup of forest fuels.

Wildfires have and will continue to occur throughout the Okanagan – attempting to eradicate fire has proven to be an impossible strategy. The variables in a wildfire scenario are when the fire will occur, and where. This assessment report addresses the wildfire-related characteristics of Kaleden and examines the area's exposure to wildfire as it relates to home ignition potential. The assessment does not focus on specific homes but examines the entire community.

A house ignites during a wildfire because of its relationship with everything in its surrounding ignition zone - the house and its immediate surroundings. To avoid a home ignition, a homeowner must eliminate the wildfire's potential relationship with their house. This can be accomplished by interrupting the natural path a fire takes. Changing a fire's path by clearing the ignition zone is an action that can prevent home loss. To accomplish this, flammable items such as excessive vegetation and flammable debris must be removed from the area immediately around the structure to prevent direct flame contact with the house. Reducing the volume of live and dead vegetation will affect the intensity of the wildfire as it nears the home.

Included in this assessment are observations made during field assessments of the Kaleden fire district. The assessment addresses the ease with which home ignitions can occur under severe wildfire conditions and how these ignitions might be avoided within the ignition zones of affected residents. Kaleden residents can reduce the risk of structure loss during a wildfire by taking actions within their ignition zones. This zone principally determines the potential for home ignitions during a wildland fire; it includes a house and its immediate surroundings within 100 m (Figure 2). Given the extent of this zone, the ignition zones of several homes sometimes overlap, and often spill over onto adjacent public or community land.

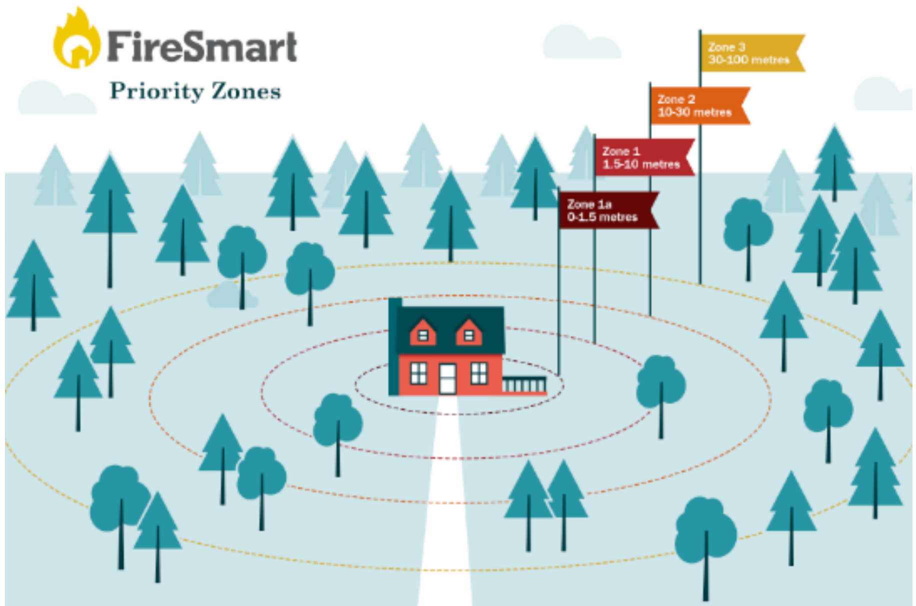


Figure 2 FireSmart Canada utilizes the concept of three priority zones surrounding a home to help residents prioritize their hazard reduction efforts. A home's immediate surroundings (Zone 1a and Zone 1) is of immediate concern to the homeowner and should targeted aggressively to reduce ignition hazards to the home.

The results of the assessment indicate that wildfire behaviour and subsequent losses will be dominated by the residential characteristics of the area. The good news is that residents will be able to substantially reduce their exposure to loss by addressing neighbourhood vulnerabilities. Relatively small investments of time and effort will reap great rewards in wildfire loss reduction.

3.0 Description of the Fire Environment

Wildland fire behaviour is influenced by the interaction of three broad environmental factors: fuel, weather and topography. Collectively, these factors describe the fire environment and determine the intensity and spread of a wildland fire. A working knowledge of the factors that characterize the fire environment is helpful to building an awareness of hazard mitigation at the site level.

3.1 Fuels

In the context of wildland fire, fuel refers to the organic matter involved in combustion. When referring to the WUI, structures, vehicles and other improvements become a component of the fuel complex. An awareness of the fuel conditions around the home will help residents properly assess and mitigate fuel hazards.

In Canada, wildland fuels are classified into 16 fuel types within the Canadian Forest Fire Behaviour Prediction (FBP) System. The FBP system is informed by the Canadian Forest Fire Danger Rating System (CFFDRS), which is the primary tool used by agencies across Canada to obtain predictive wildfire management intelligence.

3.1.1 Fuel layers

The structure and arrangement of fuels are described in terms of their horizontal and vertical continuity within three broad layers of the fuel complex – ground fuels, surface fuels and canopy (or aerial) fuels (Figure 3). Ground fuels occupy the *duff layer* and the uppermost portions of the soil mineral horizon. In general terms, the duff layer is comprised of decomposing organic material and is found beneath the litter layer and above the uppermost soil mineral horizon (A-horizon). The constituents of the duff layer lack identifiable form due to decomposition (as opposed to the *litter layer*, which is composed of identifiable material).

The surface fuel layer begins above the duff layer and extends 2m vertically. Surface fuels are characterized by the litter layer (leaves, needles, twigs, cones etc.) as well as plants and dead woody material up to a height of 2m. In some cases, surface fuels may act as *ladder fuels* that can carry fire from the surface fuel layer into the canopy layer.

Canopy fuels are the portions of shrubs and trees that extend from 2 m above the duff layer, upwards to the top of the fuel complex. Certain tree species, such as several spruce species (*Picea sp.)* are characterized by branches extending down to the forest floor, whereby these lower branches act as ladder fuels. Other species, particularly those found in drier, fire-maintained ecosystems, such as mature Ponderosa pine (*Pinus ponderosa)*, lack these ladder fuels and form a distinct separation between the surface fuel layer and canopy fuel layer.

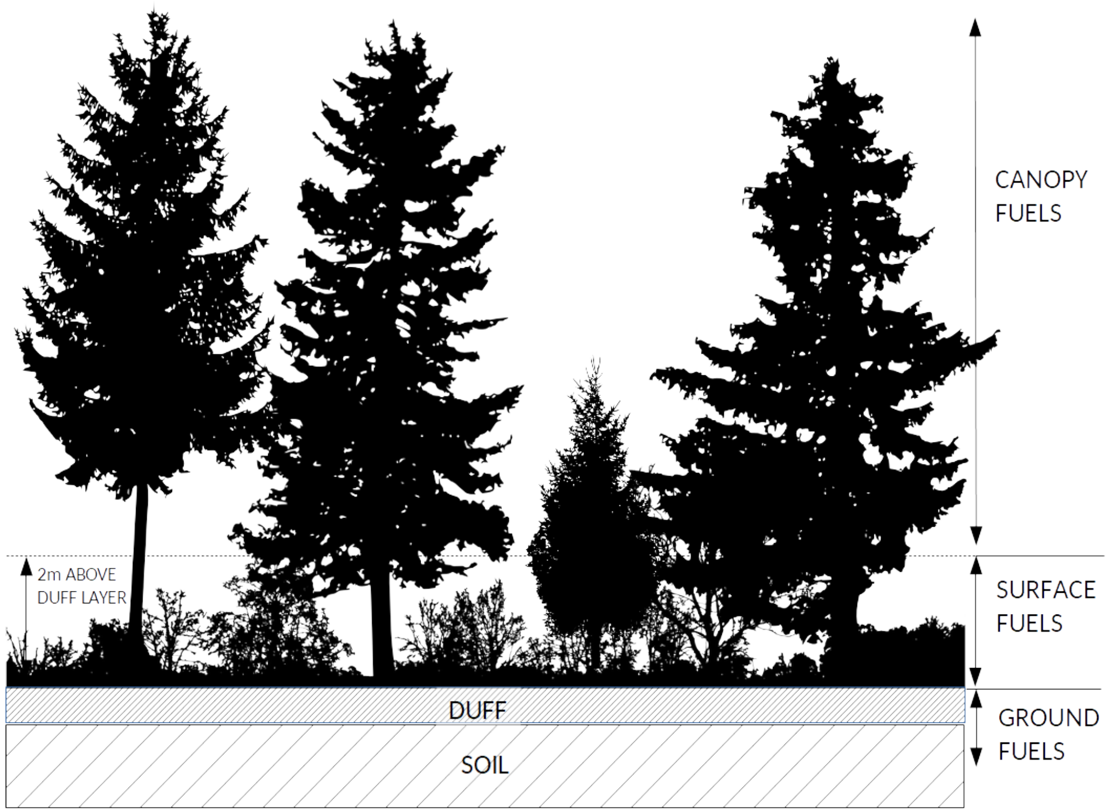


Figure 3 Wildland fuels can be described within three broad fuel layers: Ground fuels, surface fuels (to a height of 2 m above the duff layer), and canopy fuels. Canopy fuels are also referred to as aerial fuels. Graphic by A. Low.

3.1.2 Fuel size

Wildland fuel can be further described in terms of relative size – so called *fine fuels* and *coarse* or heavy fuels. Fine fuels include leaves and conifer needles, grasses, herbs, bark flakes, lichen, twigs etc. Large branches, downed logs and other large woody material are considered coarse or heavy fuels. Fine fuels have a higher surface area/volume ratio than coarse fuels, and this characteristic influences the rate of drying and ease of ignition.

With a higher surface area/volume ratio than coarse fuels, fine fuels are more readily influenced by changes in environmental conditions (e.g. relative humidity, wind, precipitation etc.). Dead fine fuels react to changes in environmental conditions at a relatively faster rate than green (i.e. live) fine fuels.

When available to burn, fine fuels ignite more easily and spread fire faster than coarser fuels. This characteristic makes fine fuels particularly susceptible to ignition from embers. Finally, fine fuels take a shorter time to burn out than coarser fuels.

3.2 Weather

Weather conditions affect the moisture content of wildland fuels and influence the rate of spread and intensity of a wildland fire. Weather is the most dynamic element of the fire environment and the most challenging to assess and forecast.

3.2.1 Wind

Wind speed and direction influences the rate and direction of spread of a wildland fire. The application of wind on open flame has the effect of tilting the flame away from the wind, and, in the case of wildland fire, placing the flame into closer proximity (or contact) with downwind fuels, and contributing to fire spread. Wind can also contribute to a preheating effect on fuels immediately downwind from open flame.

Wind can also hasten the drying process of exposed fuel, with the rate of drying being a function of the surface area/volume ratio. Having a relatively higher surface area/volume ratio, fine fuel moisture content is affected to a greater degree by wind when compared to coarse fuel.

3.2.2 Precipitation and relative humidity

The effect of moisture, in the form of precipitation or moisture in the atmosphere, on wildland fuel is dependent on the size and state of the fuel complex. The moisture content of dead fine fuel is highly reactive to changes in relative humidity, precipitation and wind. Fine fuels require less precipitation to reach saturation than do coarse fuels, and in turn dry out at a faster rate.

The moisture content of wildland fuel is constantly seeking to equalize with the moisture content of the surrounding air. This effect is most pronounced with dead fuel. When the relative humidity is high, dead fine fuels will readily absorb moisture *from* the air and conversely, when the relative humidity is low, dead fine fuels will readily give up moisture *to* the air.

3.3 Topography

In the context of the fire environment, topography refers to the shape and features of the landscape. Of primary importance for an understanding of fire behaviour is slope. When all other factors are equal, a fire will spread faster up a slope than it would across flat ground. When a fire burns on a slope, the upslope fuel particles are closer to the flame compared to the downslope fuels. As well, hot air rising along the slope tilts the flame uphill, further increasing the ease of ignition of upslope fuels. A pre-heating effect on upslope fuels also contributes to faster upslope fire spread.

Topography influences fire behavior principally by the steepness of the slope. However, the configuration of the terrain such as narrow draws, saddles and so forth can also influence fire spread and intensity. Slope aspect (i.e. the cardinal direction that a slope faces) determines the amount and quality of solar radiation that a slope will receive, which in turn influences plant growing conditions and drying rates.

3.4 Kaleden Fire Environment

Kaleden is situated in a fire environment characterized by fuel, weather and topographical factors that are conducive to the type of fire behaviour that could lead to home losses in the event of a WUI fire. An awareness of these conditions is key to focusing on the critical elements of hazard mitigation at the site level.

3.4.1 The C7 and O1 fuel types

In the Kaleden area, the FBP fuel type is predominantly C7 – Ponderosa Pine – Douglas-fir and O1 - Grass. The C7 fuel type is characterized by relatively open (<50% canopy closure), uneven-aged stands of Ponderosa pine and Douglas-fir (*Pseudotsuga menziesii).* Generally, surface fuels are characterized by perennial grasses, herbs, and scattered shrubs. In the absence of periodic fire (or other maintenance), needle litter tends to build up and persist for some time. Duff layers are relatively shallow – typically less than 3 cm (Taylor & Alexander, 2016). The O1 fuel type is an open grass fuel type characterized by continuous grass cover with few occasional trees or shrubs that do not appreciably affect fire behaviour. The preponderance of shrubs such as big sagebrush (*Artemisia tridentate)* on local grassland areas alters the O1 fuel type, for which there is no available modification to the model, other than distinguishing between matted grass (O1a) and standing dead grass (O1b).

3.4.2 Climate and weather

The climatic conditions of the southern interior of British Columbia are broadly characterized by warm, dry summers and cool winters. The south Okanagan is classified as a cold semi-arid climate. Not surprisingly, July - August is the period with lowest average relative humidity and highest daily average temperatures. What may be surprising to people not familiar with the southern interior climate is that June is normally the month with the highest average precipitation amounts (Figure 4).

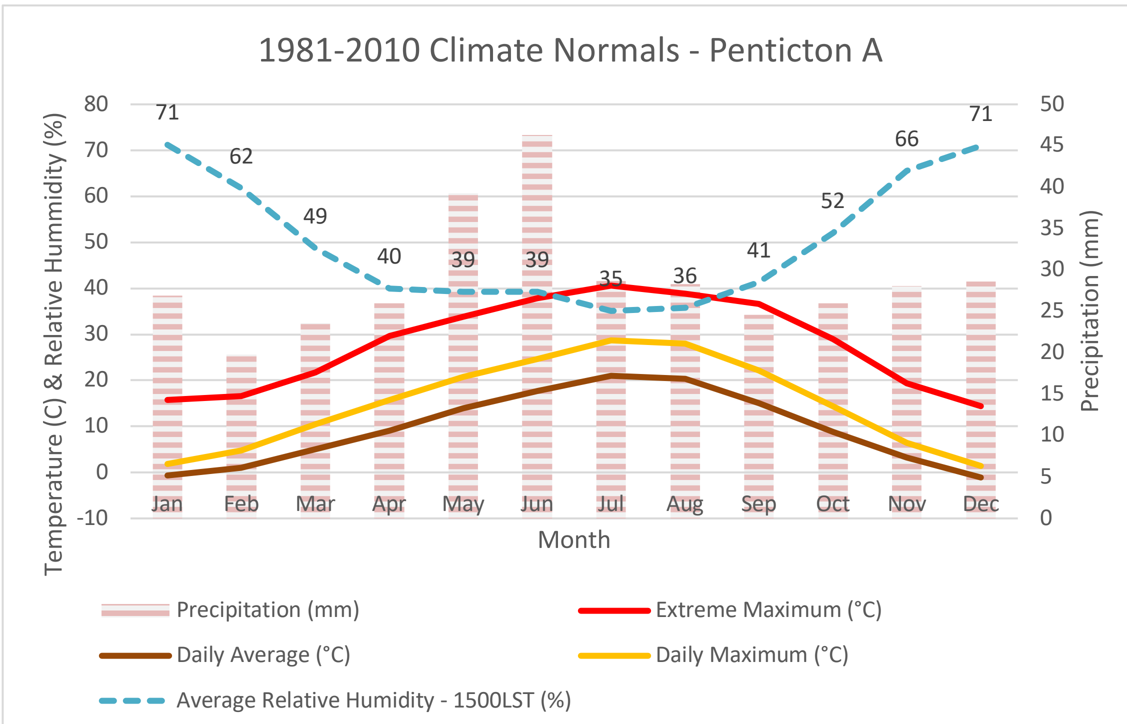


Figure 4 Canadian climate normals (1981-2010) for the Environment Canada station at Penticton. June is normally the month with the greatest amounts of precipitation.

As illustrated in Figure 4, the information presented for relative humidity is the average daily 1500 LST observation. The published climate normals data does not include extreme minimum observations of relative humidity and it is important to bear in mind that summer minimum relative humidity observations routinely fall below the average, sometimes to extremely low percentages. Relative humidity values in the teens or even lower do occur in the Okanagan during the peak fire season. Occasions when the temperature value is higher than the relative humidity value are critical fire weather conditions that can lead to fast-spreading, intense wildfire behaviour. For example, an ambient air temperature of 30°C and a relative humidity of 25% (an example of a condition known as *cross-over*) can contribute to a greater ease of ignition in fine fuels, faster rate of spread and higher fire intensity. The most frequent wind direction at the Penticton airport is from the north (Table 1). Local topography will influence wind direction and speed at the microscale, and for this reason Table 1 data is provided for information only.

Table 1 Wind station data (1981-2010) for the Environment Canada Penticton A weather station at the Penticton regional airport. For the purposes of characterizing the Kaleden fire environment, of interest is the predominant wind direction (blowing from the North) during fire season. Maximum wind speeds and directions are much more variable but provide a sense of the potential wind effects in the area.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean of hourly wind speed (km/h)	14	12	11	10	9	9	9	9	9	11	15	15
Most frequent direction	S	S	S	N	N	N	N	N	N	N	S	S
Maximum hourly speed (km/h)	65	72	68	64	68	61	67	74	60	80	80	84
Direction of maximum hourly wind speed	S	S	S	S	SW	SE	N	SW	S	S	S	S
Maximum gust speed (km/h)	85	93	113	121	97	81	109	89	97	101	97	113
Direction of maximum gust	S	N	NW	W	S	S	N	N	N	S	S	NW

3.4.3 Topography

Kaleden is characterized by topographical features that contribute to an active fire environment. For example, Kaleden proper has examples of homes built near the crest of steep slopes above the KVR trail, as well as homes within gullied terrain. The Kaleden site also has steep and narrow terrain-limited road sections that would constrain a simultaneous fire response and evacuation scenario.

The St. Andrews site has comparatively less severe topography, with the majority of the residential areas occupying the lower slopes or valley bottom. Although St. Andrews is not without homes on sloping ground, the terrain is generally more uniform with fewer deeply incised gullies and steep slopes.

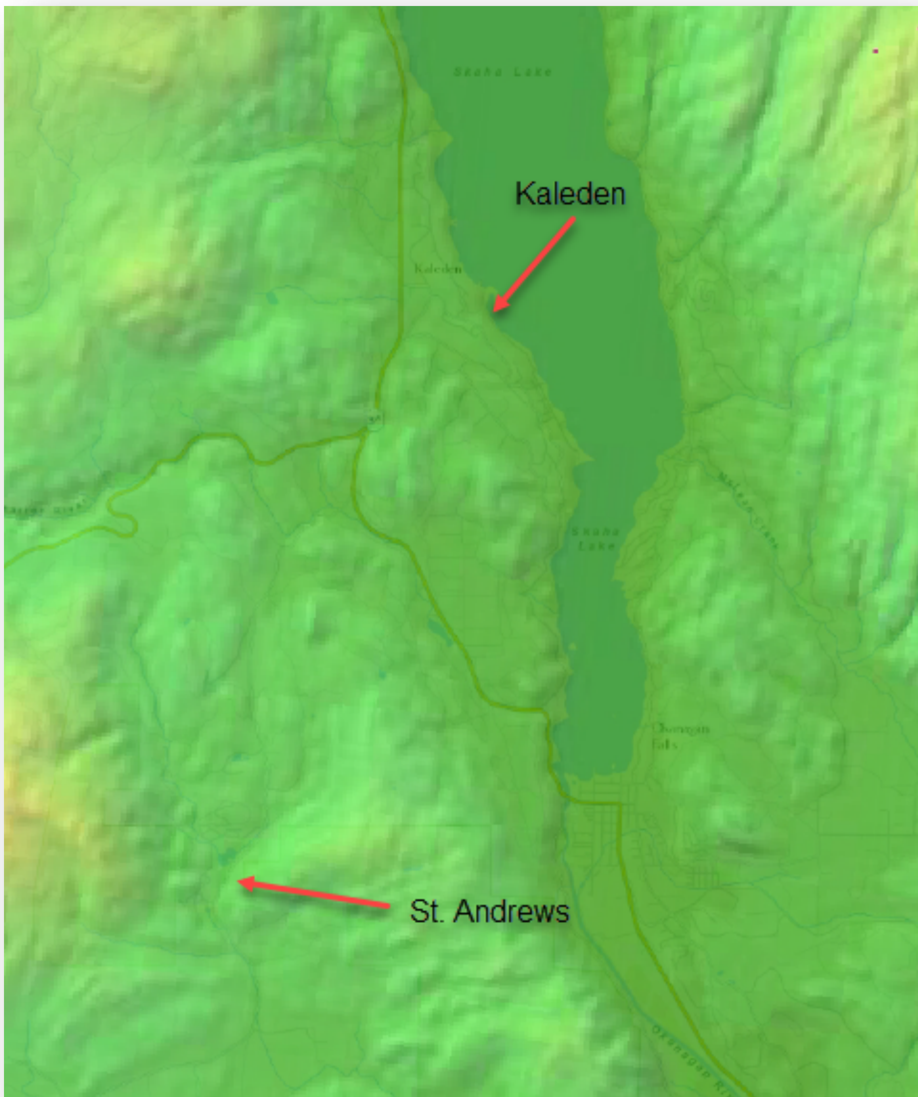


Figure 5 Hillshade map of the Kaleden fire district area. Kaleden proper lies on the western shore of Skaha Lake on a predominantly east aspect slope. St. Andrews lies in a broad bowl around Prather Lake, at the eastern toe of Mount Parker.

4.0 Site Description

The Kaleden project area currently lies within the RDOS Electoral Area 'D' but will become designated as Area 'I' when Area 'D' is split, effective November 15, 2018 (RDOS, 2018). The RDOS Open Data site indicates 1357 properties within the Kaleden community, which includes the Twin Lakes area. When the areas that are outside the Kaleden fire district area are removed (as best as possible through a rudimentary filter process) there are 887 parcels remaining within the Kaleden fire district. Of these remaining parcels, 765 have assessed improvements totaling nearly $448 million (RDOS, 2018). The majority of these improved parcels are in Kaleden proper and St. Andrews.

4.1 Ecology

The ecological classification of most of the Kaleden fire district is defined by the Bunchgrass very dry hot (BGxh1) and Ponderosa pine very dry hot (PPxh1) biogeoclimatic subzones (see Figure 6). A minor component of Interior Douglas-fir very dry hot (IDFxh1) is found in the south west corner of the fire district, on Mount Parker. The natural disturbance pattern of the PPxh1 and adjacent Interior Douglas-Fir and Bunchgrass zones has been characterized by historically frequent stand maintaining fires prior to the fire-return interval being interrupted by contemporary forest management and fire suppression policies. Stand maintaining fires are typically low intensity surface burns that consume understory fuels while retaining a healthy green overstory. These frequent fires kept ladder fuels to a minimum and typically resulted in an open, park-like stand structure. Ecosystems characterized by frequent low-intensity disturbance events are classified as Natural Disturbance Type 4 (NDT4) owing to historically frequent stand-maintaining fires (Province of British Columbia, 1995).

In the absence of periodic low intensity fire in the area, small trees that would have typically been fire-killed have become established, forming thickets and creating ladder fuels and resulting in relatively higher tree densities. Fine fuels, most notably dead Ponderosa pine needles, have accumulated at the base of mature trees, resulting in higher fine fuel loading that could produce fire intensity great enough to result in lethal scorching of trees whose thick bark would have otherwise protected the vital phloem and cambial tissues.

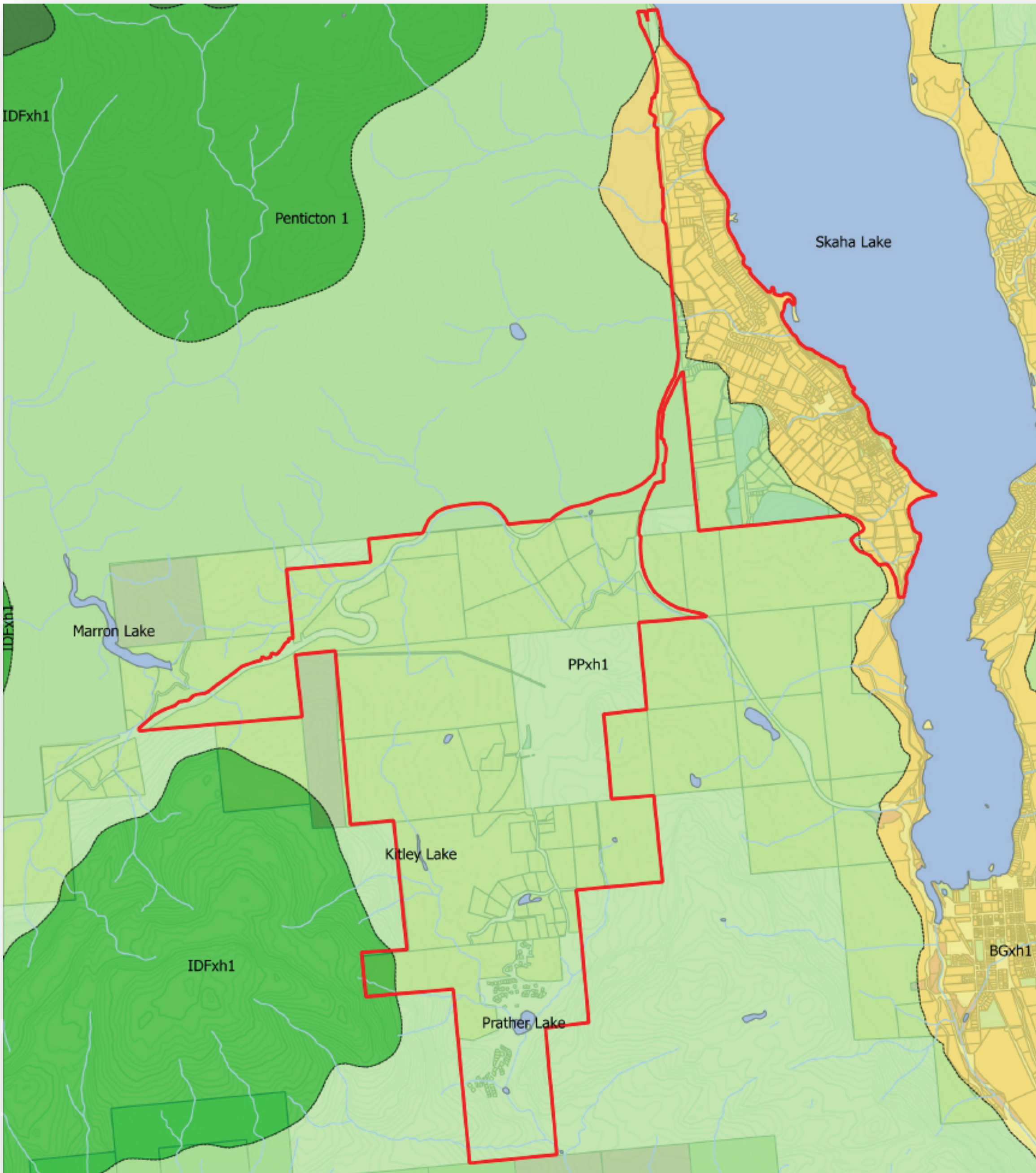


Figure 6 The biogeoclimatic ecological classification of the Kaleden fire district and surrounding area is primarily comprised of variants of the Bunchgrass very dry hot and the Ponderosa pine very dry hot subzones. A full-size map is provided as an appendix.

4.2 Land Status

The majority of land within the Kaleden fire district is private property. Abutting large portions of the northern boundary of the fire district is the Penticton 1 Indian Reserve. Further south, between Kaleden and St. Andrews are areas of Crown land under a grazing lease. Within Kaleden proper are several lots of municipal land. A variety of Crown tenures occur throughout the Kaleden fire district. See Figure 7 for an overview of land ownership and disposition and a full-size map as an appendix.

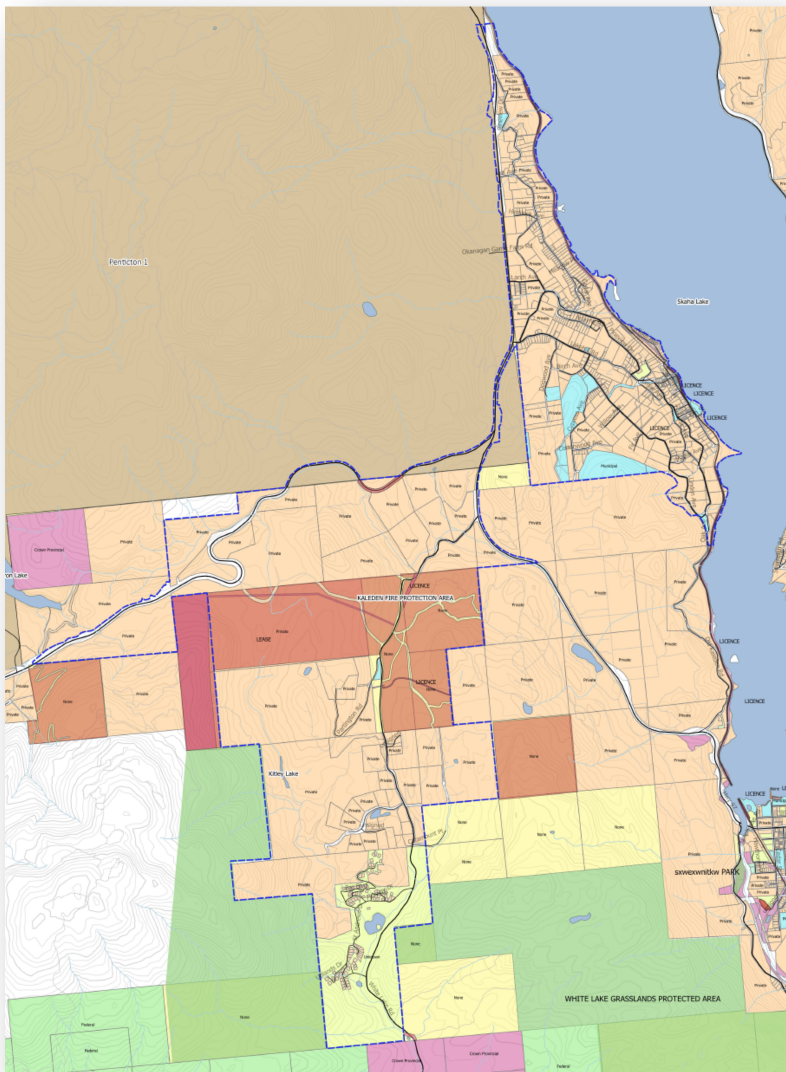


Figure 7 Ownership and disposition of land within the Kaleden fire district. Full size map is provided as an appendix.

4.3 Fire History

The Okanagan has a persistent history of wildfire on the landscape. The BCWS maintains a database of wildfires dating back to the early 1900s. Fire history data for fires that occurred prior to 1950 are limited to larger perimeters only and does not include fires that may only have been spot-sized. These perimeters have been digitized from a variety of sources, some dating back to linen maps. From 1950 onwards, the wildfire dataset becomes more complete, capturing wildfires of all size classes and provides a more accurate picture of fire occurrence trends. For the purposes of this particular fire history analysis, a five-kilometer buffer was applied to the Kaleden fire district boundary and all wildfires within the buffer (including within the fire district boundary) were analyzed (Figure 8).

4.3.1 Past wildfires near Kaleden

The modern provincial dataset for detailed fire information, including fire cause, dates to the 1950s. This dataset shows a total of 642 wildfires occurring within a five-kilometer buffer of the current Kaleden fire district between 1950 and 2018. Of these fires, 135 are recorded as lightning-caused and 507 as person-caused (Figure 9). As illustrated in Figure 9, wildfires within 5 km of the Kaleden fire district have occurred in every year since 1950, with the average between 1950 and 2018 being 9.3 wildfires per year. The most wildfires in a single year (29) occurred in 1987, while the least number of wildfires (2) occurred in 1950, 1956 and 2017, respectively.

More recent fire history was graphed in Figure 10 to analyze the trend in fire occurrence and annual area burned within the five-kilometer buffer. The trend since 1988 has been a decrease in the annual occurrence of wildfires but an increase in annual area burned. A similar trend has been noted in other areas of the Okanagan.

It should be noted that this analysis only includes wildfires listed in the provincial dataset and may not reflect small fires that were suppressed by the fire department or general public without any assistance from BCWS crews or aircraft. The Kaleden Volunteer Fire Department regularly responds to small wildfires without the assistance of the BCWS, therefor the number of wildfires reported here is less than the total number of wildfires that have occurred within the Kaleden fire district.

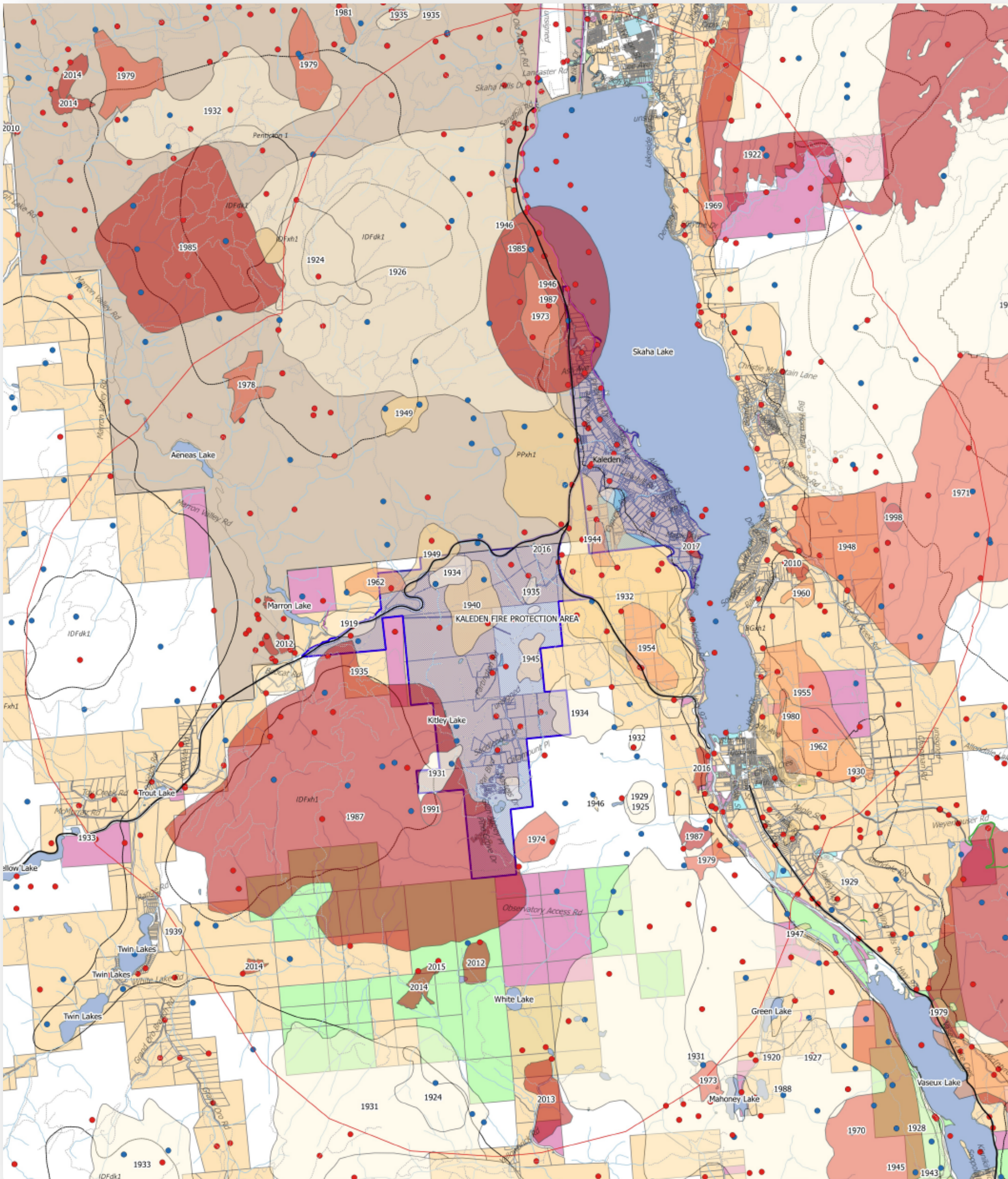


Figure 8 Historic fire perimeters (greater than 3ha) dating back to the early 1900s, as recorded in the BC Wildfire Service fire history database. Full size map is provided as an appendix.

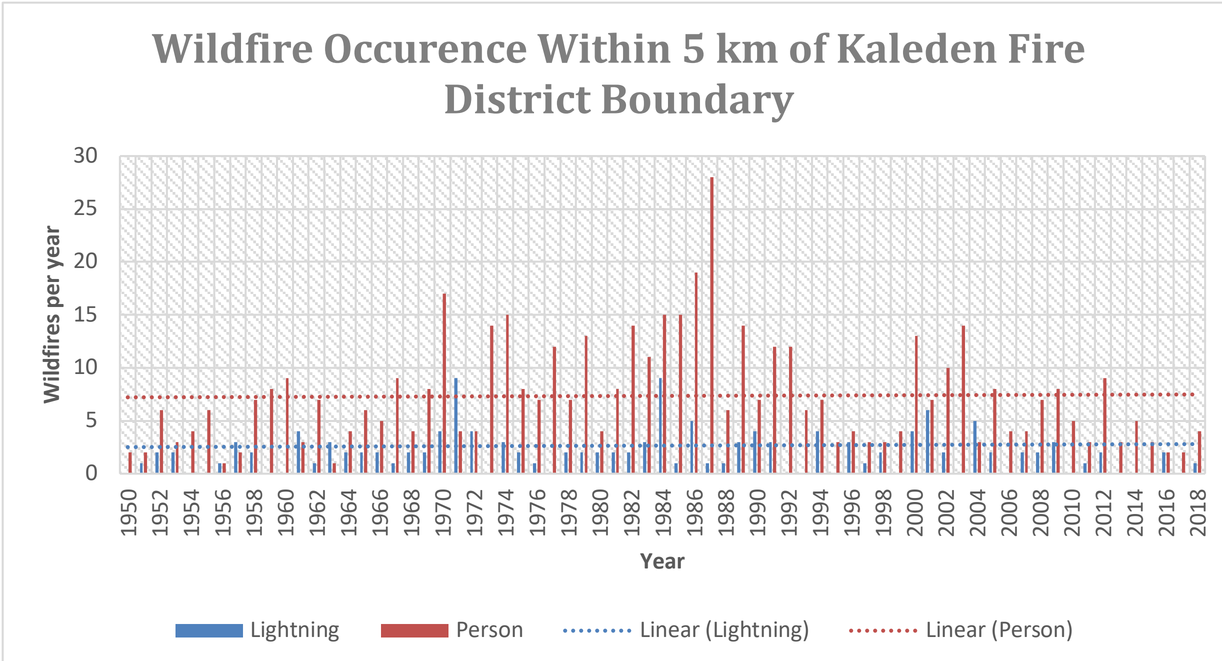


Figure 9 Wildfires that have occurred within 5km of Kaleden, from 1950 to 2018, as recorded in the BC Wildfire Service fire history database

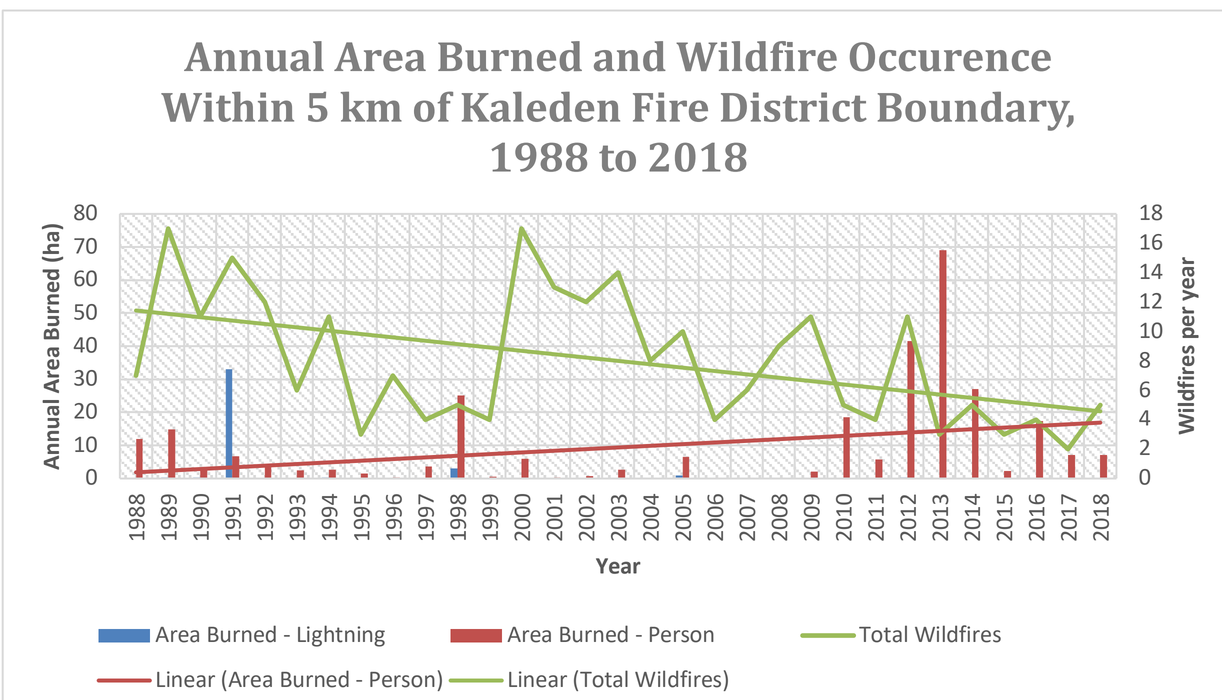


Figure 10 Annual area burned and wildfire occurrence within 5km of the Kaleden fire district, from 1988 to 2018. The trend during this period has been a decrease in wildfire occurrence and an increase in annual area burned.

4.3.2 Fire K50588 – 2017

The 2017 Kaleden fire ignited on July 4 and destroyed one home, several outbuildings and damaged additional property. An evacuation order was made for 18 properties with an additional 165 properties on evacuation alert. Ignition occurred sometime after 3:30PM on July 4 and the fire quickly grew to 6.5 ha before containment the following day. The final fire perimeter from the BCWS fire history dataset is presented in Figure 11.

The Kaleden fire was a wind-driven fire incident. Hourly wind data from the Environment Canada (2018) weather station at the Penticton airport (Figure 12) indicates that winds were northerly for most of the day prior to the fire, and that a shift to strong southerly winds occurred sometime after 1:00PM. By 8:00PM that night winds subsided and shifted back to northerly. No official fire cause has been released.

Figure 11 The July 4, 2017 Kaleden fire burned 6.5 ha and destroyed one home.

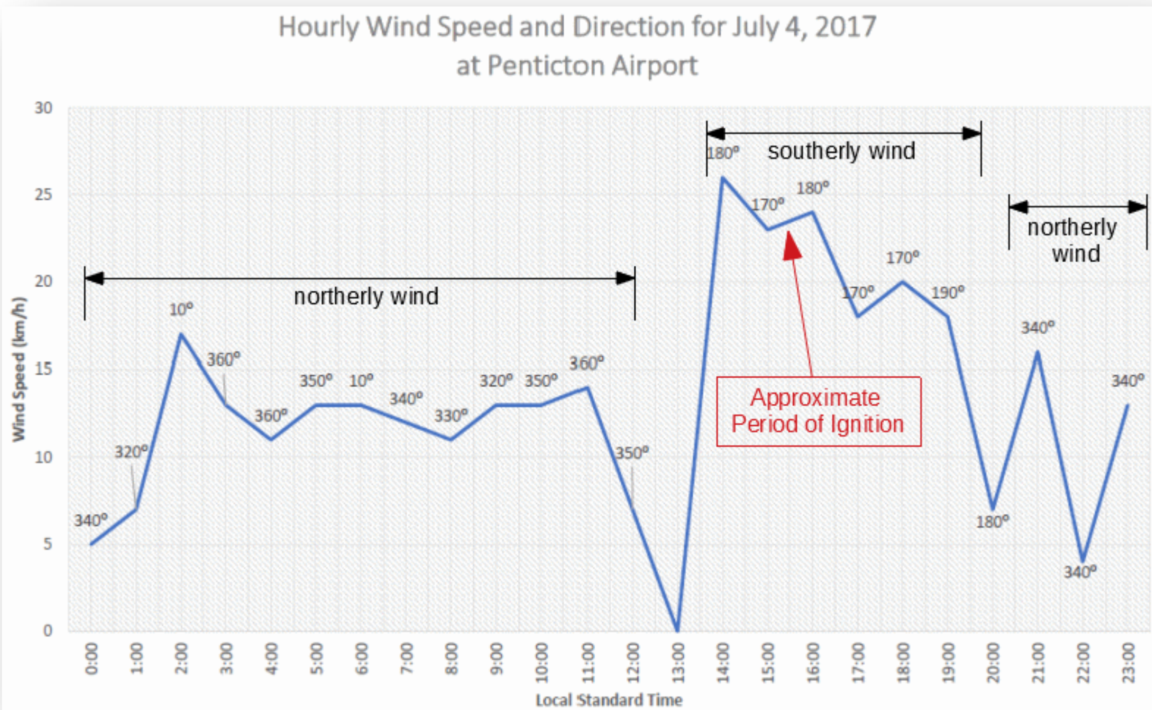


Figure 12 Hourly wind data for July 4, 2017 from the Environment Canada weather station at the Penticton airport.

5.0 Assessment Process

An initial reconnaissance of the project area was conducted in June 2018 by the author and the Kaleden Fire Chief to gain familiarity with the neighbourhood in the context of FireSmart guidelines. Assessments of the Kaleden fire district occurred at various times throughout the summer, owing to the comparatively large area of this particular project. The assessment process was completed using the Community Wildfire Hazard Assessment form which focuses on the following FireSmart hazard factors:

- roof assemblies;
- building exteriors;
- vegetation in Priority Zone 1-3;

- topography;
- infrastructure;
- fire suppression;
- fire ignition and prevention.

Photos are an important aspect of any assessment of conditions and photos of the Kaleden fire district area have been used in this report. Where a photo depicts a risk factor or hazard in relation to a private building, efforts have been taken to obscure identifying features of the specific property. This has been done in order to draw attention to particular risk factors and hazards and not towards any particular house. Put simply, the assessment is about what, not who.

6.0 Observations and Issues

Increasingly, research and post-fire disaster reviews (e.g. Cohen & Saveland, 1997; Westhaver, 2017) are indicating that the most important factors that influence the survivability of a structure during a WUI fire are the structure's characteristics and its immediate surroundings (Cohen, 2000; Blanchi & Leonard, 2008; Cohen, 2008). During high-intensity crown fire experiments in the Northwest Territories (Butler & Cohen, 1998), findings indicated that at distances of 30m or more between a wood paneled structure and adjacent high-intensity crown fire in a C-2 fuel type there was insufficient radiant heat to ignite the structure. In fact, Butler and Cohen (1998) found that the critical distance for sufficient radiant heat transfer to ignite a structure may only be 10m, however they concluded that a 30m distance would incorporate a conservative margin.

It is important to point out the differences in fuel type between the Butler and Cohen crown fire experiments (C-2 Black Spruce) and the fuel type described in this assessment (C-7 Ponderosa Pine/Douglas-fir), because these two fuel types have very different fire behaviour characteristics. Stand structure is considerably different, whereby C-2 fuel has greater vertical continuity (i.e. ladder fuels (branches etc.) that extend down to the forest floor) and C-7 typically has less vertical continuity. Vertical continuity has a direct relationship to the probability of crown fire initiation –

crown fires are more probable and occur at a much lower threshold in C-2 fuel types than in C-7.

Of particular importance to the ignitability of a structure is its resilience to embers accumulating on or in the structure itself, or onto combustible material immediately adjacent to the structure (Blanchi & Leonard, 2008; Calkin, et al., 2014; Moritz, et al., 2014). Wood roofs, wood decks, stacked firewood, certain landscaping materials and plants, unscreened openings into a structure etc. can all be ideal locations for the accumulation of embers during a wildfire. These embers can in turn ignite the structure itself, likely leading to the destruction of the structure.

Direct flame contact on a structure is another important factor in structure survivability. Effectively "disconnecting" structures from the surrounding wildland fuels is an important hazard mitigation measure. This includes ensuring that improvements, such as wooden fences or sheds, don't act as a pathway for fire to transfer from wildland fuels (such as cured grass) onto a nearby or connected structure. Commonly used landscaping materials and plants, such as bark much, ornamental cedar hedges and junipers, can also facilitate direct flame contact on a structure when used near the structure itself.

6.1 Fuel

Vegetation is assessed in three concentric zones around a home (Figure 2), with Zone 1 being the area occupying the first 10 m around the structure. The quantity and condition of canopy, ladder and surface fuels are the key factors assessed. Most homes in Kaleden have overlapping Zones. In many cases, one home's Zone 1 is the adjacent home's Zone 2 or 3. This is a common characteristic of most WUI areas, and it reinforces the view that many individual FireSmart efforts can increase the overall wildfire resilience of the neighbourhood. Unfortunately, the opposite holds true when one (or more) homes aren't FireSmart and pose a threat to adjacent homes that are.

In Kaleden, Ponderosa pine and Douglas-fir are the dominant canopy fuels across all zones, with extensive occurrence of cedar and ornamental conifers established for landscaping. Numerous homes in the area have one or more mature Ponderosa pines or Douglas-firs established within Zone 1 or at least Zone 2. The presence of conifer trees within Zone 1 represent a hazard when assessed using the Structure and Site Hazard Assessment form from FireSmart Canada (Partners in

Protection, 2003). In this case the author disagrees with the assessment form when assessing *occasional well-spaced and pruned Ponderosa pines* occupying Zone 1.

It is recognized that the structure and site hazard assessment form is a national assessment tool that can't possibly consider all variations in overstory composition and tree morphology found across all WUI areas in Canada, while still being a simple and accessible tool for homeowners to use. One drawback of this simplified approach to conifers in Zone 1 is that homeowners may feel obligated to remove one or more mature well-spaced and pruned conifers (as are common with Ponderosa pines in Kaleden) because this factor contributes 30 points to the overall hazard rating for the site and structure. This places the structure into the 'High' hazard level even if all other factors score zero. This type of tree removal most often requires a tree service provider, at considerable expense.

A more nuanced view of well-spaced and pruned conifers in Zone 1 is taken by the author, in the hope that the hazard mitigation efforts (and expense) of homeowners can be better targeted towards more prescient hazard factors.

To be clear, *this proviso applies only to well-spaced and pruned conifers that won't readily support torching* (i.e. a tree burning completely from bottom to top), such as those depicted in Figure 13. Conifers with ladder fuels that connect surface fuels with canopy fuels, such as various ornamental and native spruce, *present a very real hazard when occupying space in Zone 1 and should be considered for removal*. It should also be reiterated that mature Ponderosa pine can produce a considerable amount of needle litter, and this characteristic may in fact be a more significant hazard (fortunately, one that is easier and significantly less costly to mitigate).

Figure 13 The Ponderosa pines in the foreground provide an example of well-spaced and pruned conifers with a low liklihood of torching.

6.1.1 Landscaped fuel

One vegetation feature that is very popular and pervasive in landscaping is the use of arborvitaes (cedar) and juniper shrubs and hedges. The use of cedar hedging is popular throughout the Okanagan, including the Kaleden fire district (see Figures 14 & 15), and this can be problematic from a home ignition perspective. The presence of these conifers in Zone 1 needs to be carefully considered, as they are extremely volatile from a fire behaviour standpoint.

Arborvitaes and juniper are members of the Cupressaceae (cypress) family and their foliage are rich in organic volatile compounds and terpenes, which have low flash points (Ubysz & Valette, 2010). Having a cedar or juniper shrub growing up against a house could very well be the source of a home ignition in the very likely event that these plants combust during a wildfire. Similarly, a long cedar hedge that leads up to a house can be viewed as a veritable wick of fuel waiting for a wildfire to light it. If removal is not an option, these fuels should be isolated by spacing and pruning so as to reduce the continuity and connectivity to adjacent structures (FIREsafe Marin, 2017).

Figure 14 An extensive clump of junipers in proximity to a home. These junipers have also surrounded a residential propane tank, identified by the red regulator cover on the white tank.

Figure 15 An extensive clump of junipers in proximity to a home.

Another popular, low maintenance landscaping strategy that unfortunately presents a home ignition hazard is the use of bark mulch as a ground cover. Kaleden has several examples of bark mulch used in landscaping – and in some cases this is presenting a hazard to the adjacent homes. During the hot summer months, bark mulch will dry out and become extremely receptive to ember ignition and conducive to persistent surface fire spread (Quarles & Smith, 2011). Bark mulch should be viewed as a fuel bed that can effectively transport fire throughout its extent when sufficiently dry (e.g. Figure 16). Homeowners should consider any flammable connections between a bark mulch bed and the house (e.g. wood siding, wood stairs etc.) as a pathway for direct flame contact that could result in the ignition of the home. Through their research, Quarles and Smith (2011) recommend that noncombustible materials (e.g. rock, gravel, concrete, pavers etc.) or ignition-resistant plants (e.g. irrigated lawn) be used within five feet from a structure in place of combustible materials such as bark mulch.

Figure 16 Various types of mulch can be extremely susceptible to ember ignition during a wildfire (FIREsafe Marin, 2013).

6.1.2 Roadside fuel

Public roads within the Kaleden fire district are managed and maintained under the jurisdiction of the Ministry of Transportation and Infrastructure (MOTI), within Service Area 8 (South Okanagan). Road maintenance is provided by Argo Road Maintenance (S OK) Inc. under a highway maintenance agreement which began on May 10, 2004 and is due to expire on April 30, 2019 (MOTI, 2015). The highway maintenance standards in effect are contained in the original agreement entered into in 2004 (MOTI, 2003). When a new highway maintenance agreement is entered into in 2019, the highway maintenance standards will reflect those within the 2018-2019 highway service agreement (MOTI, 2018).

The issue of roadside mowing (referred to as shoulder mowing in the highway maintenance standards) has received attention in the aftermath of the 2017 Kaleden wildfire (RDOS, 2017) and was voiced as a concern by the Kaleden FireSmart Board. The 2003-2004 highway maintenance standards specify the following:

- shoulder mowing along summer maintenance class 1-5 roads;
- mowing width is 1.8 m beyond the shoulder edge;
- mowing height is down to the lowest possible height, given terrain; and
- mowing to be performed when the grass reaches 25 cm, up to a maximum of two cuts per year.

The summer road maintenance classification map layer was clipped to the Kaleden fire district boundary in order to summarize the various classifications (see Table 2) and the implications for shoulder mowing. As depicted in Table 2, of the 52.2 km of classified roads within the Kaleden fire district, 16 km of road have a summer maintenance classification of 6 through 8, and as such are not included in the highway maintenance standards for shoulder mowing. However, the 2018-2019 maintenance standards that will form part of the new maintenance agreement in 2019 specifies shoulder mowing for maintenance class 1 through 7 roads. Roads that are maintenance class 8 receive no summer maintenance.

Figure 17 Cured grass along the shoulder of Linden Avenue, which is a summer maintenance class 5 road and included in the highway maintenance standards that are currently in effect. The cured grass on this shoulder would likely permit fire spread along the shoulder.

Shoulder mowing is done in part to manage fire hazards along roadways, and for good reason. During the July 4, 2017 wildfire in Kaleden, roadside vegetation provided an avenue for fire spread (D. Gaudry 2018, pers. comm., 20 June). Although grass doesn't burn with particularly high intensity, it can support a high rate of spread and provide connectivity to other fuel, such as flammable landscaping or agricultural fields and quickly contribute to additional firefighting problems (see Figure 17). Additional examples of shoulder vegetation are provided in Figures 18 -20.

Figure 18 Looking north east down Dogwood Avenue. This road is summer maintenance class 6, which is not included for shoulder mowing in the highway maintenance standards that are currently in effect.

Figure 19 Looking south on Linden Avenue. This road is summer maintenance class 5, which is included for shoulder mowing in the current highway maintenance standards. This photo depicts an extensive clump of juniper that have spilled onto the road from an adjacent property.

Figure 20 Shoulder vegetation along Spruce Avenue, a summer maintenance class 6 road, and as such not included for shoulder mowing in the current highway maintenance standards.

Table 2 Summary of road length by summer road maintenance class within the Kaleden fire district.

Summer Road Maintenance Class	Length (km)
1	8.0
2	11.1
3	0.0
4	0.0
5	17.1
6	9.6
7	3.8
8*	2.7
Total	**52.2 km**

*No Summer Maintenance

6.1.3 Fuel on cultivated land

The Kaleden site has extensive areas established as vineyards, orchards and other agriculture intermixed among homes. These areas are generally considered fairly resistant to fire given irrigation practices, however there are conditions under which vineyards can carry fire, and this was apparent during the 2017 Kaleden fire (D. Gaudry 2018, pers. comm., 20 June).

The issue experienced during the Kaleden fire was related to the ability of the cover crop or mulching used in the alleyway between vine rows to carry fire through the vineyard. Perennial cover crops, such as grass species, are commonly planted in established vineyards to facilitate worker and tractor movement. Grasses can also prevent nitrate leaching in soil and help to reduce soil erosion significantly. In regions with dry summers, grasses go quiescent (a state of dormancy) and do not compete aggressively for water during the season (Skinkis, 2015).

When a grass cover crop goes dormant and becomes cured it becomes increasingly available to burn. If the cover crop has connectivity with adjacent fuels, such as a road shoulder, fire could spread freely between the two and contribute to additional fire spread beyond.

Several abandoned agricultural lots exist in Kaleden. Generally, these ‘old fields’ are characterized by grass, weeds, old fruit trees, various refuse etc. Left unmanaged, these areas represent fuel loading that can contribute to rapid fire spread and potentially threaten adjacent properties.

Figure 21 Vineyard with a green cover crop in the alleyway between rows. There is no concern of fire spread through the vineyard when the cover crop is green, however, as the cover crop goes dormant and becomes cured it becomes increasingly available to burn. Isolote long durnable alleyways from adjacent fuels, such as the shoulder grass in the foreground.

6.1.4 Yard waste dumping

Several examples of yard waste dumped into gullies and over the edge of slopes were observed (see Figures 22 & 23). Yard waste, such as pruning debris, grass clippings, Ponderosa pine needles etc. need to be viewed as a fuel source for wildfire. While perhaps considered “out of sight, out of mind”, these yard waste fuel sources are often dumped into some of the worst possible places, where steep topography contributes to increased fire behaviour. At best, yard waste fuel accumulations are a stubborn mop-up problem for firefighters – at worst, they intensify upslope fire spread and concentrate energy up the length of gullies and at slope crests putting people and property at increased risk. A longtime Kaleden resident summarizes perfectly: “I strongly advise people not to discard yard waste into these draws and gullies, of which Kaleden has many. It’s just a huge fuel load,” (Richardson, 2017).

Figure 22 Yard waste vegetation is commonly dumped into gullies and over the edge of steep slopes, resulting in elevated fuel loads. This practice can contribute to increased fire intensity at slope crests and in gullies, making firefighting more difficult.

Figure 23 This home has junipers growing at the slope crest below the home, as well as a yard waste pile to the left of the junipers, at the slope crest. Both of these features would increase the intensity of a wildfire as it crested the slope below the home.

6.1.5 Nearby combustibles

In the context of the structure and site hazard assessment, nearby combustibles refer to non-vegetative fuel, such as firewood, wood fences, sheds etc. One such fuel in this category is firewood stacked within 10 m (or directly adjacent) of the structure. Firewood stacked against the house, in a carport or under an open deck space, during the summer, is a bad combination. A stack of firewood has ample gaps and surface area where embers could deposit and ignite, and if the stack is situated too close to the house, ignition of the structure is likely.

Figure 24 Avoid placing firewood adjacent to the home until after the fire season. Prior to the start of the next fire season, eighter ensure the firewood is used up or move the pile away from the house.

Avoid this possibility during the summer by storing firewood well away from the home (a minimum of 10 m), so that if the firewood stack does ignite during a wildfire, the house won't follow suit. If firewood is stored in a woodshed within 10 m of the house, and the shed can't be relocated further away from the house, the woodshed should be retrofitted to prevent embers from entering the shed and igniting the firewood. This retrofit can be accomplished through a combination of 12 mm exterior-grade plywood sheathing and 3 mm non-corrosive screening, and still provide adequate airflow to season the stored firewood.

Wood fences, particularly those that attach to the house, can provide a pathway for fire to potentially ignite the house. Where a wood fence is within 10 m of a house, the entire fence should be assessed for locations where the fence intersects any fine fuel beds, such as bark mulch, natural grasses etc. For example, a wood fence with a bark mulch bed up against it is susceptible to embers igniting the bark mulch and in turn igniting the fence (Figure 22). As well, a wood fence that backs onto natural grasses could ignite from a low-intensity surface fire moving through the grass. In either case, the length of the fence could burn, including the portion where the fence attaches to the house, potentially leading to ignition of the structure. One strategy that can help to maintain the privacy of a wood fence while also lowering the chance of a connected fence from igniting the house, is to install a metal gate at or near the fence-house junction.

Even innocuous items commonly found around the outside of a home may act as combustibles that could ignite the structure. Flammable patio furniture (particularly seat cushions), sisal doormats and rugs, or even a corn broom leaning against the house are all potential fuels that could ignite from ember accumulation.

6.2 Structure Characteristics

6.2.1 Roof assemblies

A home's roof is the largest surface most exposed to embers during a wildfire. Homes with a flammable wood shake roof have a much higher probability of igniting during a wildfire compared to non-wood roofing systems. In Kaleden, a mix of roofing materials are in use, the most common being composite shingles (i.e. asphalt shingles), while a smaller percentage have metal roofs or torch-on roofing systems. A small number of homes were noted as having a wood shake roof. A wood shake roof is not recommended in a WUI area.

The fire-resistant properties of most roofing systems are reduced when flammable accumulations burn on the roof surface. Areas dominated by a Ponderosa pine overstory, such as areas of Kaleden, will likely always have some amount of needle litter present on roofs, especially after periodic wind events. The key problem areas that should be attended to are accumulations that occur at a roof to wall joint (e.g. where a dormer meets the roof), in the rain gutters or in or near any opening in the roof (vent, skylight etc.). Inspecting and cleaning debris accumulations in the spring, prior to the start of the summer fire season is a recommended practice.

6.2.2 Exterior cladding

Risk factors associated with the exterior surface of a structure are less dependent on the characteristics of the exterior cladding system (e.g. stucco vs. cement board vs. vinyl siding etc.) and more dependent on the likelihood of direct flame contact and/or ember accumulation on the structure. Accumulated fuel along an exterior wall can negate the fire-resistant advantages that any particular exterior cladding system provides, should the fuel ignite. This is especially important when assessing features that are attached to a home, such as decks and porches. Decks are often used for dry storage of a variety of materials, including firewood, building materials, outdoor furniture etc. Should these stored materials ignite, the deck above is likely to ignite as well, most likely leading to the ignition and subsequent destruction of the home.

6.2.3 Decks, porches and balconies

When boards are used for the decking surface, any gaps between boards (referred to as the *between-deck-board gap* in ember ignition research, such as Quarles and Standohar-Alfano [2017]) should be viewed as avenues for organic debris to fall through and accumulate underneath the deck or accumulate on the deck surface. Debris and embers can also accumulate at a between-deck-board gap location above a support joist (Quarles & Standohar-Alfano, 2017). Between-deck-board gaps can also permit embers to fall through and ignite accumulated debris under the deck, potentially resulting in the ignition of the deck and subsequently the house.

If combustible material is to be stored under a deck, this area should be sheathed in 12 mm exterior-grade plywood or screened with 3 mm non-corrosive metal screening to prevent embers from entering the space and igniting the stored material. Areas underneath deck boards should be assessed for debris accumulations and cleaned out as needed.

Figure 25 This photo was taken during testing by the Insurance Institute for Business & Home Safety. A full-scale home model placed in a burn chamber was subjected to an ember blizzard to test the effect of embers and ember accumulation on structures during a wildfire. Deck boards permitted embers to pass through the between-deck-board-gaps and ignited combustible accumulations under the deck. A deck or porch where the underside is completely open offers no resistance to ember accumulation. [Photo: (Quarles & Standohar-Alfano, 2017)]

6.3 Topographical Factors Related to Home Sites

Where homes are situated in relation to local topography can have a strong influence on home ignition probability during a wildfire. Whether a home is located at the bottom or top of a slope presents entirely different fire behaviour potential. As well, topography also influences the layout of property lot boundaries, which may benefit a particular land use or value (such as preserving a view) but may also present an unintended fuel management challenge to the owner.

6.3.1 Setback from crest of slope

Setback refers to the relative distance between a structure and the crest of a slope (Figure 26). FireSmart Canada recommends a minimum 10 m setback for a single-story house and the setback should be increased proportionally for taller buildings (Partners in Protection, 2003). Existing homes without adequate setback need to mitigate fuel hazards further down the slope below in an effort to reduce potential fire intensity at the slope crest. Adequate setback becomes negated when flammable vegetation occurs at or near the crest of the slope, as depicted in Figure 23. Finally, a setback assessment must consider any decks or balconies between the crest of the slope and the home.

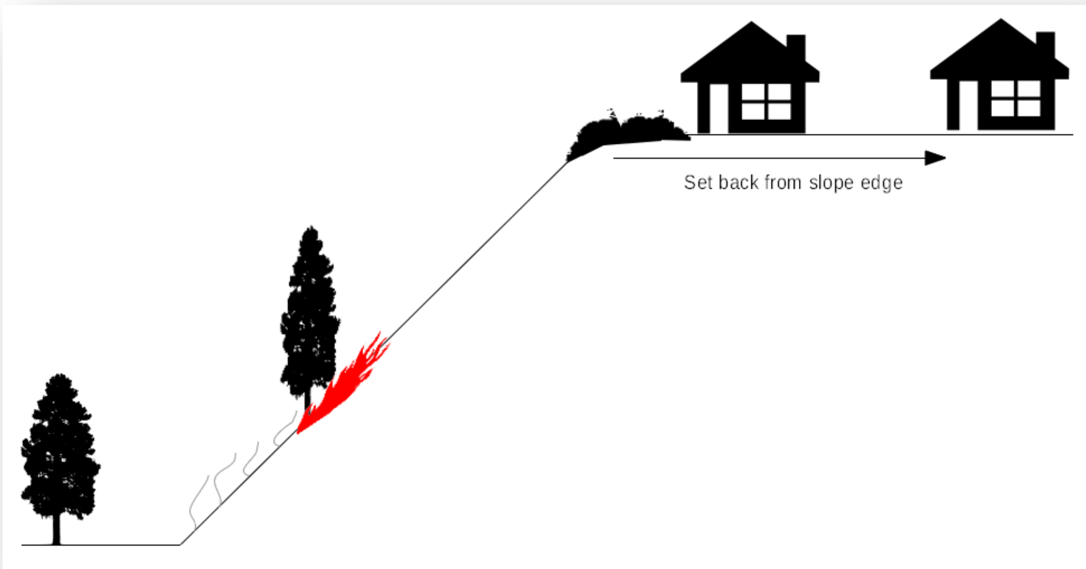


Figure 26 Set back from slope edge is the degree to which a home is away from the crest of a slope leading up towards the home. In this example, the home on the right has greater set back. The home on the left has less set back and would be subjected to fire as it crested the slope. In this illustration fuel loading attributed to landscaping is also present at the slope crest, further exaserbating the set back issues.

Decks that extend out over a slope require careful assessment. A fuel-laden slope leading up towards a deck could result in direct flame contact or ember accumulation on the deck or stored material under the deck. The underside of the deck may also trap heat from a fire coming upslope towards the structure, further contributing to increased ease of ignition. Figure 27 illustrates an example in Kaleden where the deck and home extend out over the crest of the slope. In this situation, without an effective fuel break below the home, a fire spreading upslope would impact the underside of the deck and home, through direct flame contact, convective heat and ember accumulation. In this case, fuel mitigation efforts need to be carried out down the slope. FireSmart Canada has developed a guideline for expanding the treatment area on slopes below a structure, as illustrated in Figure 28 (Partners in Protection, 2003).

Figure 27 No set back between the home and a 70% slope below. In addition, an overhanging deck and home further exposes the home to upslope fire spread and direct flame contact.

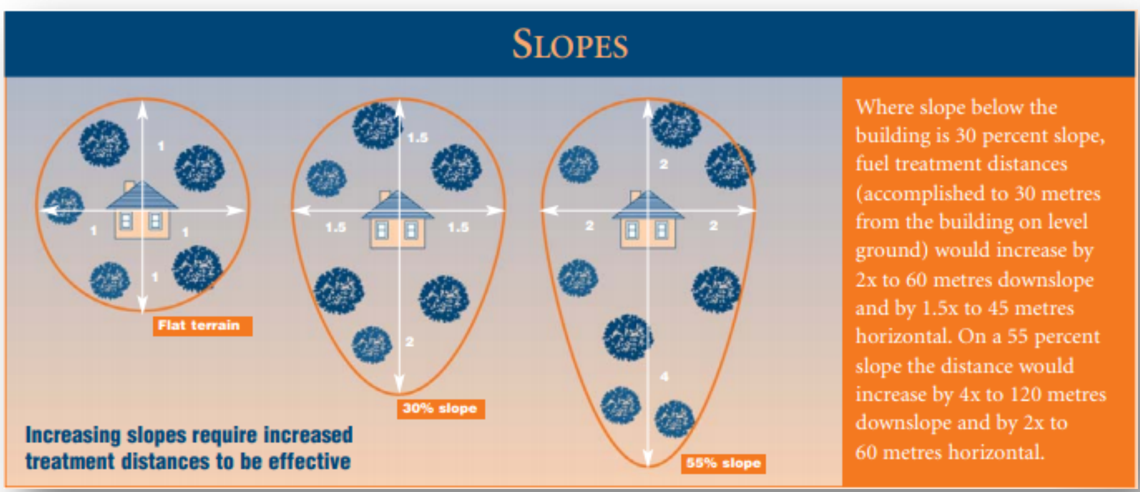


Figure 28 FireSmart Canada recommends expanding the treatment areas downslope from a home to account for the increased rate of spread and associated fire intensity of a fire spreading upslope towards the house (Figure reproduced from the Protecting Your Community from Wildfire manual published by FireSmart Canada and Partners in Protection).

6.3.2 Lot boundaries

Kaleden has several examples of lot boundaries that extend a significant distance downslope below the homes. A number of properties along Pineview Drive typify this issue, whereby lot boundaries extend downslope to the KVR rail trail or other private lots along the rail trail. In most cases, the lower portions of these lots are unused, in large part due to steep slopes (e.g. Figures 23 and 27). Figure 29 illustrates the land ownership and disposition between a portion of Pineview Drive and Skaha Lake. In this case, lot boundaries extend down to a strip of Crown Provincial land which contains the KVR trail. The trail itself exists under a Crown licence of occupation.

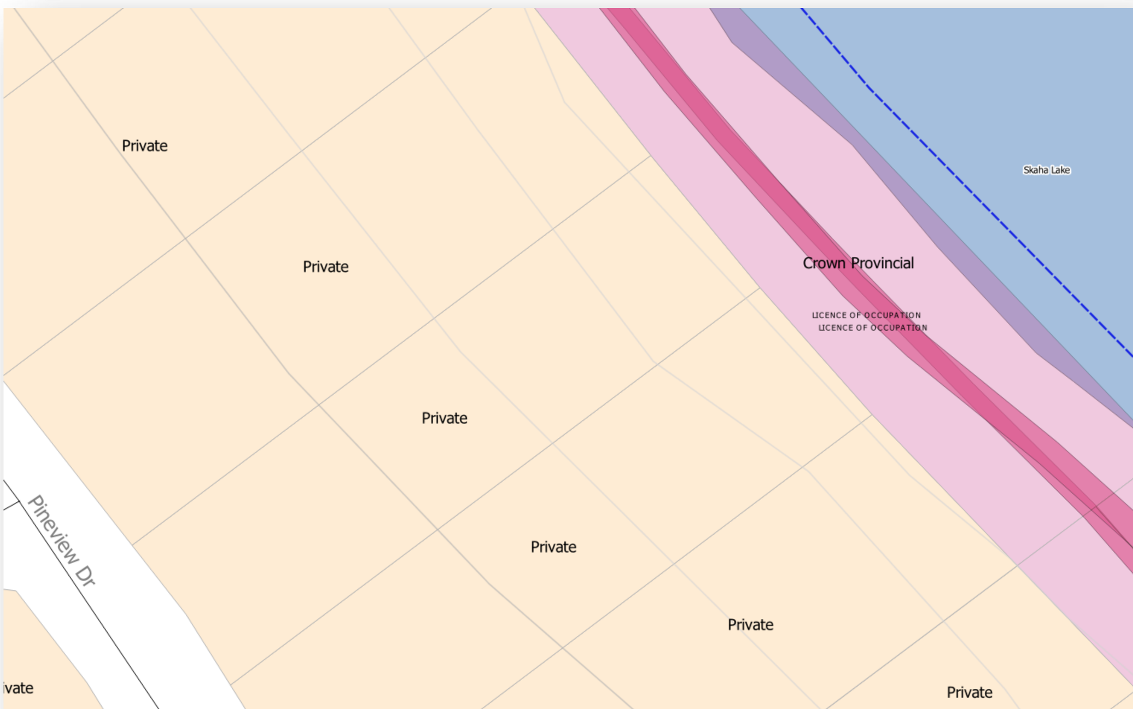


Figure 29 Parcel fabric for a portion of Pineview Drive above the KVR trail.

The strip of Crown Provincial land between the lot boundaries and the lake, as depicted in Figure 29, entails the toe of the slope below the private lots, as illustrated in the approximately corresponding Google Earth image in Figure 30. This situation effectively isolates the bottom of the lots from the trail and shoreline, meaning any fuel reduction efforts by property owners are contingent on bringing fuel upslope to Pineview Drive or treating in situ.

Where measured, as was done in Figure 27, slopes were up to 70% below portions of Pineview Drive, though steeper slopes and near vertical bluffs occur at various locations along the bench above the KVR trail. Conducting work on slopes of this magnitude can be extremely challenging and not without significant effort.

Figure 30 Three-dimensional Google Earth image of the area approximated in Figure 29. Significant portions of property lie downslope above the KVR trail where slopes are up to 70%. Fuel management on these slopes would be challenging.

6.5 Wildfire Preparedness and Part-time Residents

The Kaleden area has several motivated and proactive residents trying to address concerns related to wildfire preparedness in their neighbourhood. One common characteristic among proactive neighbourhoods is the recognition of the value of information sharing. To this end, even prior to this FireSmart project a group was formed in conjunction with the Kaleden VFD to build awareness around WUI fire safety and prevention. With the formation of the Kaleden FireSmart Board, it's likely that these efforts will continue to show promise.

One challenge to this is that a number of properties in the area are not occupied year-round, which can make it difficult to share information and build neighbourhood support, particularly for efforts that occur during the off-season. Additionally, there may be varying levels of concern related to wildfire preparedness and safety, depending on whether one lives in the neighbourhood full-time or not.

7.0 Recommendations

The FireSmart Canada Community Recognition Program seeks to create a resilient balance between residential safety and the natural aesthetics that are attractive to living in the WUI. Homeowners already balance their decisions about fire protection measures against their desire for certain flammable components on their properties. It is important for them to understand the implications of the choices they are making. These choices directly relate to the ignition potential of their home ignition zones during a wildfire.

Homeowners, and the community, should focus attention on the home and surrounding area and eliminate a wildfire's potential relationship with the house. This can be accomplished by disconnecting the house from potential fire spread, and by being conscious of the devastating effects of wind-driven embers.

7.1 Recommendations for Residents

The following recommendations are *in addition* to the guidelines and practices recommended by FireSmart Canada and are intended to provide residents living in the Kaleden fire district with specific guidance tailored to their area. The following are specifically recommended:

1. Substantially reduce the amount of highly combustible plants used in landscaping, such as cedar and juniper shrubs and hedges within Zone 1 (<10 m from the home);
    a. prioritize removal from the home, outwards;

b. where removal is not possible, isolate highly combustible plants through thinning and pruning so that if they do ignite, the resulting fire won't threaten an adjacent structure.

i. A number of resources exist to help make FireSmart plant selections. In addition to the FireSmart Guide to Landscaping, an interactive plant selection tool from the Monrovia Nursery Company allows users to select plants based according to hardiness zones and *Firescaping/Fire Wise* plants.

ii. Plants to avoid establishing include:

1. Pampas Grass (*Cortaderia selloana)*
2. Broom (*Genista sp.)*
3. Holly (*Ilex spp.)*
4. Juniper (*Juniperus spp.)*
5. Fountain Grass (*Pennisetum spp.*)
6. Colorado Spruce *(Picea pungens)*
7. Yew (*Taxus spp.*)
8. Cedar, Arborvitae (*Thuja spp.)*

2. Remove completely any combustible ground cover, such as bark mulch within five feet of a home and any attachments, such as decks, porches and stairs;

a. within five feet of a home, maintain a fuel-free strip of non-combustible material, such as rock, gravel, green lawn, concrete or paving stone walkways etc.;

b. beyond five feet, consider replacing combustible ground cover with non-flammable options, such as rock or gravel;

i. remove accumulations of combustible ground cover underneath highly-combustible plants, such as ornamental conifers.

3. Remove highly-combustible plants and landscaping materials at the crest between a home and slope.
4. Stop dumping yard waste into gullies or over the edge of slopes, as this practice increases fuel loading in some of the worst possible places;
    a. remove any existing yard waste that has been dumped where it increases fuel loading below homes.
5. Where grass is used as a cover crop in alleyways between grape vines, and the cover crop goes dormant during the dry season, ensure that the cover crop won't allow fire to spread into or out of vineyards, by:
    a. maintaining separation between alleyways and headlands by irrigating the ends of alleyways to keep them green through the summer, or
    b. maintaining a green or fuel-free strip across the length of the headland.
        i. suggested width of green or fuel-free strips is 1-2 m for a mowed grass cover crop – higher cover crops should have a wider fuel break.
6. Abandoned or fallow agricultural fields should be managed to prevent fire from spreading into or out of the field and posing a threat to adjacent properties;
    a. at minimum, establish and maintain a fuel break around the perimeter of abandoned fields;
    b. preferably manage the entire fuel complex within an abandoned field so that the field is either non-combustible or only capable of supporting low intensity fire (restricted by a perimeter fuel break), achieved through mowing, irrigation, cover cropping or reestablishment of a crop.

7.2 Recommendations for Local Government

7. Loosen the restrictions contained in the burning bylaw to enable more proactive debris disposal;

   a. modify the parameters for burning to be less dependent on lot size and more focused on safe and efficient burning conditions that present less risk and fewer smoke impacts.

8. Develop or improve the means to identify and mitigate wildfire fuel hazards on private property;
   a. Bylaw No. 2326, 2004 (A bylaw to regulate and control untidy and unsightly premises) speaks to *"…trees, brush, and other growths that create a safety hazard…"* but the process to initiate enforcement is dependent on three complainants willing to submit a complaint and appear as witnesses.
   b. enforcement should not be wholly contingent on complaints from residents; rather, the fire chief should be able to make a fuel hazard declaration and trigger the contents of Bylaw No. 2326, 2004 or a similar bylaw.
9. Consider the Crown land between Kaleden and St. Andrews for inclusion in a Forest Enhancement Society (FES) project to manage fuel conditions, while preserving or enhancing forage.
   a. Previous fuel management treatments along White Lake Road and Catamount Place are due for maintenance treatments.
10. Establish a vegetation maintenance standard jointly with the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) for the KVR trail, with the following considerations:
    a. Vegetation management along the KVR trail should at minimum occur annually, prior to grass curing;
    b. Vegetation management should serve to create a minimum 3 m buffer of reduced and less flammable fuel on the hill side of the trail;
    c. Ongoing funding for an enhanced vegetation maintenance schedule is required, as CRI and/or FES likely won't fund given the recurring nature of treatment;

d. This vegetation management issue along the KVR is not unique to Kaleden – MFLNRORD should assess all areas of wildland fuel along the KVR used by the public and that are situated below private property to determine if hazardous fuel conditions exist on Crown Provincial land.

11. Establish a memorandum of understanding with the Ministry of Transportation and Infrastructure to establish best practices for shoulder mowing in the Kaleden fire district for the purpose of mitigating roadside fine fuel hazards;

    a. ideally mowing should occur in the period between spring growth and grass dormancy.

8.0 Successful FireSmart Mitigations

When adequately prepared according to FireSmart guidelines a house can likely withstand a wildfire without the intervention of the fire service. Furthermore, a house and its surrounding community can be both FireSmart and compatible with the area's natural aesthetic. The FireSmart Communities Program is designed to enable communities to achieve a high level of protection against wildfire loss while maintaining a sustainable ecosystem balance.

Other than the replacement of an unrated wood roof or replacing a flammable deck, most FireSmart hazard mitigations around the home are inexpensive and straightforward. In many ways, hazard mitigation and spring or fall yardwork go together and can be scheduled as such. Most often it is the little things that a homeowner attends to that can make a big difference in whether their home will survive during a WUI fire. The following are good examples of steps that homeowners in Kaleden have taken to make their neighbourhood more resilient to wildfire:

8.1 Fire-Resistant Roofing

Replacing a roof is one of the single-most expensive FireSmart improvements. Fortunately, Kaleden is an example of a community where almost all the observed roofs consisted of some type of rated roofing system. Additionally, it is apparent that numerous properties maintain a high degree of roof cleanliness, which is an important practice in a WUI area with litter-producing trees occupying Zone 1 space. The combination of a rated roof that is free of fuel accumulations is a big step to improving the survivability of a home during a wildfire event.

8.2 Landscaping

Residents of Kaleden can look to several examples where their neighbours have established less-flammable vegetation and landscaping solutions in their respective Zone 1 areas. The use of rock and less-flammable vegetation is one such example (Figure 31). Maintaining a green lawn and placing walkways and patios against a home are also examples of landscape design that serves to disconnect the home from direct flame contact from adjacent fuel. In each of these examples, the landscaping employed has the effect of minimizing the chance of embers igniting fuel adjacent to the home and reducing the chance of direct flame contact to occur.

Figure 31 The landscaping materials used on this property help to increase the home's resilence to wildfire. Removal of the juniper shrubs within Zone 1 (<10 m from the house) should also be considered.

8.3 Nearby Combustibles

Keeping combustible material away from the home is crucial to reducing the home ignition potential. A number of examples of firewood piles situated beyond Zone 1 (<10 m from the house) were identified, including the log deck depicted in Figure 32. Admittedly the log deck location was likely chosen for convenience as much as hazard mitigation, but the result is the same.

Figure 32 This deck of unbucked firewood is well away from any structures. Admittedly this was likely the most convenient location to unload these logs, but the benefit of separating firewood from the home during the summer remains.

Figure 33 Although the natural grasses immediately adjacent to this home could use some mitigation, the rest of the Zone 1 (<10 m from the home) is generally free from heavy fuel accumulations and represents reasonably good defensible space.

9.0 Next Steps

The Kaleden FireSmart Board was established prior to the beginning of this project and the goal from the outset has been to pursue FireSmart Community recognition status. As the Local FireSmart Representatives retained to complete this project on behalf of the Kaleden fire district and RDOS, the author has prepared the CAR needed for application.

In addition to this assessment report, the author has drafted the initial FireSmart Community Plan for Kaleden. This plan is simple and intended to be the first iteration of the annual operating plan for the Kaleden FireSmart Board as they strive to maintain their community recognition. Subsequent annual FireSmart Community Plans will be drafted by the Kaleden FireSmart Board, with the initial template providing an easy starting point.

To ensure initial and ongoing community recognition, the following standards have been incorporated into the Kaleden FireSmart Community Plan:

- support the Kaleden FireSmart Board in their goal to maintain the Kaleden FireSmart Community Plan and ongoing recognition status;
- invest a minimum of $2.00 annually per capita in its local FireSmart Events and activities (work done by municipal employees or volunteers, using municipal or other equipment, can be included, as can provincial/territorial grants dedicated to that purpose);
- hold a FireSmart Event (e.g. FireSmart Day) each year that is dedicated to a local FireSmart project;
- submit an application form or annual renewal application form with supporting information to FireSmart Canada. This application or renewal process documents continuing participation in the FireSmart Communities Program with respect to the above criteria.

Finally, the Kaleden CAR is not intended to replace the foundational Community Wildfire Prevention Plan for the RDOS. The RDOS has applied to the UBCM for funding to update the CWPP for the regional district, and this will be an important step in reevaluating fuel hazards on public land and recommendations for fuel hazard mitigation. The CWPP forms the basis for subsequent treatment rationale in requests for provincial mitigation funding under the Community Resiliency Investment program, administered by the UBCM. The Kaleden CAR will help to guide the update of the CWPP and bolster the rationale for fuel hazard mitigation treatments on public lands in the fire district.

10.0 Signature of Local FireSmart Representative

The completion of a FireSmart Community Assessment Report is not normally contingent upon certification by a qualified professional. Rather, the qualification needed to conduct these assessments is the Local FireSmart Representative training authorized by FireSmart Canada. The CAR for the Kaleden fire district includes certain information and opinions related to wildfire management that fall within the scope of professional forestry. As such, this CAR is signed and sealed accordingly.

Signed:

REGISTERED PROFESSIONAL FORESTER
PROVINCE OF
ANDREW K. LOW
BRITISH COLUMBIA
NO. 4949

"I certify that the work described herein fulfills the standards expected of a member of the Association of British Columbia Forest Professionals and that I did personally supervise the work."

January 29, 2019

Andrew K. Low, RPF and Local FireSmart Representative

Davies Wildfire Management Inc.

References

Arstad, S., 2017. Kaleden couple spared wildfire's wrath. *iNFOnews.ca*, 9 July.

Blanchi, R. & Leonard, J., 2008. Property safety. In: J. Handmer & K. Haynes, eds. *Community Bushfire Safety.* s.l.:CSIRO, pp. 77-85.

Butler, B. W. & Cohen, J. D., 1998. Modeling potential structure ignitions from flame radiation exposure with implications for wildland/urban interface fire management. *Proceedings of the 13th Fire and Forest Meteorology Conference,* pp. 81-86.

Calkin, D. E., Cohen, J. D., Finney, M. A. & Thompson, M. P., 2014. How Risk Management Can Prevent Future Wildfire Disasters in the Wildland-Urban Interface. *Proceedings of the National Academy of Sciences,* 111(2), pp. 746-751.

Cohen, J., 2000. Preventing disaster: Home ignitability in the wildland-urban interface. *Journal of Forestry,* 98(3), pp. 15-21.

Cohen, J., 2008. The wildland-urban interface fire problem. *Forest History Today,* Volume Fall 2008, pp. 20-26.

Cohen, J. & Saveland, J., 1997. Structure Ignition Assessment Can Help Reduce Fire Damages in the W-UI. *Fire Management Notes,* 57(4).

Environment Canada, 2018. *Historical Data.* [Online]
Available at: http://climate.weather.gc.ca/historical_data/search_historic_data_e.html
[Accessed 15 October 2018].

FIREsafe Marin, 2013. *Mulch.* [Online]
Available at: https://www.firesafemarin.org/mulches
[Accessed 31 October 2018].

FIREsafe Marin, 2017. *Arborvitae.* [Online]
Available at: https://www.firesafemarin.org/plants/fire-prone/item/arborvitae
[Accessed 31 October 2018].

FireSmart Canada, 2012. *FireSmart Guide to Landscaping.* [Online]
Available at: https://www.firesmartcanada.ca/images/uploads/resources/FireSmart-Guide-to-Lanscaping.pdf
[Accessed 12 December 2018].

Monrovia Nursery Company, 2019. *Plant Catalogue.* [Online]
Available at: https://www.monrovia.com/plant-catalog/
[Accessed 2 January 2019].

Moritz, M. et al., 2014. Learning to coexist with wildfire. *Nature,* Volume 515, pp. 58-66.

MOTI, 2003. *Ministry of Transportation and Infrastructure Highway Maintenance Specifications, 2003-2004 Chapter 4.* [Online]

Available at: https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/highway-bridge-maintenance/highway-maintenance/maintenance-agreements/maintenance-specifications/chapter_4_roadside_maintenance.pdf
[Accessed 15 August 2018].

MOTI, 2015. *Ministry of Transportation and Infrastructure - Highway Maintenance Value of Agreements.* [Online]
Available at: https://www2.gov.bc.ca/gov/content/transportation/transportation-infrastructure/contracting-to-transportation/highway-bridge-maintenance/highway-maintenance/value-of-agreements
[Accessed 16 August 2018].

MOTI, 2018. *Ministry of Transportation and Infrastructure Highway Maintenance Specifications, 2018-2019 Schedule 1.* [Online]
Available at: https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/highway-bridge-maintenance/highway-maintenance/maintenance-agreements/maintenance-specifications/schedule_1a_specifications_-_final_-_2018-19.pdf
[Accessed 15 August 2018].

Partners in Protection, 2003. *FireSmart: Protecting your Community from Wildfire.* 2nd ed. Edmonton: Partners in Protection.

Province of British Columbia, 1995. *Biodiversity Guidebook.* [Online]
Available at: https://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/biodiv/biotoc.htm
[Accessed 3 April 2017].

Quarles, S. L. & Standohar-Alfano, C. D., 2017. *Ignition Potential of Decks Subjected to an Ember Exposure,* Tampa: Insurance Institute for Business & Home Safety.

Quarles, S. & Smith, E., 2011. *The combustibility of landscape mulches,* Reno: University of Nevada Cooperative Extension.

RDOS, 2009. *Open Air Burning Bylaw No. 2364, 2005.* [Online]
Available at:
http://www.rdosmaps.bc.ca/min_bylaws/bylaws/leg_services/RDOS/2009/BL2364_Consolidated.pdf

RDOS, 2017. *Schedule of meetings, agenda package.* [Online]
Available at:
http://www.rdosmaps.bc.ca/min_bylaws/contract_reports/CorpBd/2017/20170803AgendaPackage.pdf
[Accessed 31 October 2018].

RDOS, 2018. *Electoral Area "I" and LGA Revisions Update.* [Online]
Available at: http://www.rdos.bc.ca/departments/development-services/planning/strategic-projects/electoral-area-i-lga-revisions-update/
[Accessed 31 October 2018].

RDOS, 2018. *Regional District of Okanagan-Similkameen - Open Data.* [Online]
Available at: http://hub-rdos.opendata.arcgis.com/datasets/f463999e18ed425a98bf1da12fc1a71a_2

[Accessed 19 October 2018].

Richardson, L., 2017. *Kaleden couple spared wildfire's wrath* [Interview] (9 July 2017).

Skinkis, P., 2015. *Overview of vineyard floor management.* [Online]
Available at: https://articles.extension.org/pages/31597/overview-of-vineyard-floor-management
[Accessed 31 October 2018].

Taylor, S. W. & Alexander, M. E., 2016. *Field Guide to the Canadian Forest Fire Behaviour Prediction (FBP) System.* 2nd ed. Edmonton: Natural Resources Canada, Canadian Forest Service, Nothern Forestry Centre.

Ubysz, B. & Valette, J.-C., 2010. Flammability: Influence of Fuel on Fire Initiation. In: J. S. Silva, F. Rego, P. Fernandes & E. Rigolot, eds. *Towards Integrated FIre Management - Outcomes of the European Project Fire Paradox.* Joensuu: European Forest Institute.

Westhaver, A., 2017. *Why some homes survived: Learning from the Fort McMurray wildland/urban interface fire disaster,* Toronto: Institute for Catastrohic Loss Reduction.

Wilson, A. A., 1988. Width of firebreak that is necessary to stop grass fires: some field experiments. *Canadian Journal of Forest Research,* 18(6), pp. 682-687.

Appendix 1 – FCCRP Community Wildfire Assessment

This Community Wildfire Hazard Assessment form provides a written evaluation of the overall community wildfire hazard – the prevailing condition of structures, adjacent vegetation and other factors affecting the FireSmart status of a small community or neighbourhood. This hazard is based on the **hazard factors** and **FireSmart recommended guidelines** found in **FireSmart: Protecting Your Community from Wildfire** (Partners in Protection, 2003) and will assist the Local FireSmart Representative in preparing the FireSmart Community Assessment Report. **NOTE: Mitigation comments refer to the degree to which the overall community complies or fails to comply with FireSmart recommended guidelines with respect to each hazard factor**

Community Name: Kaleden Fire Dist. (RDOS)		**Date: June 20, 2018**
Assessor Name: A. Low		**Accompanying Community Member(s): D. Gaudry – KVFD Chief**
Hazard Factor	**Ref**	**Mitigation Comments**
1. Roof Assemblies		
a. Type of roofs ULC rated (metal, tile, asphalt, rated wood shakes) unrated (unrated wood shakes)	2-5 3-21	Kaleden and St. Andrews have a mix of roofing materials – mainly asphalt composition shingles. Small number of homes have a wood roof.
b. Roof cleanliness and condition * *Debris accumulation on roofs/in gutters; curled damaged or missing roofing material; or any gaps that will allow ember entry or fire impingement beneath the roof covering*	2-6	Areas of St. Andrews had some amount of debris accumulations attributable to Ponderosa pine (Py) needles. Treed areas of Kaleden proper had varying amounts of roof debris, mainly Py needles.
2. Building Exteriors		
2.1 Materials		
a. Siding, deck and eaves	2-7 2-8 2-9	Broad range of siding materials in use: wood, cement board, vinyl, stucco, small number of log homes.
b. Window and door glazing (single pane, sealed double pane)	2-10	Window construction can be difficult to assess at the community level. However, given the age and characteristics of the homes in the community, it can be assumed that most windows are double pane, which provide at least moderate protection. Regarding windows, focus vegetation management or removal within 10m of windows and glass doors, paying particular attention to fuels that could impinge on large picture windows.
c. Ember Accumulator Features (scarce to abundant) * *Structural features such as open eaves, gutters, unscreened soffits and vents, roof valleys and unsheathed crawlspaces and under-deck areas*		Moderate to abundant. Most exposure is attributed to under-deck areas and deck board surfaces. For under-deck areas, remove combustible accumulations that could that could be ignited by embers. If able to do so, enclose or at minimum screen, ember accumulator features. Screening should consist of corrosion-resistant, 3mm non-combustible wire mesh.
d. Nearby Combustibles – firewood, fences, outbuildings	2-11	Various examples of nearby combustibles such as firewood and wood fences. During fire season, store firewood at least 10m from the building. If firewood pile is downslope from the building, increase the distance away from the building. When choosing fencing options that adjoin the building, consider the flammability of the fencing, particularly where it attaches to the house.

Hazard Factor	Ref	Mitigation Comments
3. Vegetation		
3.1 **PZ-1:** Vegetation - 0 - 10m from structure **Page Reference 3-5**		
a. Overstory forest vegetation (treated vs. untreated)	2-14	Where overstory exists in the PZ-1 is primarily Ponderosa pine with a Douglas-fir component. Minor components of ornamental spruce are well-established in PZ-1 and in most cases, these are presenting a fuel hazard to adjacent homes.
b. Ladder fuels (treated vs untreated)	2-17	Majority of ladder fuels in PZ-1 are attributable to ornamental conifers that have branches extending down to ground level, as well as extensive use of mature cedar hedges established along lot boundaries for privacy. Juvenile Py and Fdi occur.
c. Surface fuels - includes landscaping mulches and flammable plants (treated vs untreated)	2-16	Bark mulch is being used on several properties for landscaping ground cover; in some cases, immediately adjacent to buildings. Coniferous ornamental plants (e.g. juniper; cedar; and cypress) are also highly abundant and often found immediately adjacent to buildings. Bark mulch is a receptive fuel bed for ember ignition, when available to burn. In general, ornamental conifers are highly flammable, due to volatile compounds, as well as a form and structure conducive to ignition and flaming combustion.
3.2 **PZ-2:** Vegetation - 10 - 30m from structures **Page Reference 3-9**		
a. Forest vegetation (overstory) treated vs untreated	2-14	Where overstory exists, primarily Ponderosa pine with a Douglas-fir component. Occasional ornamental conifers.
b. Ladder fuels treated vs untreated	2-17	Majority of ladder fuels are attributed to ornamental conifers and juvenile Py and Fdi.
c. Surface fuels treated vs untreated	2-16	PZ-2 transitions to native plants (e.g. Bluebunch wheatgrass, pinegrass, and arrow-leaved balsamroot) or agricultural fields (active and abandoned). Ponderosa pine needle litter accumulations present. Examples of landscaping extending from PZ-1 to PZ-2.
3.3 **PZ-3:** Vegetation - 30 - 100m from structures **Page Reference 3-13** Provide mitigation comments on the prevailing PZ3 fuel type		
a. Light fuel - deciduous – grass, shrubs	2-16	PZ-2 transitions to native plants (e.g. Bluebunch wheatgrass, pinegrass, and arrow-leaved balsamroot) and agricultural fields (active and abandoned). Ponderosa pine needle litter accumulations present.

Hazard Factor	Ref	Mitigation Comments
b. Moderate fuel - mixed wood – light to moderate surface and ladder fuels, shrubs	2-17	Big sagebrush, some antelope brush. Occasional deciduous shrubs. Juvenile Py and Fdi within overstory.
c. Heavy fuel - coniferous - moderate to heavy surface and ladder fuels, shrubs	2-14	Heavy concentrations are mainly found in gullies. Deep Py needle accumulations.
d. Logging slash, dead/down fuel accumulations	2-16	No slash or significant dead/down fuel accumulations observed.
e. Diseased forest – without foliage vs with foliage		No significant forest health factors observed.
f. Fuel islands within community - treated vs untreated		Most prominent fuel islands are found within gullies.
4. Topography		
4.1 Slope (within 100m of structures)		
a. Slope - Flat or < 10 %, 10 – 30% or >30%	2-19	Areas of Kaleden have slopes >30%, including areas along Pineview Drive where homes are above 70% slopes.
4.2 Buildings setback on slopes >30 %, position on slope. Provide mitigation comments on items a – c as applicable		
a. Setback from top of slope > 10m, or bottom of slope – valley bottom. b. Buildings located mid-slope c. Setback from top of slope <10m, or upper slope	2-12	Various setback issues. Most significant are along Pineview Drive with 70% slopes below.

Hazard Factor	Ref	Mitigation Comments
5. Infrastructure – Access / Egress, Roads, Driveways and Signage		
5.1 Access Routes – Road Layout To FireSmart Recommended Guideline?		
a. Single Road or Looped Road	3-28	Mainly looped, however short sections of single no-outlet roads are present.
5.2 Roads- width, grade, curves, bridges and turnarounds		
a. To FireSmart Recommended Guideline?	3-30	Mainly paved. Kaleden has some very narrow, steep and winding road sections. Little to no shoulder space is common and several no-outlet roads have no turnaround.
5.4 Fire Service Access / Driveways - Grade, Width/Length, Turnarounds		
a. To FireSmart Recommended Guideline?	3-30	Highly variable. Steep areas of Kaleden has the majority of driveways unsuitable for apparatus. In these cases, apparatus should park on the road.
5.5 Street Signs / House Numbers		
a. To FireSmart Recommended Guideline?	3-30	Yes.
6. Fire Suppression - Water Supply, Fire Service, Homeowner Capability		
6.1 Water Supply		
a. Fire Service water supply – hydrants, static source, tender or no water supply	3-32	Kaleden and St. Andrews have hydrants, though the spacing is significant in some cases. RDOS doesn't have an engineering layer on their public mapping system so exact distance between hydrants was not measured.
6.2 Fire Service		
a. Fire Service < 10 minutes or > 10 minutes, no fire service	2-25	Kaleden Volunteer Fire Dept. Within Kaleden proper drive time is <10 minutes. Drive time to St. Andrews is around 10 minutes. Times do not account for time needed for volunteers to muster.

6.3 Homeowners Suppression Equipment		
a. Shovel, grubbing tool, water supply, sprinklers, roof-top access ladder	3-28	Not assessed to the detail.
Hazard Factor	**Ref**	**Mitigation Comments**
7. Fire Ignition and Prevention – Utilities, Chimneys, Burn Barrel / Fire Pit, Ignition Potential		
7.1 Utilities		
a. To FireSmart Recommended Guideline?	2-24	Appears to be. Kaleden has overhead powerlines. St. Andrews has buried electrical and residential propane tanks at most homes.
7.2 Chimneys, Burn Barrel / Fire Pit		
a. To FireSmart Recommended Guideline?	2-22	Not assessed.
7.3 Ignition Potential - Provide mitigation comments on items a – d as applicable		
a. Topographic features adversely affect fire behaviour b. Elevated probability of human or natural ignitions c. Periodic exposure to extreme fire weather or winds d. Other	2-21	a. Homes situated at the top of slopes should focus fuel reduction efforts on slopes below relative to slope steepness. b. Extensive trail use occurs along KVR trail. Public education on interface risks for non-resident users of the area could be beneficial. c. Areas of the Okanagan experience elevated fire weather conditions through much of the summer. Hot and windy conditions are characteristic of the region during fire season and have influenced past WUI fire incidents in the past in the region.

General Comments:

- **Topographic features are a significant concern. Homes in proximity to gullies and at the top of slopes will experience increased fire behaviour attributable to slope effect and increased gulley fuel loading.**
- **Kaleden has extensive use of cedar and juniper shrubs and hedges in close proximity to homes. This factor will be one of the primary determinants of structure survivability in the event of a wildland urban interface fire.**
- **Hazard reduction efforts should focus on reducing the volume of cedar and juniper plants on properties.**

Appendix 2 – Structure and Site Hazard Assessment Form

Structure and Site Hazard Assessment Form

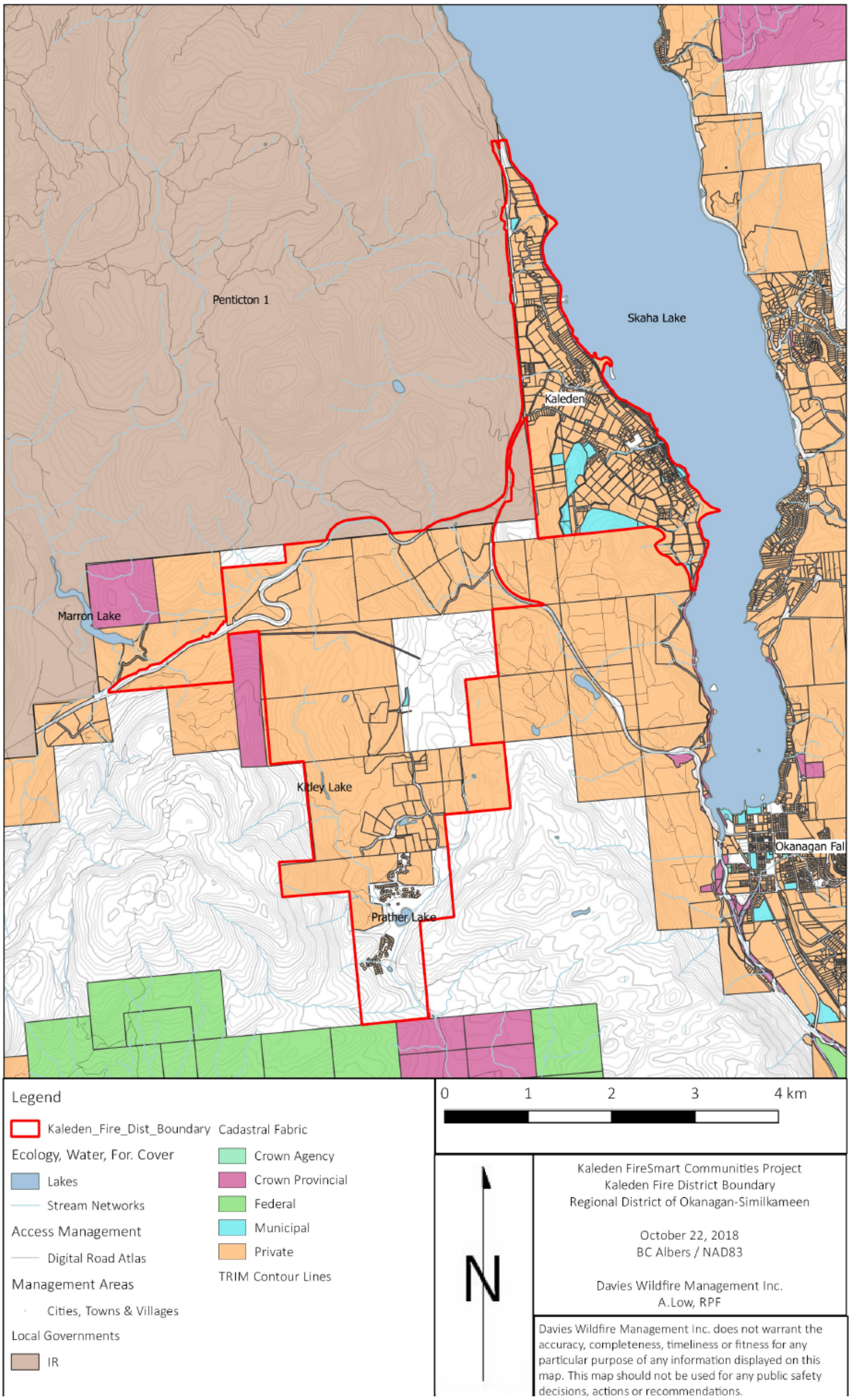
Factor	Page reference	Characteristics and point ratings			Score
1 Roofing material	2-5	Metal, tile, asphalt, ULC-rated shakes or non-combustible material		Unrated wood shakes	
		0		30	
2 Roof cleanliness	2-6	No combustible material	Scattered combustible material, <1 cm in depth	Clogged gutter, combustible material ≥1 cm in depth	
		0	2	3	
3 Building exterior	2-7	Non-combustible stucco or metal siding	Log, heavy timbers	Wood or vinyl siding or wood shake	
		0	1	6	
4 Eaves, vents and openings	2-8	Closed eaves, vents screened with 3 mm mesh and accessible	Closed eaves, vents not screened with 3 mm mesh	Open eaves, vents not screened, debris accumulation	
		0	1	6	
5 Balcony, deck or porch	2-9	None, or fire-resistant material sheathed in	Combustible material, sheathed in	Combustible material, not sheathed in	
		0	2	6	
6 Window and door glazing	2-10	Tempered	Double Pane	Single Pane	
			Small/medium | Large	Small/medium | Large	
		0	1 | 2	2 | 4	
7 Location of nearby combustibles	2-11	None or >10 metres from structure		<10 metres from structure	
		0		6	
8 Setback from edge of slope	2-12	Adequate		Inadequate	
		0		6	
9 Forest vegetation (overstory)	2-14	Deciduous	Mixed wood	Coniferous	
				Separated | Continuous	
<10 metres		0	30	30 | 30	
10 - 30 metres		0	10	10 | 30	
10 Surface vegetation	2-15	Lawn or non-combustible material	Wild grass or shrubs	Dead and down woody material	
				Scattered | Abundant	
<10 metres		0	30	30 | 30	
10 - 30 metres		0	5	5 | 30	
11 Ladder fuels	2-17	Absent	Scattered	Abundant	
10 - 30 metres		0	5	10	
				Total Score for Factors 1 – 11	
				Structure and Site Hazard Level	

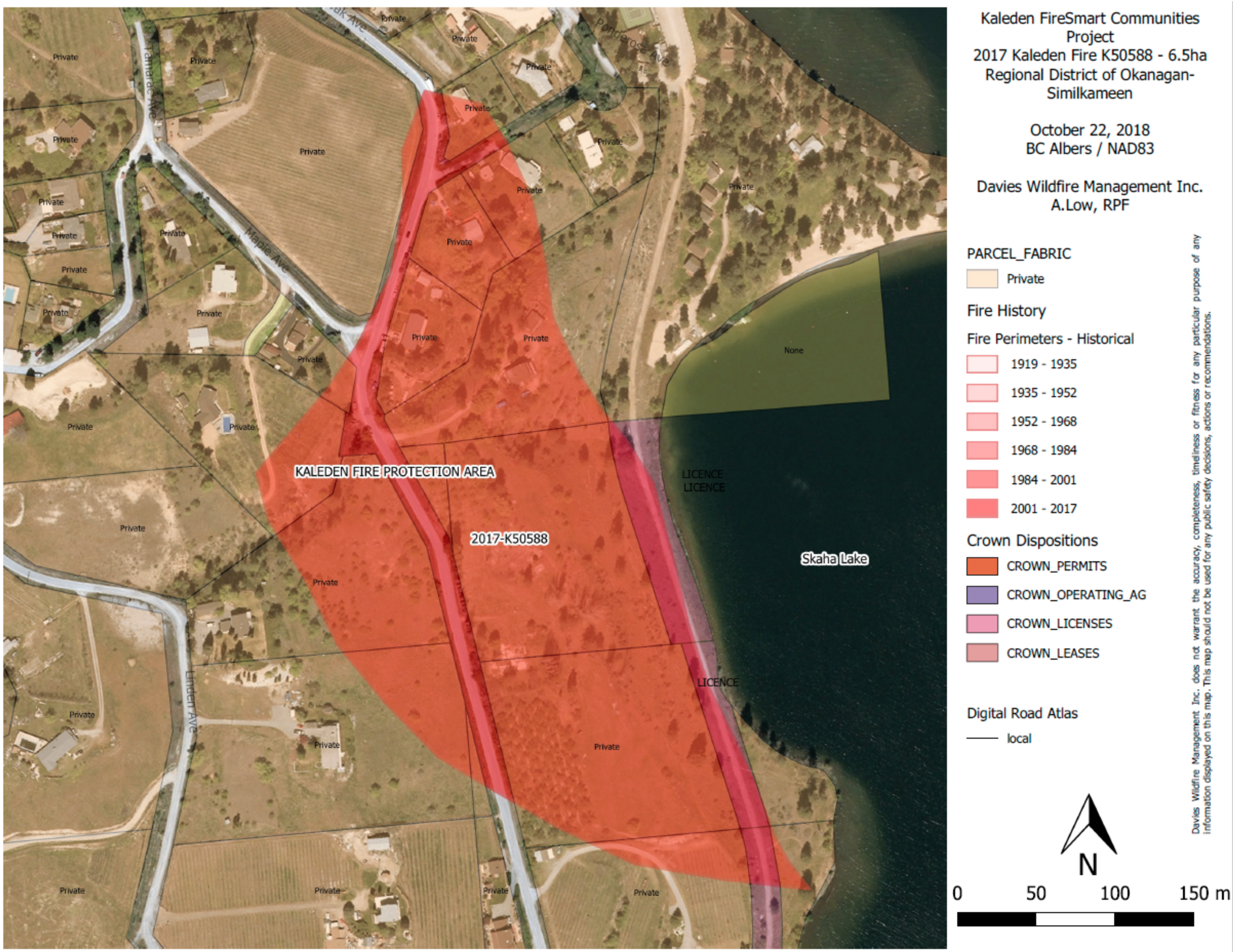
Hazard Level Low <21 points Moderate 21-29 points High 30-35 points Extreme >35 points

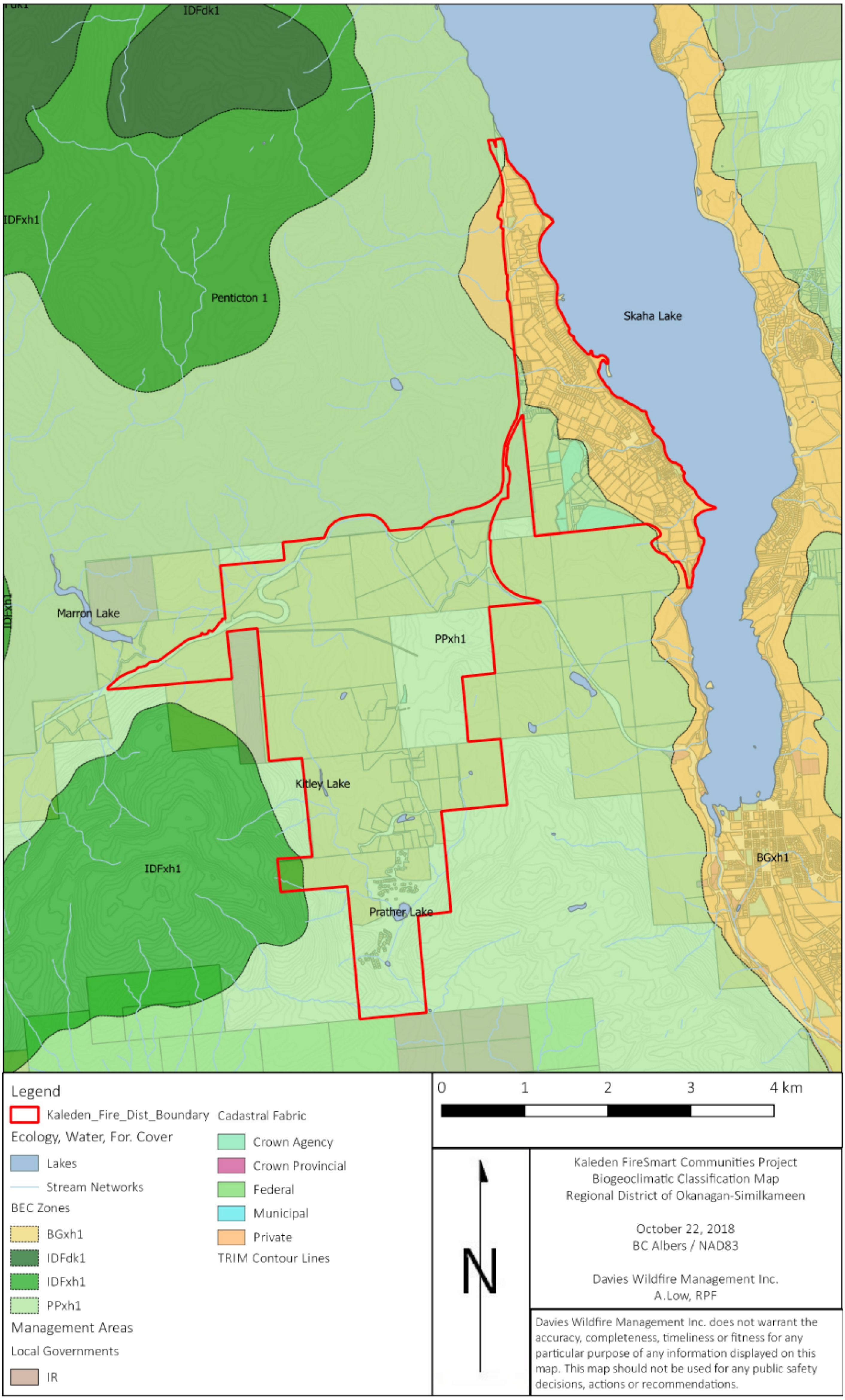
PARTNERS IN PROTECTION

Copyright © July 2003 Partners in Protection. All rights reserved.

Appendix 3 – Project Maps




Kaleden FireSmart Communities Project
2017 Kaleden Fire K50588 - 6.5ha
Regional District of Okanagan-Similkameen
October 22, 2018
BC Albers / NAD83
Davies Wildfire Management Inc.
A.Low, RPF
PARCEL_FABRIC
Private
Fire History
Fire Perimeters - Historical
1919 - 1935
1935 - 1952
1952 - 1968
1968 - 1984
1984 - 2001
2001 - 2017
Crown Dispositions
CROWN_PERMITS
CROWN_OPERATING_AG
CROWN_LICENSES
CROWN_LEASES
Digital Road Atlas
local
N
0 50 100 150 m
Davies Wildfire Management Inc. does not warrant the accuracy, completeness, timeliness or fitness for any particular purpose of any information displayed on this map. This map should not be used for any public safety decisions, actions or recommendations.
KALEDEN FIRE PROTECTION AREA
2017-K50588
Skaha Lake
LICENCE
LICENCE
LICENCE
None
Maple Ave
Linden Ave
Ponderosa Ave
Private


IDFdk1
IDFxh1
Penticton 1
Skaha Lake
Marron Lake
PPxh1
Kitley Lake
IDFxh1
Prather Lake
BGxh1
Legend
Kaleden_Fire_Dist_Boundary
Ecology, Water, For. Cover
Lakes
Stream Networks
BEC Zones
BGxh1
IDFdk1
IDFxh1
PPxh1
Management Areas
Local Governments
IR
Cadastral Fabric
Crown Agency
Crown Provincial
Federal
Municipal
Private
TRIM Contour Lines
0 1 2 3 4 km
N
Kaleden FireSmart Communities Project
Biogeoclimatic Classification Map
Regional District of Okanagan-Similkameen
October 22, 2018
BC Albers / NAD83
Davies Wildfire Management Inc.
A.Low, RPF
Davies Wildfire Management Inc. does not warrant the accuracy, completeness, timeliness or fitness for any particular purpose of any information displayed on this map. This map should not be used for any public safety decisions, actions or recommendations.