Community Wildfire Protection Plan

District of Lake Country

CWPP Update - January 2019

Davies Wildfire Management Inc.

District of Lake Country
Community Wildfire Protection Plan

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"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."

Supervision certification statement

Executive Summary

The Community Wildfire Protection Plan (CWPP) has been a foundational element of the Strategic Wildfire Prevention Initiative (SWPI), and now the Community Resiliency Investment (CRI) program and serves to paint the complete wildfire picture for communities in British Columbia. The District of Lake Country has long had a relationship with the surrounding environment, including wildland fire. Most recently during the 2017 fire season, the Okanagan Centre fire destroyed eight homes and displaced hundreds of residents. The cause of the fire was later determined to be arson. To reframe the wildfire issues faced by the community, and to position the municipality to access prevention funding under CRI, Lake Country retained Davies Wildfire Management Inc to undertake an update to its CWPP, which was first completed in 2010.

As a partial indicator of potential future wildfire activity, a fire history analysis has been completed. The occurrence rate of wildfires within the Lake Country area of interest (AOI) indicates a gradual increase in the occurrence of person-caused wildfires. Similarly, an analysis of three BC Wildfire Service fire weather stations in the surrounding region demonstrates a marked increase in the number of Fire Danger Class 4 and 5 days per year.

Geospatial analysis of provincial fuel type layers and the provincial strategic threat analysis (PSTA) outputs further characterize the wildfire impacts that Lake Country continues to face. Although parts of Lake Country are relatively well-protected by orchards or large fields dominated by agricultural crops, as well as Okanagan, Kalamalka, Wood and Ellison lakes, continued emphasis needs to be placed on the responsibilities of private property owners to manage their fuel hazards. This includes residential property owners and the steps they can take to manage their landscaping and structure characteristics to make their homes less prone to ignition during a wildfire.

Wildland urban interface wildfire threat assessments were completed on Crown and municipal land where geospatial analysis and fire behaviour modelling was classified as moderate or higher. Based on the threat assessments, five landscape fuel breaks and four interface fuel break have suggested, totalling 121.5 ha and 20.2 ha, respectively.

Lake Country will continue to face wildfire pressures, and these should be expected to increase in a changing climate. By maintaining a proactive focus on wildfire prevention and mitigation efforts, and through continued advocacy at the local and provincial levels, the community can continue to find ways to grow and thrive in an active wildfire environment.

Summary of CWPP Recommendations

- **Recommendation 1 (Public Engagement):** When developing wildfire-related communications for the public, consider including the ecological and cultural role that fire has played on the regional landscape.
- **Recommendation 2 (Prevention and Preparedness):** Consider approaching the BC Wildfire Service to explore the possibility of re-establishing a fire weather station on the Aberdeen Plateau to provide improved fire weather information related to important watershed values.
- **Recommendation 3 (Prevention and Public Engagement):** Maintain the link from the District of Lake Country website to the BC Wildfire Service Fire Danger Rating webpage to enable the public to maintain awareness of potential wildfire conditions. If possible, integrate an API into the Lake Country website that enables display of the current Fintry and West Kelowna Danger Class directly on the Lake Country website.
- **Recommendation 4 (Preparedness and Governance):** On an annual basis, consider preparing a Danger Class report for the Fintry, West Kelowna and Ida Bell 3 fire weather stations to help characterize fire danger trends year over year and assist decision makers in representing wildfire-related challenges faced by Lake Country.
- **Recommendation 5 (Prevention):** The application of prescribed fire in and around Lake Country should be supported as a proactive method of fuels management that can result in less smoke output than similar areas burning under wildfire conditions.
- **Recommendation 6 (Prevention and Public Engagement):** Wildland urban interface threat reduction should be promoted as a mutually beneficial strategy between private property owners and governments. Private property owners and governments alike need to take responsibility for the wildland fuel under their ownership.
- **Recommendation 7 (Prevention and Governance):** Maintain the Wildland Fire Development Permit Area requirements as drafted in the 2018 – 2038 District of Lake Country Official Community Plan. As various development permit requirements are amended from time to time, ensure that requirements and guidelines complement the Wildland Fire Development Permit Area requirements.
- **Recommendation 8 (Prevention and Public Engagement):** Lake Country should consider initiating FireSmart projects, as it is one of the best available options for generating public interest and action regarding hazard reduction on private property. Suggested neighbourhoods are listed in 5.2.3.

- **Recommendation 9 (Prevention and Public Engagement):** Establish a wildfire safety and hazard reduction page on the Lake Country Fire Department website to highlight the FireSmart program and simple actions that homeowners can take to reduce their homes' susceptibility to ignition during a wildfire. Engage in public education information sessions throughout Lake Country associated with wildfire management and/or FireSmart.
- **Recommendation 10 (Prevention):** Consider the landscape and interface fuel breaks referenced in Tables 17 and 18 for fuel mitigation treatments, followed by periodic maintenance.
- **Recommendation 11 (Operations):** As interagency partners in wildfire suppression operations, Lake Country Fire Department should consider pursuing seats in basic and intermediate wildfire training opportunities with the BC Wildfire Service.
- **Recommendation 12 (Operations and Preparedness):** Lake Country should consider acquiring a Type 2 Structure Protection Unit for the Lake Country Fire Department that can be used locally or deployed under cost recovery elsewhere in the province when conditions allow.

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1. Introduction

The Community Wildfire Protection Plan (CWPP) program was initiated by the Province of British Columbia as a response to key recommendations contained in the Firestorm 2003 Provincial Review (Filmon, 2004). The CWPP program has been administered by the Union of BC Municipalities (UBCM) as a foundational component of the overarching Strategic Wildfire Prevention Initiative (SWPI) suite of funding programs since 2004 (Union of BC Municipalities, 2018). Recently, the provincial government announced that SWPI programs and funding would be rolled into the new Community Resiliency Investment (CRI) program (BC Government News, 2018). The CWPP program continues to be available to all local governments and First Nations in BC (Union of BC Municipalities, 2018).

1.1 Purpose

A CWPP is intended to provide the basis for all future wildfire mitigation actions in a community. As such, the content of a CWPP provides a clear description of the wildfire environment, wildfire risks to the community, as well as strategic and operational recommendations to reduce risk and increase the community's resilience to wildfire threats.

A comprehensive awareness of the factors of the wildfire environment is the foundation upon which future hazard identification and mitigation efforts can proceed. In the intervening years since the adoption of the original CWPP, the regional and provincial wildfire picture has come into greater focus. Several high-profile wildland urban interface (WUI) fires have since impacted the community and surrounding area. Further afield, significant wildfire disasters have occurred in BC and other parts of Western Canada.

With these persistent factors in mind, the CWPP remains a cornerstone of wildfire mitigation planning for communities. The intended outcome of the CWPP planning process is to provide the community with a detailed framework to further efforts that will:

- Reduce the likelihood of a wildfire occurring the community;
- Reduce the impacts and/or losses to property and critical infrastructure;
- Reduce negative economic and social wildfire impacts to the community.

1.2 CWPP Planning Process

Davies Wildfire Management Inc. (DWM) was retained as the consulting firm to conduct the CWPP update. Andrew Low, RPF, and John Davies, RPF, conducted the threat assessments, analysis and report compilation as forest professionals qualified in all aspects of wildland fire management.

2. Local Area Description

The District of Lake Country was incorporated by Letters Patent issued on May 2, 1995. Upon incorporation, the rural areas of Carr's Landing, Winfield, Okanagan Centre and Oyama were

brought together into one municipal structure. The identities of these areas live on as wards within the municipal governance structure.

2.1 CWPP Area of Interest

The area of interest (AOI), as used in CWPP terminology, essentially describes the study area. The UBCM guidance for defining the AOI is rather flexible, ranging from simply the extent of wildland urban interface (WUI) as the minimum, to taking a wider view consisting of the local government's legal boundary, with an added 2 km buffer beyond.

The AOI for Lake Country CWPP update was selected through consultation with the UBCM and Lake Country staff. As the funding body, the UBCM needs to ensure that work conducted on adjacent CWPPs would not be duplicated in the course of Lake Country CWPP update, given that adjacent local government CWPP AOIs abut the Lake Country municipal boundary. For this reason, the AOI for the 2019 CWPP update is slightly different than the 2010 CWPP AOI, which extended north and south 2 km into the cities of Vernon and Kelowna, respectively.

2.2 Community Description

Lake Country is a diverse region in many respects. Ecologically, the AOI is mainly situated in the hot and dry Okanagan Valley, while the plateau area further east is generally cooler and moist. Given a diverse ecology, the region invites a range of land use, including agriculture and forestry, as well as a multitude of tourism and recreational pursuits.

2.2.1 Governance and Administration

The District of Lake Country has gone through governance adjustments in the past few decades. The communities of Winfield, Oyama, Okanagan Centre and Carr's Landing were part of a rural electoral area governed by the Regional District of Central Okanagan (RDCO), formerly known as Electoral Area A before being incorporated as the District of Lake Country in 1995.

The District of Lake Country has a hybrid ward system of governance, which is unique in British Columbia. The four wards of Winfield, Oyama, Okanagan Centre and Carr's Landing each elect their own representative on Council. The Mayor and also two at-large councillors are elected to represent the entire community (2010 OCP).

The Okanagan Indian Band (OKIB) are the original inhabitants of the area and have a rich history and culture. The OKIB has an active government and administration, and now offers a variety of services and facilities to band members. Lake Country continues to develop a strong relationship with the OKIB, through community-to-community forums, protocol agreements, involvement of the OKIB on District committees, meaningful consultation, and shared projects and programming.

2.2.2 Infrastructure and Services

Electricity is supplied to Lake Country via BC Hydro 60L205 transmission lines (69kV), from Vernon Terminal (iMapBC, 2018). Additionally, the District of Lake Country completed construction of the Lake Country Hydroelectric Generating Station in 2009. The facility has a generating capacity 1.1 megawatts and the average annual energy production is expected to be 3871 megawatt hours

(Mwh) (District of Lake Country, 2010). The generating station is located approximately 3 kilometers east of the community of Winfield (District of Lake Country, 2010).

The District of Lake Country is in the Okanagan health service area of the Interior Health Authority (IHA). Lake Country is situated between the Kelowna General Hospital to the south, and the Vernon Jubilee Hospital (VJH) to the north. KGH provides high-level, specialty medical care, including 24-hour emergency and trauma services, as well as specialized services, including cardiac surgery while VJH provides core medical and surgical specialty services, 24-hour emergency and trauma services, acute and obstetrical care. (Interior Health, 2018).

Table 1 Hospitals and health centres in Lake Country.

Hospitals and Health Services	Services Provided
Kelowna General Hospital	Tertiary referral hospital. High-level specialty medical care.
Vernon Jubilee Hospital	Regional hospital. Core medical and surgical specialty services to patients in the service area.
Public Health Satellite Office	Public health core programs.
Lake Country Lodge	Long-term care.
Blue Heron Villa	Assisted living.

2.2.3 Economic Drivers

The 2016 Census employment data provide an indication of the economic drivers in the District of Lake Country. As illustrated in Figure 1, the top five sectors (construction; retail; healthcare; accommodation/food services and manufacturing) account for nearly half (48.77%) of the employed labour force in the District of lake Country (Government of Canada, 2016).

These top sectors can be particularly sensitive to the impacts of wildfire on the region. For example, evacuations and smoke impacts, whether they are affecting the community directly or the indirect effect of negative perception among potential visitors regarding fires elsewhere in the province can all lead to a decrease in visitation and tourist spending (Deacon, 2017). Wildfire smoke also contributes to increased health concerns among susceptible populations, resulting in increased strain on health care facilities (HealthLinkBC, 2017).

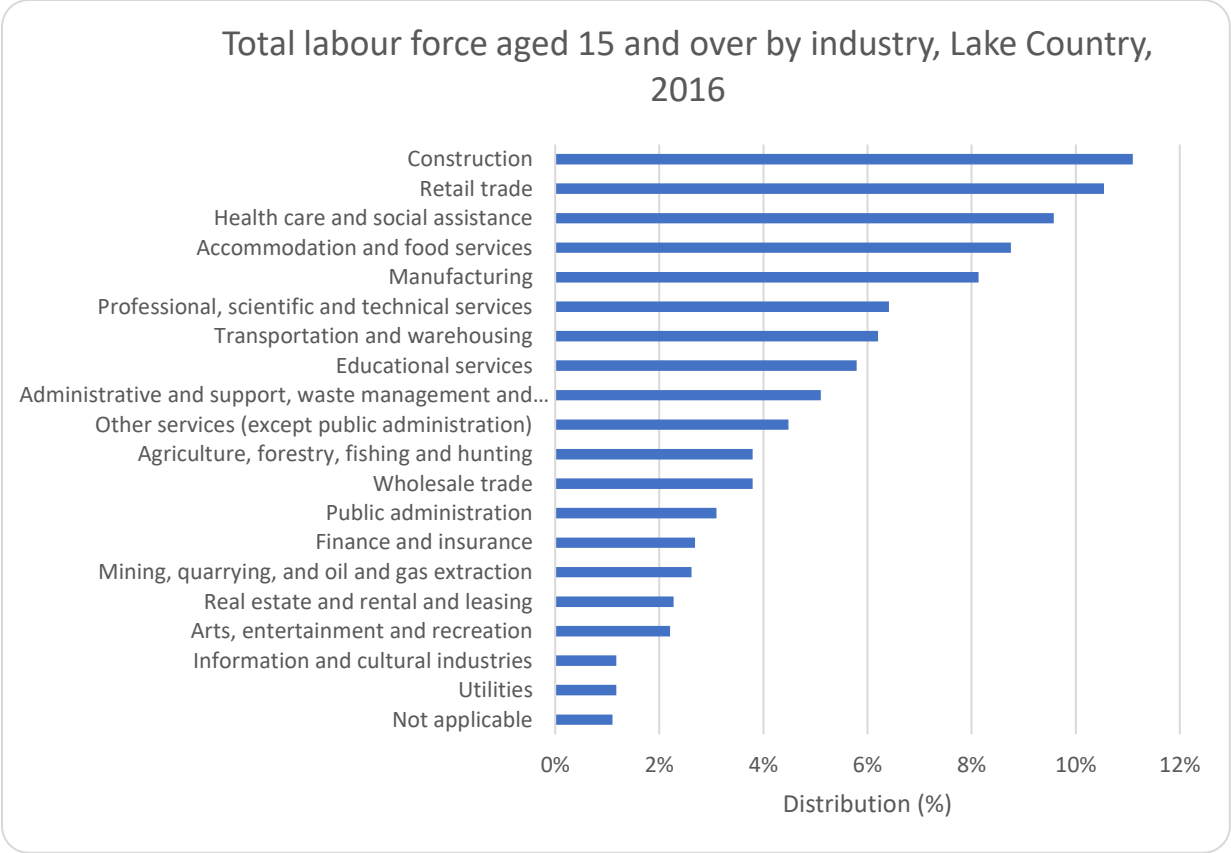


Figure 1 Employed labour force by industry in Lake Country, as per the 2016 census.

2.2.4 Land Ownership

The AOI is comprised of 51% crown land with the bulk of the remainder consisting of private land (44%). Municipal ownership makes up a small proportion of land in the AOI (193 ha or 1%). Land ownership directly relates to the ability to carry out funded fuel management as CRI and FES funding is intended for mitigation activities on public land.

Table 2 Land ownership types within Lake Country AOI.

Type	Area (ha)	%
Crown Provincial	11,904	51%
Private	10,231	44%
None	636	3%
Municipal	193	1%
First Nation	137	0.6%
Unknown	58	0.3%
Crown Agency	11	0.05%
Mixed Ownership	5.9	0.03%
Federal	1.2	0.01%
	23,178	100%

2.2.5 Firefighting Jurisdiction

Fire protection for the District of Lake Country is provided by the Lake Country Fire Department (LCFD) – a fire department composed of both career and paid-on-call volunteers (District of Lake Country, 2018). An operational profile of LCFD is provided in Section 6.

2.2.6 Existing Evacuation and Egress Routes

The 2016 District of Lake Country Emergency Evacuation plan provides policies and procedures for moving or dispersing persons from threatened or hazardous areas to areas of safe refuge during emergencies (District of Lake Country, 2016). The plan states that the best routes for evacuation from the threatened area are to be selected by the RCMP with input from the Incident Commander (IC) at the time of the incident (District of Lake Country, 2016).

The major egress routes out of Lake Country include Highway 97 northward to Vernon (approximately 28 kilometers) or southward to Kelowna (approximately 23 kilometers). Partial alternate egress routes include Commonage Road north toward the city of Vernon (via Okanagan Centre Road East and Carr's Landing Road, approximately 33 kilometers) and Glenmore Road south to Kelowna (via Okanagan Centre Road East, approximately 23 kilometers).

2.3 Past Wildfires, Evacuations and Impacts

Wildfires have been a regular and natural disturbance agent in the Okanagan for millennia. In recent years, Lake Country has felt the effects of several wildfires (Table 3), ranging from small fast-moving fires that are contained relatively quickly, to prolonged periods of large fires burning in the surrounding area

Most concerning was the 2017 Okanagan Centre wildfire that ignited on the afternoon of July 15. Ultimately, eight homes were destroyed in the Nighthawk Road area as a result of the fire, which was mapped at a final size of 50.4 ha. On July 26, 2017 the RCMP announced that the cause of the wildfire was arson (RCMP, 2017). The following July, the RCMP announced that the 2017 Okanagan Centre arson fire was one of 28 other wildfires believed to have been deliberately set throughout the Okanagan over the past four years (RCMP, 2018).

Fortunately, and through a concerted response by multiple agencies and neighboring fire departments, no fatalities resulted from the Okanagan Centre fire. This fact is made more remarkable with the knowledge that the fire was set at one of the worst possible times and locations – the hottest and driest part of day, at the bottom of a steep slope with homes above. Ultimately, the insured losses for the Okanagan Centre fire reached $13,000,000 (Lake Country Fire Department, 2018), but the outcome had the potential of being much worse.

Table 3 Past wildfires of significance in Lake Country.

Fire number	Cause	Geographic	Size (ha)	Date of discovery
K41118	Person	Okanagan Centre	50.4	July 15, 2017
K40046	Lightning	Ellison Ridge	1.2	May 4, 2016
K40571	Person	Beaver Lake Rd.	4.7	August 11, 2015
K40137	Person	Coral Beach	0.5	June 17, 2015
K40896	Person	Carr's Landing	1.4	March 17, 2014
N/A	Lightning	S of Beaver Lk Rd, E of Jim Bailey Rd.	5.0	July 25, 2013
K41040	Person	Barkley Rd.	1.0	July 24, 2008
K40196	Person	Lodge Rd.	4.0	June 28, 2006
K40344	Person	Oyama Middle Bench Rd.	30.0	September 18, 2001
K40136	Person	Okanagan Centre	1070	August 30, 1985
K50009	Person	Ellison Lake	28.3	April 21, 1982
K00210	Person	N of Spion Kop	559.5	July 7, 1960
K00512	Person	Woodsdale	39.7	July 14, 1958
129	Person	Ellison Lake	108.7	July 24, 1943
660	Person	Mill Creek	428.6	August 20, 1940

2.4 Current Community Engagement

The Public Education Division of the District of Lake Country Fire Department developed the Safety, Awareness and Fire Education (SAFE) Program in Lake Country with the aim of protecting families in the event they experience a residential structure fire. It is a 4-hour program instructed over a period of 2 weeks in grade 3 classrooms with the emphasis on home escape planning. In addition, the District of Lake Country website has resources for homeowners on FireSmart, emergency evacuation procedures, burning regulations, campfire bans and links to past community wildfire protection plan information (District of Lake Country, 2018).

2.5 Linkages to Other Plans and Policies

Several plans and policies exist at various levels of government that pertain to the response and recovery of WUI fires, as well as wildfire management in general. The following is a broad survey of the various plans and policies.

2.5.1 Local Authority Emergency Plan

The District of Lake Country is party to the Regional District of Central Okanagan Emergency Plan, which is coordinated by the City of Kelowna on behalf of the regional district, the District of Lake Country, the District of Peachland, Westbank First Nation, Kelowna and West Kelowna (City of Kelowna, 2016). The emergency plan is intended to:

- assist emergency personnel to respond to disasters and major emergencies, such as floods, wildfires, major spills, plane crashes etc.;
- establish a centralized assessment and decision-making organization to share regional resources or request assistance from the provincial or federal governments;
- guide post-emergency recovery operations.

2.5.2 Affiliated CWPPs

Lake Country's original CWPP was completed in 2010. Communities with adjacent CWPPs to Lake Country include:

- City of Kelowna (2016)
- Regional District of Central Kootenay (2006)
- Regional District of Central Okanagan (2008)
- Regional District of Kootenay-Boundary (2010)
- City of Vernon (2013)

2.5.3 Local Government Plans and Policies

Wildfire planning and mitigation requirements are included in the Draft Official Community Plan 2018-2038 (District of Lake Country, 2018). Lake Country has established 11 development permit areas (DPAs), including the Wildland Fire Development Permit Area requirements. The wording of the wildland fire DPA guidelines remain largely unchanged from the previous 2010 OCP, with minor changes including the additional requirement for the preparation of a fire mitigation report

from a Registered Professional Forester[1] for development within the DPA not covered under an exemption.

Broadly, the wildland fire DPA guidelines intend to:

- minimize the risk to life and property from possible wildfires;
- ensure that development in potentially hazardous areas is conducted safely;
- require construction techniques and materials that are resistant to wildfire for buildings located within the Wildland Fire Development Permit Area, and;
- not further contribute to the existing risk of wildfire through the appropriate siting of vegetation and type of species planted for landscaping on lots at risk of wildfire (District of Lake Country, 2010).

Lake Country has in force the Burning Bylaw 612, 2007 (District of Lake Country, 2008). Specifically, the bylaw:

- restricts open burning permits to:
    - residents that have properties >1 ha
    - fire no larger than 2 m high and 3 m wide
    - minimum separation of 30 m from fire and property boundaries, improvements
- Establishes the parameters within which open burning is permitted.
- Sets permit fees and describes offences and associated penalties.

2.5.4 Higher Level Plans and Relevant Legislation

The Okanagan Shuswap Land and Resource Management Plan (LRMP) was completed in 2001 and relates to Crown land throughout the Okanagan Shuswap Natural Resource District (Province of British Columbia, 2001). The LRMP makes several references to wildfire management and hazard reduction (Table 4), none of which impinge on the ability of local governments to undertake mitigation work. Flowing from the LRMP are orders pertaining to the establishment of resource management zones and old growth management objectives (Province of British Columbia, 2007) and none of these orders impede Lake Country from pursuing strategic wildfire mitigation efforts.

[1] Registered Professional Foresters engaged to prepare fire hazard mitigation reports must also be qualified and competent to render assessments, prescriptions, opinion etc. related to wildland fire.

Table 4 Wildfire references in the Okanagan Shuswap Land and Resource Management Plan (Province of British Columbia, 2001).

Part 4 Community/Crown Interface (Page CCI 4-1)	
Sec 7	Protect populated areas from forest fire hazards in the wildland – urban interface, and protect the provincial forest from fires originating on contiguous private land.
Sec 7.1	The Ministry of Forests is to coordinate fire hazard reduction in the Interface zone through consultation with the public, licensed tenure holders, affected resource agencies, First Nations, and local government.
Sec 7.2	Where practical, coordinate and implement fire hazard reduction activities with priority areas for prescribed burning for ecosystem enhancement purposes.
Part 4 Ecosystem – Natural Disturbance Type 4 (page NDT4 4-9)	
Sec 10.1	Where practical, return fire to the NDT4a at historical fire cycle intervals by developing and implementing a burn plan that includes restoration and maintenance burning.
Sec 10.3	Develop and implement a plan to modify suppression on naturally occurring wildfires that meet impact prescriptions.
Sec 11.9	Develop a fire management plan for the NDT4a and b.
Sec 11.11	Develop and implement a plan to modify suppression on naturally occurring wildfires that meet impact prescriptions.
Part 4 Mountain Goat Habitat (page Wildlife_Goat 4-3)	
Sec 2.1	Where other resource values are not threatened, enhance early seral foraging opportunities by implementing a "let burn" policy for high elevation wild fires in inoperable areas that are on, or adjacent to, goat winter ranges.
Part 4 - Mule Deer Winter Range (page Wildlife_Mdeer 4-12/)	
Sec 3.4	Where practicable, utilize prescribed burns under specific conditions or mechanical treatments to enhance winter range forage values.

2.5.5 Ministry Plans

The Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) has prepared fire management plans for each Natural Resource District in the province, as required by ministry policy. Fire management plans are intended to address all wildfire-related issues within the natural resource district, particularly the desired interaction between resource management concerns and fire suppression requirements. It is important to note that district fire management plans are currently not public documents. For the purposes of this CWPP update, the authors were afforded the opportunity to view the plan.

The current fire management plan for the Okanagan Shuswap Natural Resource District dates from 2015 and carries forward the 2014 wording with updates to spatial data only. The district fire management plan is a brief 15-page document that also includes high-level district mapping according to four broad "priority themes". The mapping themes are as follows:

- Theme 1 – Human Life and Safety
    - WUI areas (high, moderate and low structure density)
    - Evacuation routes and marshalling points
- Theme 2 – Critical Infrastructure and Property (that relates to maintaining Theme 1)
    - Energy generation and transmission, healthcare, first responder facilities, transportation, wildland structures etc.
- Theme 3 – High Environmental Cultural
    - Water resources, species at risk, cultural values
- Theme 4 – Resource Values
    - Ungulate winter range, old-growth management areas, timber, silviculture investments, range management, and visual quality areas

3. Values at Risk

Values at risk (VAR) include human health and safety, facilities, services, cultural and natural resources etc. that may be negatively impacted by wildfire. This includes human life, property, critical infrastructure, high environmental and cultural values, and resource values.

3.1 Human Life and Safety

The most recent census data from the Government of Canada indicates an enumerated population for Lake Country of 12,922 – up 10.4% from the 2011 census. The 2016 census also indicates 5,094 occupied private dwellings in Lake Country, an increase of 12.4% from 2011. With a land area of 122.19 square kilometers, the population density of Lake Country is 105.8 people per square kilometer (Government of Canada, 2016).

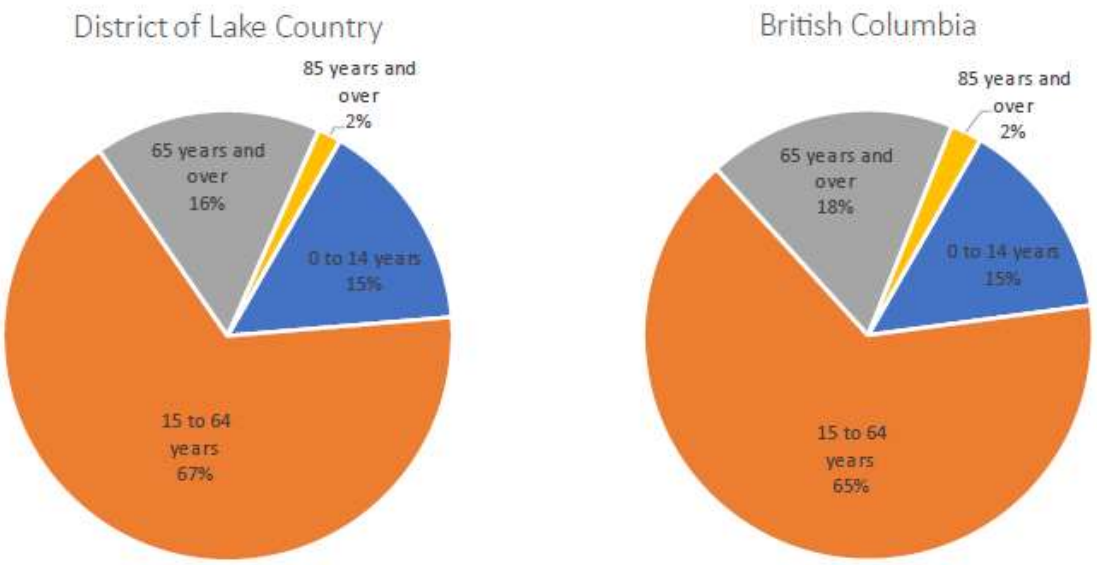


Figure 2 Age distribution in Lake Country and British Columbia, as determined by the 2016 census.

Compared to the provincial average, Lake Country has a similar proportion of people in both the 65 years and over and 85 and over age classes (Figure 2). With nearly one quarter of the population of Lake Country over the age of 65, extended periods of wildfire smoke will have an impact on a significant number of residents (as with many other parts of the province).

Among a host of other constituents, wildfire smoke contains particulate matter (PM) which is primarily composed of organic carbon and black carbon components (Naeher, et al., 2007). The size of PM that biomass burning produces is usually fine particles less than 2.5 micrometers (µm), referred to as $PM_{2.5}$ (Duran, 2014).

Although everyone responds to wildfire smoke exposure differently, the BC Centre for Disease Control (2018) identifies the following groups as being most at risk:

- people over 65;
- women who are pregnant;
- infants and small children;
- people with existing chronic respiratory conditions.

3.2 Critical Infrastructure

The Lake Country water system serves over 4,350 residential, commercial, industrial, institutional, seasonal irrigation and agricultural connections, representing a total population served of approximately 13,000 people. Users consume approximately 9,622 mega liters of water annually (District of Lake Country, 2015).

The District of Lake Country receives water from four sources: Swalwell (Beaver) Lake, Okanagan Lake, Kalamalka Lake and Oyama Lake. In the case of Swalwell Lake and Oyama Lake the intakes are located within the downstream creeks of Vernon Creek and Oyama Creek (Urban Systems,

2012). Recent major water systems projects include a $7 million Eldorado treated water reservoir and Glenmore booster station (Urban Systems, 2012).

As of 2009 the District of Lake Country liquid waste central collection system extended out toward Okanagan Centre and Chase Road, up to The Lakes development and the Davidson Road area. This collection system delivers raw sewage to the District of Lake Country's wastewater treatment plant located north of Beaver Lake Road. In addition to the central collection systems there are three smaller satellite systems within the District boundary; two systems in Carr's Landing and one in the Oyama area (AECOM, 2009).

3.2.1 Electrical Power

Electricity is supplied to Lake Country via BC Hydro 60L205 transmission lines (69kV) from Vernon Terminal. The transmission line from Vernon runs south along the west side of Kalamalka lake, turns eastward at Oyama and south along Oyama road.

Additionally, the District of Lake Country completed construction of the Lake Country Hydroelectric Generating Station in 2009. The facility has a generating capacity 1.1 megawatts and the average annual energy production is expected to be 3871 megawatt hours (Mwh) (District of Lake Country, 2010). The generating station is located approximately 3 kilometers east of the community of Winfield (District of Lake Country, 2010).

3.2.2 Communications, Pipelines and Municipal Buildings

The following infrastructure are noted:

- Lake Country has several Telus Mobility, Bell Mobility and Rogers Communications cellular towers serving the area (Nikkel, 2018).
- Transmission pipeline for natural gas, runs through Lake Country and south to Kelowna (FortisBC, 2009). FortisBC has a corporate emergency response plan for pipeline and electrical emergencies (FortisBC, 2016).

Key public buildings in Lake Country are summarized in Table 5.

Table 5 Key municipal buildings in Lake Country.

Facility	Address
Arena- Winfield	9830 Bottom Wood Lake Road
Community Centre- Beasley	3450 Woodsdale Road.
Community Hall- Okanagan Centre	11099 Maddock Avenue
Community Hall- Oyama	15710 Oyama Road
Community Hall- Winfield	10130 Bottom Wood Lake Road
Fire Hall 71 Winfield	10575 Okanagan Centre Road East
Fire Hall 81 Carr's Landing	16625 Commonage Road
Fire Hall 91 Oyama	15656 Oyama Road
Municipal Hall- District of Lake Country	10150 Bottom Wood Lake Road
Museum	11255 Okanagan Centre Road W
RCMP	3231 Berry Road
Seniors Activity Centre	9832 Bottom Wood Lake Road
Wastewater Treatment Facility	4062 Beaver Lake Road

3.2.3 Water and Sewage

The District of Lake Country has four primary water systems serving most District users. These systems are fed by the following sources: Swalwel (Beaver) Lake (Crooked Lake chain flows into Beaver Lake), Oyama Lake (Damer Lake flows into Oyama Creek), Okanagan Lake and Kalamalka Lake (District of Lake Country, 2015). The Eldorado balancing reservoir was constructed downstream of the Vernon creek intake on the Swalwell (Beaver) Lake system in 2007 (Urban Systems, 2012).

Community watersheds that feed the various water systems are listed in section 3.3.1.

Sewage treatment for Lake Country is handled by the wastewater treatment plant located north of Beaver Lake Road which is operated by the District of Lake Country, as detailed in section 3.2.

The following water source areas are identified in Lake Country:

- Coral Beach – Okanagan Lake
- Lake Pine – Okanagan Lake
- Beaver (Swalwell) Lake
- Oyama Lake
- Kalamalka Lake
- Okanagan Lake

3.3 High Environmental and Cultural Values

Parks, recreation and culture services are provided by Lake Country through the Infrastructure Services and Community Services departments. The Engineering and Environmental Services department is responsible for watershed protection, dam safety and infrastructure emergency preparedness.

3.3.1 Drinking Water Supply Area and Community Watersheds

One community watershed is located within the District of Lake Country municipal boundary and two additional watersheds are located within the AOI. Portions of the Oyama Creek and Vernon Creek community watersheds lay within the AOI, feeding the Oyama and Swalwell (Beaver Lake) water systems, respectively. The Kelowna (Mill) Creek community watershed lies within the AOI but does not feed into the District of Lake Country System. The community watersheds pertaining to the District of Lake Country AOI are summarized in Table 6. .

Table 6 Community Watersheds in Lake Country AOI.

Community watershed name	Source	Area within AOI (ha)
Vernon	Vernon Creek	1,234
Kelowna	Kelowna Creek	954
Oyama	Oyama Creek	419

3.3.2 Cultural Values

Due to an extensive and uninterrupted First Nation presence throughout the Okanagan, wildfire and associated suppression operations have the potential to inadvertently seriously impact or destroy cultural heritage resources.

It can be challenging to navigate the requirements of the Heritage Conservation Act (HCA) during the critical initial attack phase of a wildfire response, but a basic awareness of what to look for can help to ensure that cultural heritage resources aren't impacted by suppression actions. For good reason, the exact locations of known resources are often privileged information, but through agreement and trust, general information regarding areas could be shared. From there, it is incumbent on personnel who are actively working in the field to be able to identify resources so that suppression actions can be planned or altered in such a way as to not to contravene the HCA.

3.3.3 High Environmental Values

The BC Conservation Data Centre identifies Red, Blue, and Yellow listed vertebrate animals, plants and plant communities within Lake Country AOI, as summarized in Table 7 (BC Conservation Data Centre, 2018).

Table 7 Red and Blue listed species and plant communities within Lake Country AOI.

Common name	Scientific name	BC list status
Vertebrate animals		
American Badger	*Taxidea taxus*	Red
Gopher Snake, *deserticola* subspecies	*Pituophis catenifer deserticola*	Blue
Painted Turtle - Intermountain - Rocky Mountain Population	*Chrysemys picta* pop. 2	Blue
Western Rattlesnake	*Crotalus oreganus*	Blue
Ecological community		
Baltic Rush - Common Silverweed	*Juncus balticus - Potentilla anserina*	Red
Black Cottonwood - Douglas-fir / Common Snowberry - Red-osier Dogwood	*Populus trichocarpa - Pseudotsuga menziesii / Symphoricarpos albus - Cornus stolonifera*	Red
Trembling Aspen / Common Snowberry / Kentucky Bluegrass	*Populus tremuloides / Symphoricarpos albus / Poa pratensis*	Red
Common Cattail Marsh	Typha latifolia Marsh	Blue
Hard-stemmed Bulrush Deep Marsh	*Schoenoplectus acutus Deep Marsh*	Blue
Vascular plants		
Near Navarretia	*Navarretia propinqua*	Red
Peach-leaf Willow	*Salix amygdaloides*	Blue

* Red-listed: Any species or ecosystem that is at risk of being lost (extirpated, endangered or threatened)
* Blue-listed: Any species or ecosystem that is of special concern

3.4 Other Resource Values

Lake Country, like many parts of the Okanagan, has a long agricultural history. Enjoying a mild, dry climate, tree fruits, grapes, ground crops and beef production are important contributors to the area. Wildfire can have significant direct and indirect impacts on agricultural sectors. For example, cattle can be displaced off their summer range or require evacuation. Food crops may be directly impacted by prolonged smoke-filled skies, while evacuation orders or simply worker displacement may limit the ability of producers to harvest crops in a timely manner.

3.5 Hazardous Values and Solid Waste Management

Lake Country is not characterized by extensive heavy industry associated with potentially hazardous materials that could be impacted by wildfire. Household solid waste, recycling and yard waste collection is a regional function managed by the Regional District of Central Okanagan's Waste Reduction Office.

4. Wildfire Threat and Risk

The following is a summary of the factors that contribute to an understanding of the wildfire threat around a community. These factors include natural fire regime and ecology, Provincial Strategic Threat Analysis, and a local wildfire risk analysis. Risk assessment for wildfire and its impacts to communities considers both the likelihood of a wildfire and the potential consequence associated with that likelihood.

4.1 Fire Regime, Fire Danger Days and Climate Change

Lake Country is an active fire environment where conditions often exist during the summer months where there is potential for losses to the public. When assessing the wildfire situation of the region, past conditions offer an indication of potential future conditions in the near term, and climate change scenarios must be incorporated when considering increasing future community resilience.

4.1.1 Fire Regime

The ecology of Lake Country AOI has been shaped by the frequent occurrence of frequent low-intensity, stand-maintaining natural and historical anthropogenic fires. The entirety of the AOI is classified as Natural Disturbance Type 4 (NDT4), which describes ecosystems adapted to frequent stand-maintaining fire. The NDT classification (Table 8) of an area provides an illustration of the magnitude and frequency of natural disturbance (wildfires and windstorms, predominantly) across the land base.

Table 8 Natural disturbance type classification in British Columbia.

Natural Disturbance Type (NDT)	Description
NDT1	Ecosystems with rare stand-initiating events
NDT2	Ecosystems with infrequent stand-initiating events
NDT3	Ecosystems with frequent stand-initiating events
NDT4	Ecosystems with frequent stand-maintaining fire
NDT5	Alpine Tundra and Subalpine Parkland ecosystems

In terms of natural disturbance, a distinction is drawn between stand-initiating and stand-maintaining events. Stand-initiating events typically terminate the existing forest and induce secondary succession to produce a new forest. Stand-maintaining events serve to keep successional processes stable (Province of British Columbia, 1995). In wildfire terms, high intensity fire behaviour, such as intermittent or continuous crown fire, would be considered a

stand-initiating event. Conversely, a low intensity fire surface fire consuming understory fuels while retaining a mature overstory is considered a stand-maintaining event.

These distinctions are important when assessing the wildfire history of an area. The absence of frequent stand-maintaining processes can result in a cascading series of ecological responses, including forest health, habitat and fuel loading issues. In the NDT4, low-intensity (i.e. surface fire) fire return intervals historically ranged from 4 to 50 years (Province of British Columbia, 1995). Forest protection policies centered around aggressive fire suppression have resulted in a drastically reduced frequency (or absence) of fire in ecosystems that are dependant (i.e. maintained) by frequent, low-intensity surface fires.

Stand-initiating fires (i.e. crown fires) in Ponderosa pine dominated stands were historically rare, with return intervals of at least 150 to 250+ years (Province of British Columbia, 1995). The longer a fire-maintained stand goes without fire maintenance, the greater the likelihood that a future fire occurrence will be a stand-initiating disturbance. From a firefighting standpoint this increasingly deteriorating condition can result in wildfires that require significantly more suppression effort and cost to control.

4.1.2 Fire Weather Rating

Three BCWS fire weather stations were reviewed for Lake Country CWPP (Figure 3). The Fintry and West Kelowna fire weather stations (Figures 5 and 7) are the most representative to Lake Country (Table 9). The Ida Bell 3 fire weather station (Figure 6) was also analyzed to provide a high elevation perspective of fire weather consistent with the eastern portions of the AOI. Generally, the Lake Country area is well represented by the existing BCWS fire weather station locations, however the Aberdeen Plateau watershed area may benefit from re-establishing a fire weather station in the area.

Table 9 BC Wildfire service active fire weather stations in relation to Lake Country.

Station Name	Latitude	Longitude	Elevation	Install Date
Fintry	50.207	-119.480	670m	July 13, 1990
Ida Bell 3	49.767	-119.124	1300m	August 1, 2004
West Kelowna	49.883	-119.570	650m	November 1, 2016

Figure 3 BC Wildfire Service fire weather stations in Lake Country region.

For the purposes of CWPPs in BC, fire weather conditions are described in terms of the *Fire Danger Class.* Fire Danger Class is defined in the Wildfire Regulation and is a rating derived from outputs of the Canadian Forest Fire Weather Index (FWI) System. Although the sole intent of the Fire Danger Class rating scheme is to restrict high risk activities (primarily industrial) occurring on or about forest and grassland areas, the use of Fire Danger Class has been extended to the CWPP realm as a straightforward means of characterizing fire weather conditions in an area represented by a weather station.

Fire Danger Class is determined by comparing the Buildup Index (BUI) to the Fire Weather Index (FWI) in one of three tables presented in the Wildfire Regulation. Each table is specific to one of three broad Danger Regions in BC; Lake Country is situated in Danger Region 3, along with the

Fintry, West Kelowna and Ida Bell 3 fire weather stations that were included in this analysis. The actual Fire Danger Classes are numerical ratings 1-5, in ascending order of severity. An illustration of the various inputs and components from which Fire Danger Class is derived is presented in Figure 4.

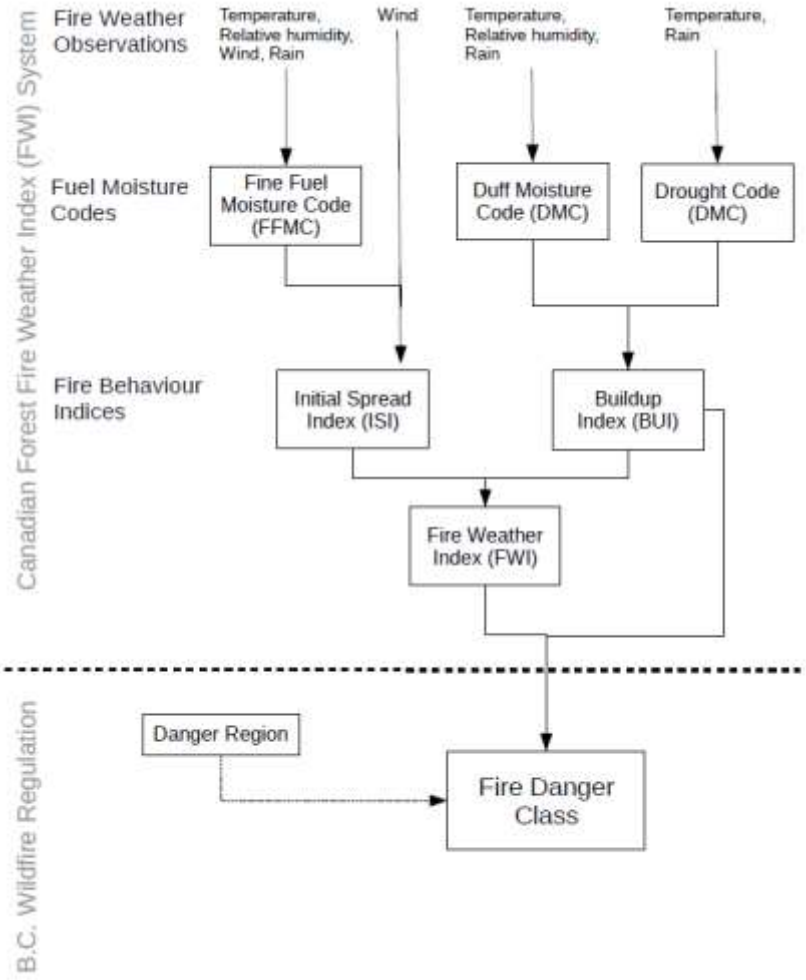


Figure 4 Fire Danger Class methodology.

A Fire Danger Class report for each of the three fire weather stations analysed has been prepared (see Figures 5-7). The Fire Danger Class reports illustrate the number of days per year when the Fire Danger Class was rated 4 or 5. The Lake Country AOI is situated in Danger Region 3, which has the following BUI and FWI ranges for Fire Danger Class 4 and 5:

- BUI: 51 – 201+
- FWI: 17 – 47+

For each of the stations, the average number of Fire Danger Class 4 and 5 days in each dataset is presented, as well as the median, maximum and year of maximum (see Table 10). For all three of the fire weather stations analyzed, 2017 had the maximum number of Fire Danger Class 4 and 5 days.

The datasets for the three fire weather sations of interest date back to 1990 (Fintry), 2004 (Ida Bell 3) and 2016 (West Kelowna) and continue to be in service (see Table 9). Of interest is the increasing linear trend for Fire Danger Class 4 and 5 days for the Fintry and Ida Bell 3 stations (Figures 5 and 6). The West Kelowna station (Figure 7) lacks sufficient fire weather history to conduct any trend analyses. Although the Ida Bell 3 station is roughly 35 km away from Lake Country and approximately 800 m higher, the station is representative of the higher elevation fire potential in the region. For this reason, Ida Bell 3 can be used as an indicator of the potential for high-elevation timber fires to the east of Lake Country.

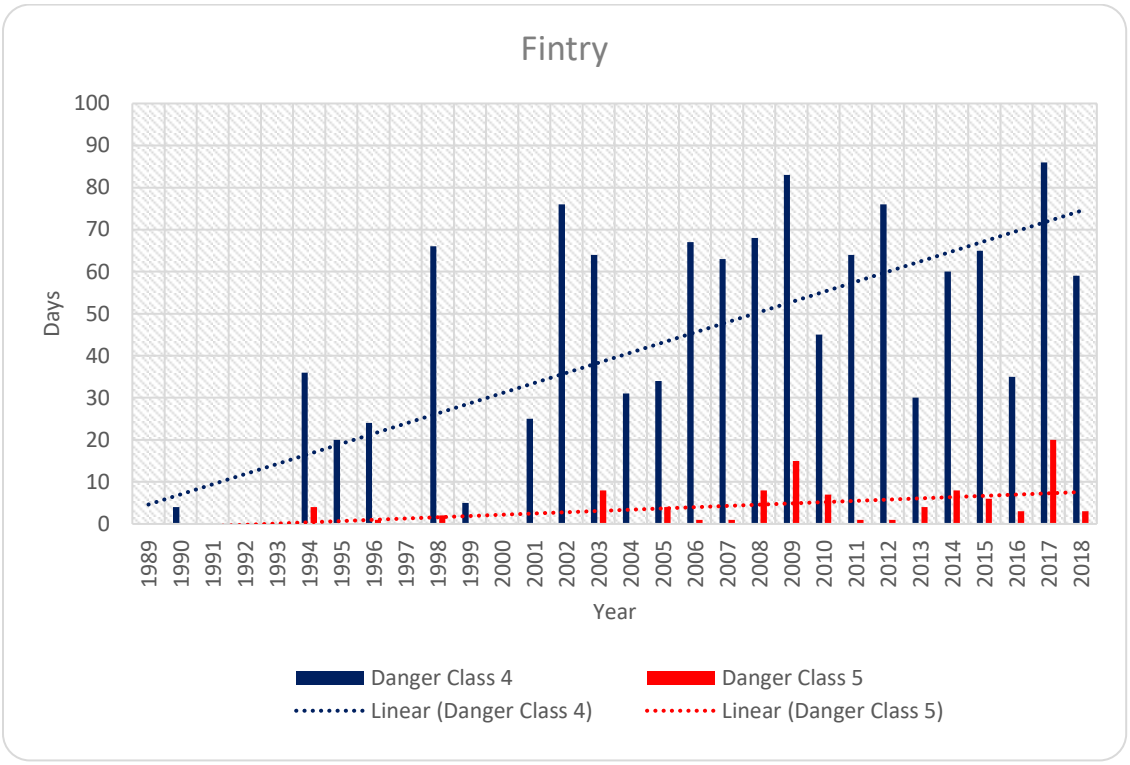


Figure 5 Fintry Danger Class 4 and 5 report.

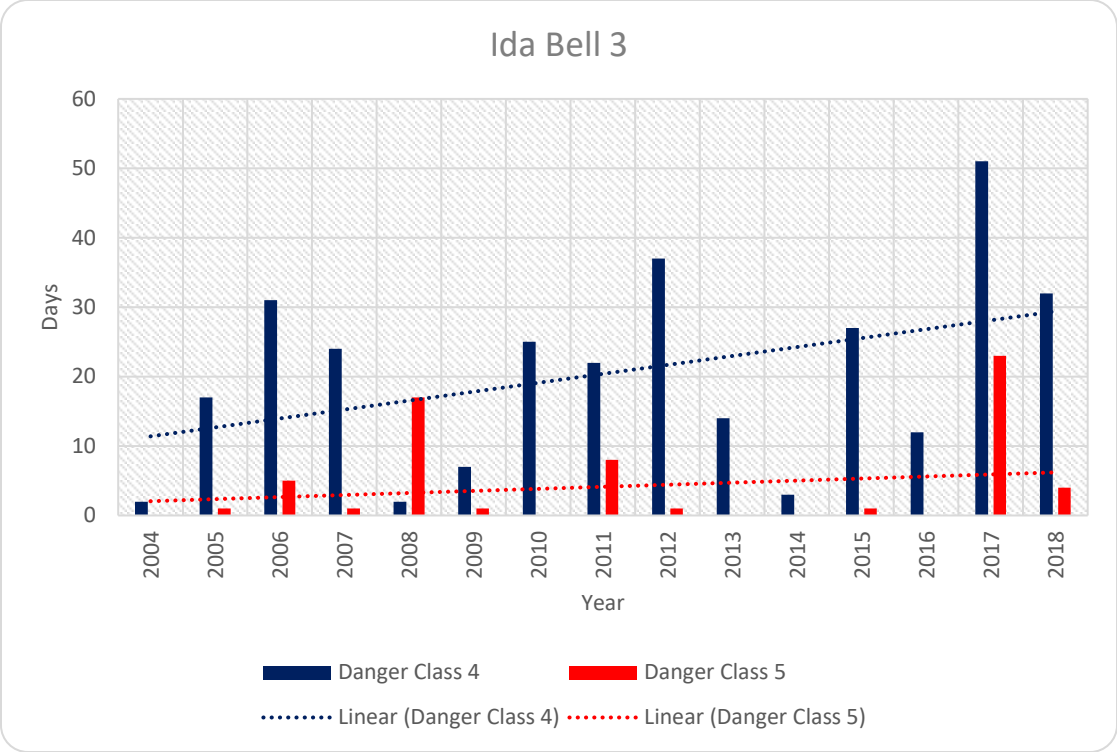


Figure 6 Ida Bell 3 Danger Class 4 and 5 report.

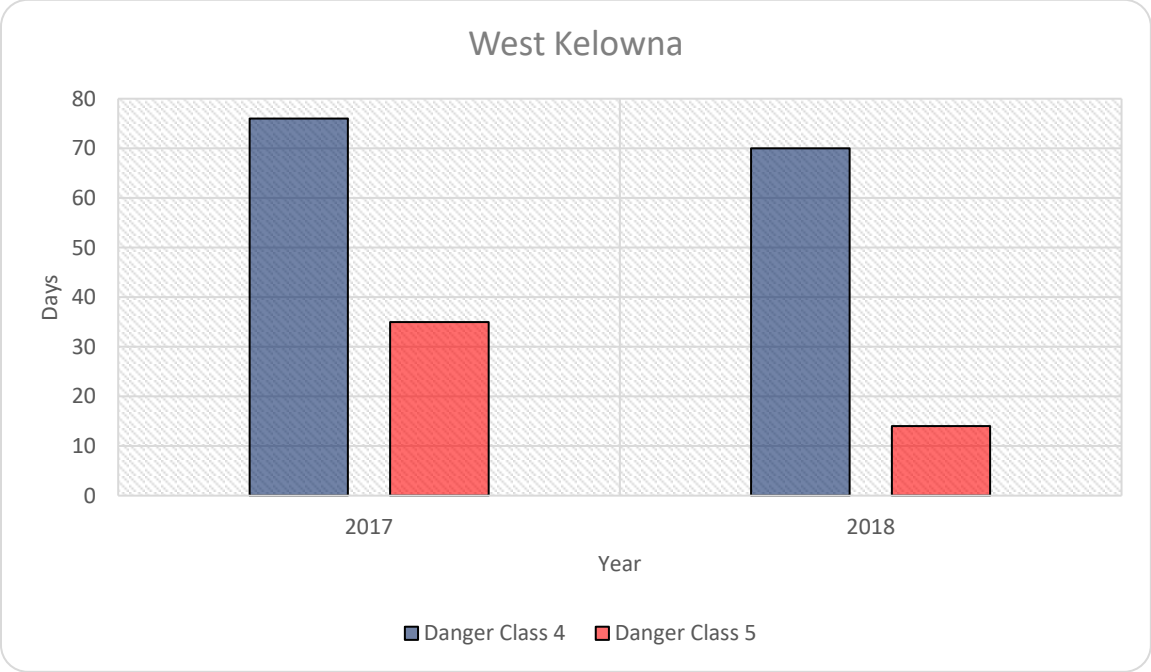


Figure 7 West Kelowna Fire Danger Class 4 and 5 report.

Table 10 Summary of Fire Danger Class 4 and 5 days for regional fire weather stations.

		Days			
Station Name	Danger Class	Average	Median	Maximum	Year of Maximum
Fintry	Danger Class 4	40	36	86	2017
	Danger Class 5	3	1	20	2017
	Combined	43	39	106	2017
Ida Bell 3	Danger Class 4	20	22	51	2017
	Danger Class 5	4	1	23	2017
	Combined	24	25	74	2017
West Kelowna*	Danger Class 4	73	73	76	2017
	Danger Class 5	24	24	35	2017
	Combined	97	97	111	2017

* Two years of data

4.1.3 Climate Change

The Pacific Climate Impacts Consortium (PCIC) is based at the University of Victoria and conducts quantitative studies on climate change and climate variability impacts for stakeholders in the Pacific and Yukon regions. Through analysis and interpretation of a variety of global climate models, PCIC serves to bridge the gap between climate research and practical application for a variety of end users. To do this, PCIC has several analysis tools available, including the Plan2Adapt toolkit, as well as the more detailed Regional Analysis Tool (Pacific Climate Impacts Consortium, 2013).

The future regional impacts of climate change are far from certain and projections are based on the best available models and information. For example, although the range of modelled future summer temperature increase is somewhat broad (Figure 8), the upward trend is conspicuous. Conversely, the range of modelled summer precipitation change (Figure 9) shows a more muddled range of projections. As with any set of models, as more data becomes available and emissions scenarios become more refined, future impacts will be brought into sharper focus.

The PCIC (2013) has drafted a set of potential climate impacts for the Central Okanagan in the 2050s, including:

- Increase in hot and dry conditions
- Increase in temperature
- Longer dry season
- High intensity precipitation
- Decrease in snowpack
- Possible changes in vegetation productivity

From a wildland fuel perspective, these impacts could result in a variety of ecological changes. Long term changes in moisture regimes can affect forest health and species distribution. Ecological communities may begin to migrate northwards or to higher elevations as site

suitability and disturbance patterns shift. Already dry ecological zones may become drier and more prevalent at higher elevations, making an already fire-prone landscape more extensive.

As some valley bottom areas and exposed slopes around Lake Country are already characterized by relatively light grass fuels, climate change induced upslope migration of treed areas may have little effect on the overall wildfire threats posed to the WUI. In fact, such a shift might actually confine high-intensity fire to higher elevations over the long term. However, in the wake of ecological migration, dead and downed fuel loading would most likely create a window of time of increased fuel hazard attributable to increased surface fuel loading, something akin to the recent effects of Western pine beetle on Ponderosa pine stands in the area.

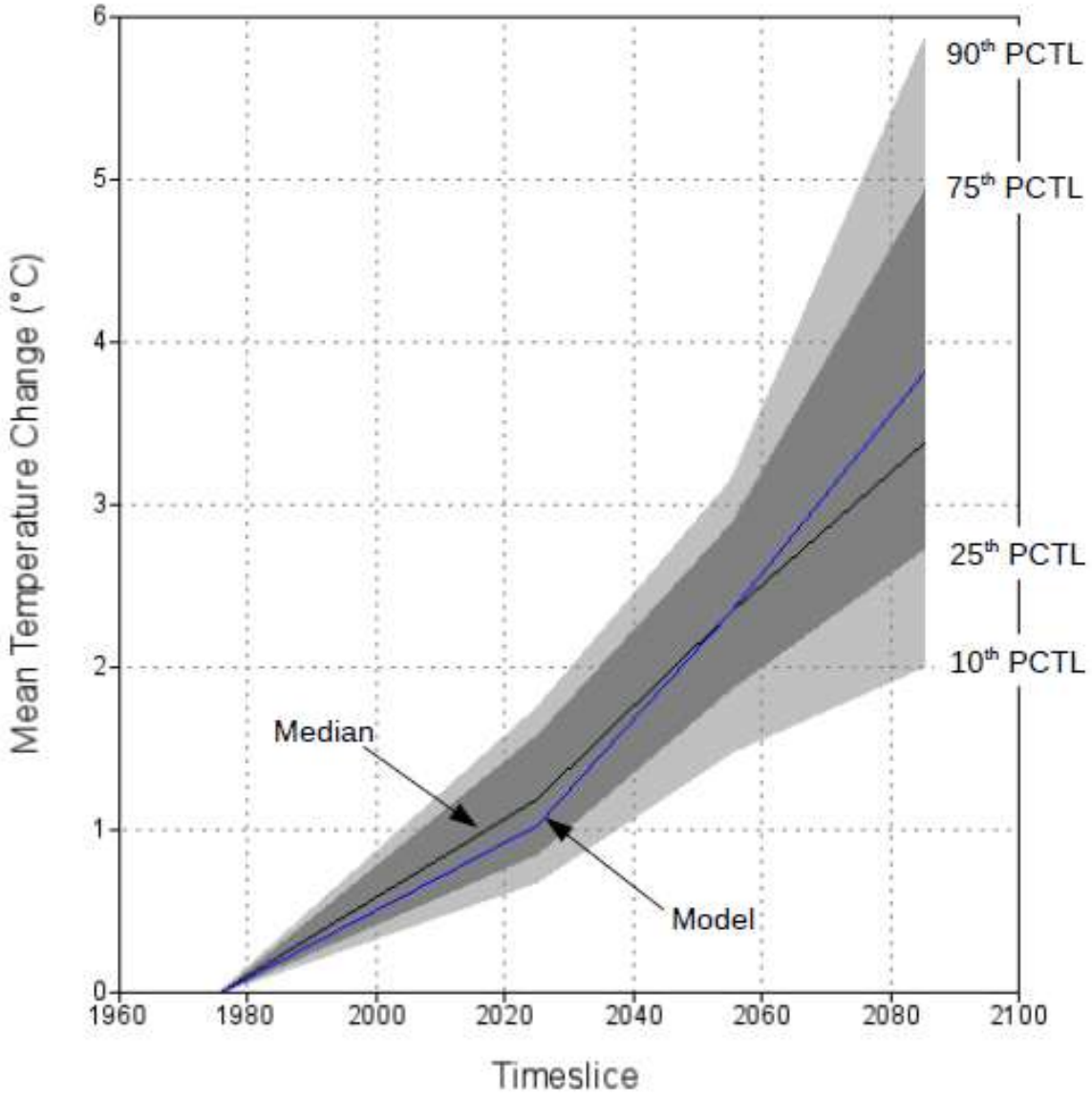


Figure 8 Range of projected summer (June, July, August) temperature change over three time periods (2020's, 2050's and 2080's) for the Central Okanagan. This figure is produced from a set of Global Climate Model (GCM) projections and represents the range of modelled outputs. The dark grey shading represents 50% of the projections used in the set, while the light grey shading

represents 80% of the projections used in the set. The black line labelled 'median' is the mid-point of projections in the set. The blue line labelled 'model' is the CGCM3 A2 run 4 model (Canadian Global Climate Model). A2 refers to one of several emissions scenarios developed by the Intergovernmental Panel on Climate Change (IPCC).

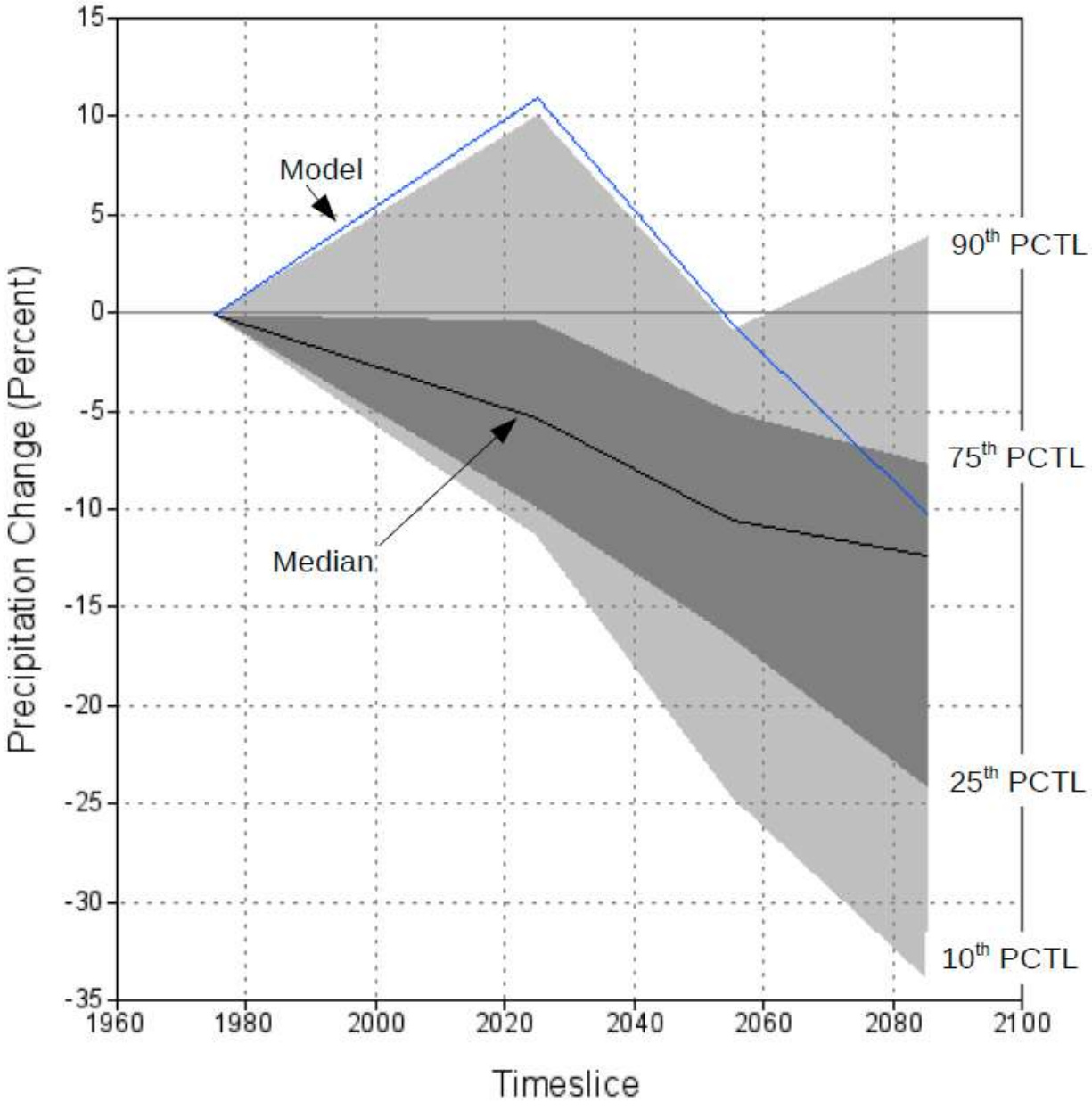


Figure 9 Range of projected summer (June, July, August) precipitation change (percent) over three time periods (2020's, 2050's and 2080's) for the Central Okanagan. This figure is produced from a set of Global Climate Model (GCM) projections and represents the range of modelled outputs. The dark grey shading represents 50% of the projections used in the set, while the light grey shading

represents 80% of the projections used in the set. The black line labelled 'median' is the mid-point of projections in the set. The blue line labelled 'model' is the CGCM3 A2 run 4 model (Canadian Global Climate Model). A2 refers to one of several emissions scenarios developed by the Intergovernmental Panel on Climate Change (IPCC).

4.2 Provincial Strategic Threat Analysis (PSTA)

The Provincial Strategic Threat Analysis (PSTA) is a provincial-scale analysis that attempts to characterize wildfire threat across BC. The analysis combines historical fire density, potential spotting impacts and predicted head fire intensity to produce a wildfire threat score. These scores are grouped into ten threat classes, ranging from 1 to 10, or Nil to Extreme. The PSTA layer is intended to serve as a starting point from which to design and conduct more detailed sampling to further characterize wildfire threat to communities.

The Lake Country PSTA ratings are illustrated on Maps 4a, 4b, 4c and 4d and are included as a separate attachment to the CWPP. Readers should be aware that private land is masked from publicly available PSTA data and products, as directed by UBCM and the BCWS.

4.2.1 PSTA Final Wildfire Threat Rating

To determine the overall PSTA Threat Rating, historical wildfire density, head fire intensity (HFI) and spotting impact are combined using a weighted averaging process. Weights are assigned as 30% fire density, 60% HFI (90th percentile fire weather index (FWI) values) and 10% spotting impact. These weighted values were added together to produce a final fire threat rating and assigned to 10 classes to produce a detailed map of fire threat rating throughout British Columbia.

The 10 threat classes represent increasing levels of overall fire threat (i.e. the higher the number, the higher the threat). PSTA Threat Class 7 is considered to be a threshold and the most severe overall threat classes are Class 7 and higher. Areas of the province that fall into these higher classes are most in need of mitigation.

Areas rated as Class 7 or higher are locations where the fire intensity, frequency and spotting can be severe enough to potentially cause catastrophic losses in any given wildfire season, where those ratings overlap with significant values at risk.

4.2.2 Spotting Impact

A common misconception amongst the public is that when homes are destroyed during a wildfire, that they are consumed by something akin to a wave of fire slamming up against neighbourhoods. This is often far from the case. Case studies from wildland urban interface fire disasters have shown that most homes aren't destroyed by direct flame impingement from extreme fire behaviour; they are more often ignited by smaller flames extending onto the house and by firebrands (embers) directly (Cohen, 2008).

4.2.3 Head Fire Intensity

Head fire intensity (HFI) is a representation of the energy release from a flaming front at the head, or leading edge of a wildfire as it proceeds in a given direction at a certain rate by

consuming available fuel. Head fire intensity is measured in kilowatts per meter (kW/m) of fire front and is a primary component of the Canadian Forest Fire Behaviour Prediction (FBP) System.

As a primary output of the FBP system, HFI is dependent on the type of fuel being burned under a given set of weather conditions and topographical characteristics. To calculate PSTA threat scores, 90th percentile weather data is used, adjusted to the existing topographical characteristics, and the prevailing fuel type. This analysis carries several assumptions (BC Wildfire Service, 2015), including:

- Applicability of the provincial fuel type layer;
- Wind and slope are aligned, which is a worst-case scenario; and
- Broad average environmental lapse rates to account for varying elevations.

Calculated HFI values are then classified into ten PSTA-HFI Classes (such as Table 11, as an example) to facilitate further calculation and analysis. The descriptors used in Table 11 will vary among fuel types and is provided simply as a generalization of potential fire behaviour.

Table 11 Head fire intensity classes and associated fire behaviour.

PSTA - HFI Class	Fire Intensity kW/m	Fire Intensity Class	Flame Length (meters)	Likely Fire Behaviour
1	0.01 – 1,000	2	< 1.8	Smouldering surface fire
2	1,000.01 – 2,000	3	1.8 to 2.5	Moderate vigour surface fire
3	2,000.01 – 4.000	4	2.5-3.5	Vigorous surface fire
4	4,000.01 – 6,000	5	3.5 to 4.2	Vigorous surface fire with occasional torching
5	6,000.01 – 10,000	5	4.2 to 5.3	Vigorous surface fire with intermittent crowning
6	10,000.01 – 18,000	6	12.3 to 18.2	Highly vigorous surface fire with torching and/or continuous crown fire
7	18,000 .01 – 30,000	6	18.2 to 25.6	Extremely vigorous surface fire and continuous crown fire
8	30,000.01 – 60,000	6	>25.6	Extremely vigorous surface fire and continuous crown fire, and aggressive fire behaviour
9	60,000.01 – 100,000	6	>25.6	Blowup or conflagration, extreme and aggressive fire behaviour
10	≥ 100,000	6	>25.6	Blowup or conflagration, extreme and aggressive fire behaviour

4.2.4 Fire History

Fire history tells the story of the relationships between fire behaviour, landscape ecology, management policy (including fire suppression), human development and other land-use changes throughout the area. The Lake Country AOI 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 fires of all size classes and provides a more accurate picture of fire occurrence trends.

Figure 10 Burned snag on the southern slope of Spion Kop. This snag is likely a remnant from the August 30, 1985 wildfire (K40136) that occurred in the area.

The fire history dataset is by no means perfect. Occasionally historical wildfires plot within lakes and there are sporadic discrepancies in information between point layers and perimeter layers for a given fire, but generally the dataset provides an adequate basis from which to conduct a historical fire analysis.

In the AOI between 1950 and 2018 a total of 385 wildfires[2] are recorded in the provincial fire history dataset. The majority of the these fires have been person-caused (68%), with the remainder (32%) being lightning-caused. On average, nearly two lightning fires and four person-caused fires occur each year in the Lake Country AOI. The most wildfires in the AOI in a one-year period occurred in 1975, with 17 total wildfires. The 1992 fire season saw the highest number of

[2] Nuisance fires, smoke chases and unknown incident types have been omitted from this analysis, as they are not technically wildfires.

lightning fires (nine), while the most person-caused wildfires (10) occurred in 1958, 1975, and 1995, respectively[3]. See Table 12 for the Lake Country AOI breakdown of wildfire occurrence from 1950 to 2018.

Table 12 Summary of total, average and annual maximum wildfires by cause in the Lake Country AOI since 1950.

	District of Lake Country AOI		
Cause	Lightning	Person	All
Total wildfires	124	261	385
Annual average	1.8	3.8	5.7
Percentage of cause	32%	68%	100%
Annual maximum	9	10	17
Year of maximum	1992	1995, 1975, 1958	1975

When wildfire occurrence since 1950 is graphed for the AOI we see that the occurrence of lightning and person-caused wildfires each display a slightly divergent linear trend (Figure 11). The annual occurrence of person-caused wildfires has increased slightly over the period, while the annual occurrence of lightning-caused fires indicates a slightly decreasing trend. While these two occurrence trends over the past 68 years may not appear significant, the rate of person-caused wildfires indicates that further prevention efforts are warranted.

The provincial fire history dataset reveals that wildfires have occurred in the AOI in all months except November, January and February (Figure 12). The occurrence of lightning-caused fires occupies a slightly narrower window, spanning March to October, with July and August as the core period for most lightning fires to start.

When pre-1950 perimeter data is included in an annual area burned analysis of the AOI (Figure 13), we see several years where the area burned exceeded 100 ha (1940, 1943, 1960 and 1985).

[3] Discrepancies are noted between fire history findings in the 2010 Lake Country CWPP and the 2019 CWPP update. We have attempted to replicate the findings of the 2010 CWPP for the 1950 -2008 period using the 2010 AOI (which is slightly different than the 2019 AOI). It appears that nuisance and smoke chase responses were included in the 2010 analysis. As nuisance fires and smoke chases do not meet the definition of a wildfire (and have only been tracked since 1999), we have excluded them from the fire history analysis for the 2019 CWPP update. Additionally, the 2010 CWPP indicates that the most wildfires to occur in a one-year period occurred in 2003 (24 fires) – we were only able to account for 12 wildfires for 2003 in the provincial dataset when the 2010 AOI was used to clip the historical fire dataset.

The largest wildfire to date in the AOI occurred on August 30, 1985 and was designated K40136 for that year. The provincial fire history datasets show a discrepancy in fire size for K40136: the attributes for the point data indicate a size of 1,670 ha, while the perimeter (polygon) information lists the size as 1,070 ha. The polygon attributes describe the source of the perimeter data as simply a buffered point as opposed to a more exact method, such as a digitized perimeter from a hard copy map source. This discrepancy in fire size appears to be limited to the one 1985 fire and is inconsequential at this point. The current practice of the BCWS is to utilize GPS tracks as a minimum for populating fire perimeter datasets, so it is unlikely that buffered points would be used in contemporary dataset versions.

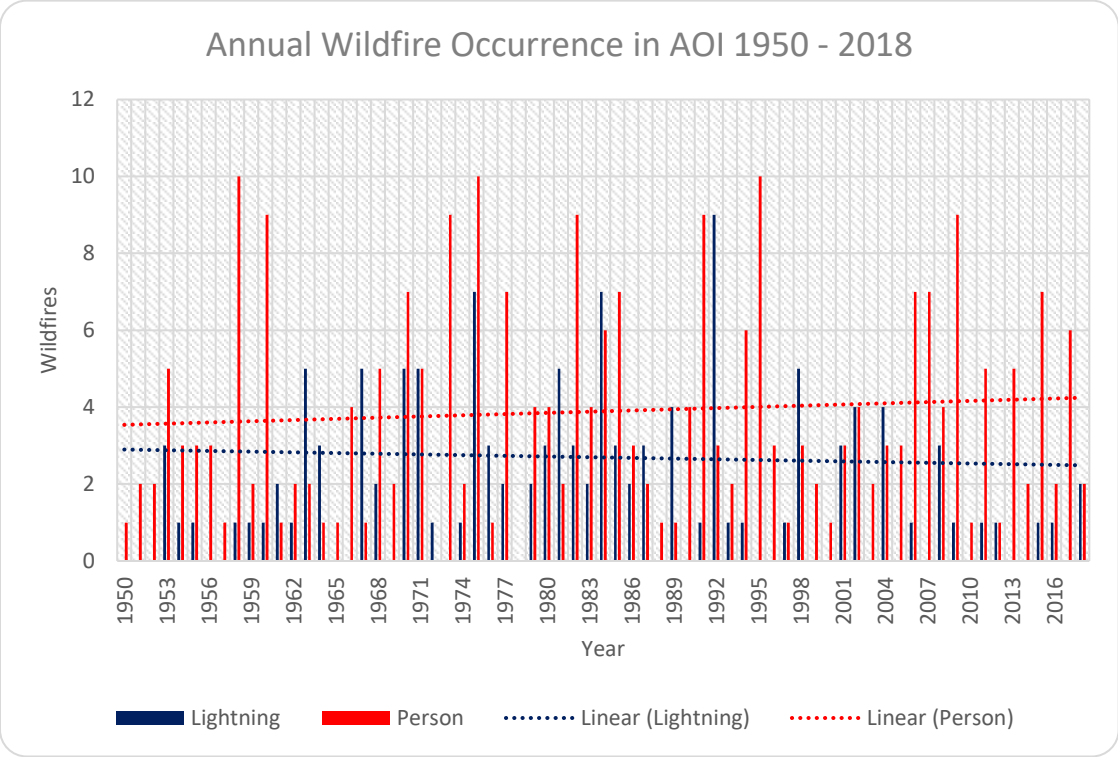


Figure 11 Wildfire occurrence in Lake Country AOI, 1950 to 2018.

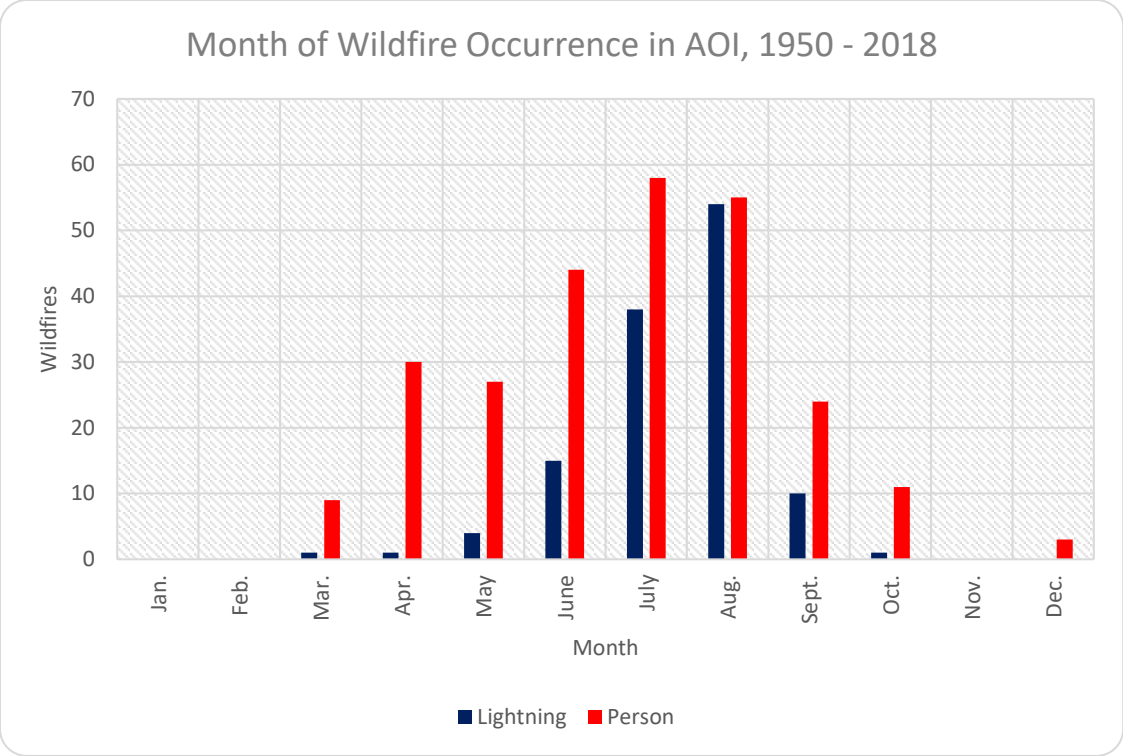


Figure 12 Month of Wildfire Occurrence in AOI (1950-2018)

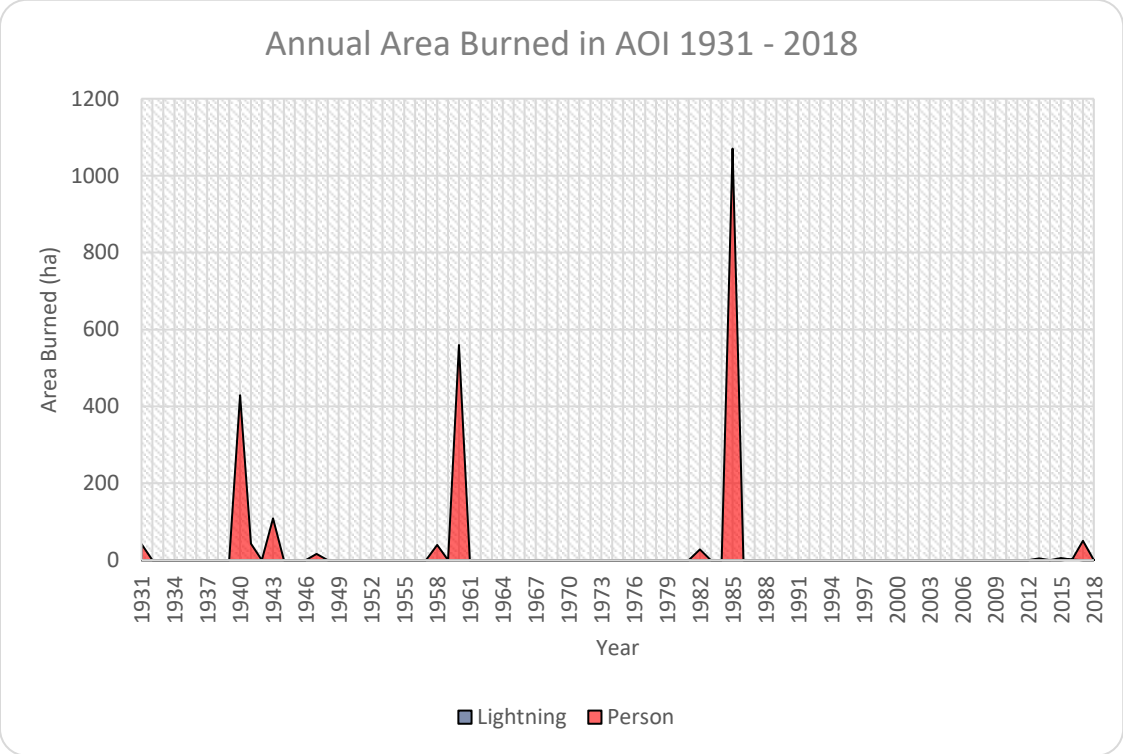


Figure 13 Annual area burned in Lake Country AOI since 1931.

For interest's sake, the entire fire history dataset for British Columbia has been summarized to help provide additional context to current wildfire issues (Figures 14 and 15). Across the province, the occurrence of person-caused wildfires[4] has displayed a steady decline since the 1970s. Curiously though, lightning fires show a nearly opposite increasing trend. Provincially, this highlights both good and bad news: humans are starting fewer unwanted wildfires, but lightning fires seem to be increasing. The former trend can be encouraged through targeted prevention campaigns and land use practices, while the latter is completely outside our control.

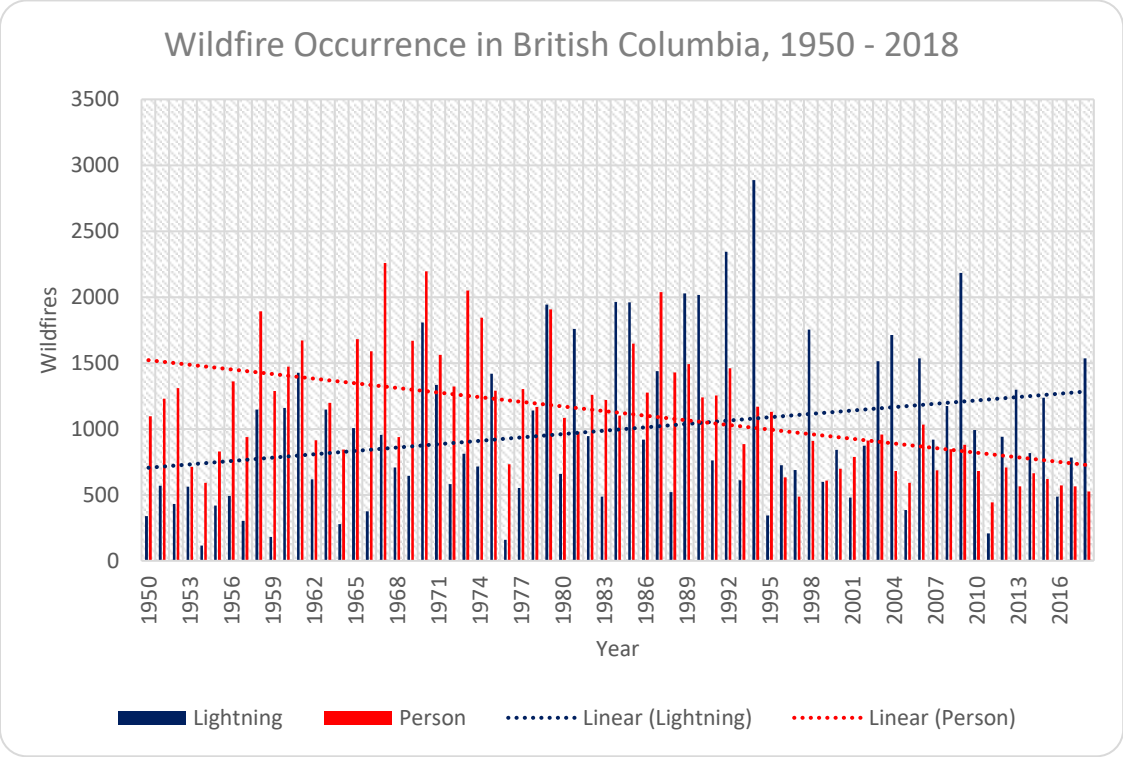


Figure 14 Wildfire occurrence in BC, 1950-2018

[4] Nuisance fires, smoke chases and unknown incident types were omitted from our analysis of the provincial data, as they are not technically wildfires.

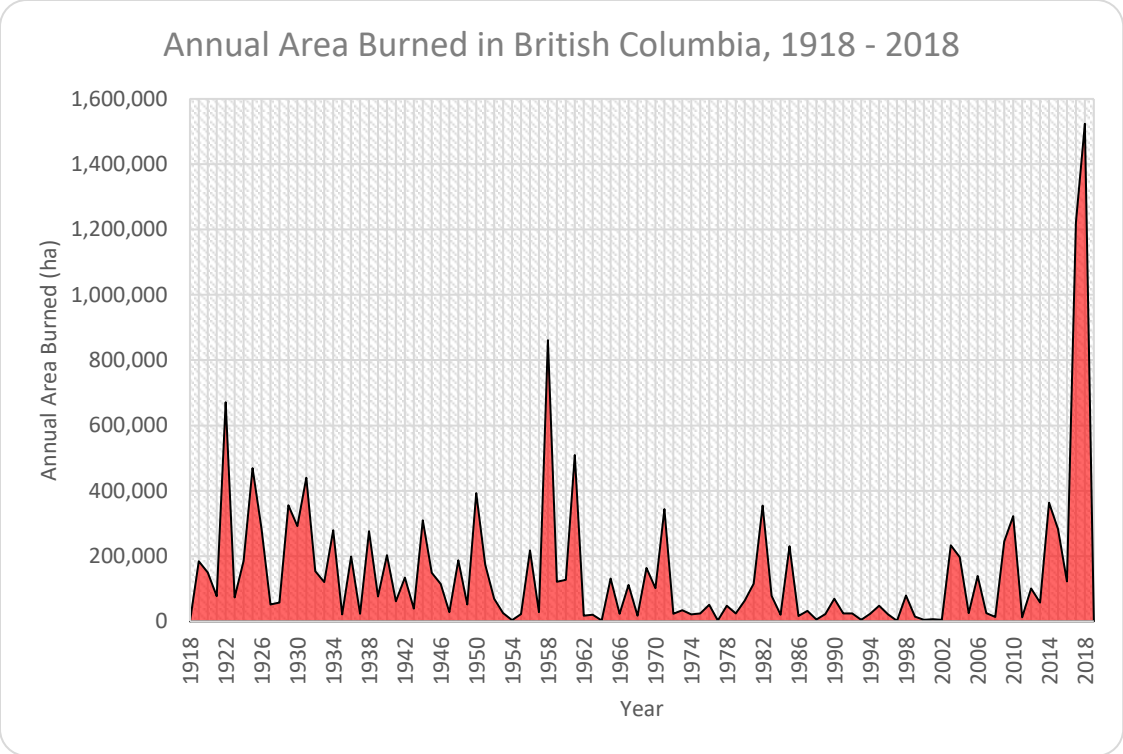


Figure 15 Annual area burned in BC, 1918-2018

4.3 Local Wildfire Threat Assessment

The process to assess wildfire threat for the Lake Country 2019 CWPP update followed the 2012 WUI Wildfire Threat Assessment guide methodology developed by Morrow et al. (2013). Normally, plot locations are selected through GIS analysis and fire behaviour modeling of the provincial fuel type layer. Specifically, the methodology (as detailed in Appendix 5) seeks municipal or crown land polygons with a modelled fire behaviour rating of Moderate or higher that are within 100-m of a structure in the WUI. This methodology serves to identify the highest priority areas for field assessment.

4.3.1 Fuel Type Verification

The issue of fuel type is somewhat more complicated in BC compared to other parts of Canada, owing to the diversity and breadth of ecosystems in this province. Fuel types are a primary input to the Canadian Forest Fire Behaviour Prediction (FBP) System and form the basis for predicting rate of spread, type of fire and fire intensity class (i.e. the primary components of the FBP system). Although FBP fuel types are intended to be viewed qualitatively and not quantitatively, many forest types in BC simply don't represent good fits with the established national FBP fuel types.

The FBP system is an adequate tool for wildfire pre-suppression (i.e. preparedness) and suppression operations. Systems such as FBP are "intended to assist firefighters and officers in estimating potential fire behaviour in constant conditions…" (Taylor & Alexander, 2016). The utility of FBP in quantifying wildfire threat or risk or assessing forest types for the purposes of

prescribing long-term fuel management treatments is not well documented or reviewed. An ecological approach to describing wildland fuels provides greater opportunity to describe characteristics related to stand structure and biomass, as it relates to wildland fire behaviour.

The ecology of Lake Country AOI is predominantly characterized by the Interior Douglas-fir and Ponderosa Pine biogeoclimatic zones, as summarized in Table 13.

Table 13 Biogeoclimatic classification of the Lake Country AOI.

Biogeoclimatic subzones/variant		Area in AOI (ha)	% of AOI
IDFxh1	Interior Douglas-fir - Okanagan Very Dry Hot	10,752	46%
PPxh1	Ponderosa Pine - Okanagan Very Dry Hot	7,001	30%
IDFdm1	Interior Douglas-fir - Kettle Dry Mild	2,327	10%
MSdm1	Montane Spruce - Okanagan Dry Mild	1,819	8%
IDFmw1	Interior Douglas-fir - Shuswap Moist Warm	957	4%
ICHmk1	Interior Cedar -- Hemlock - Kootenay Moist Cool	323	1%
		23,180	100%

The natural disturbance patterns of the IDFxh1, PPxh1 and IDFdm1 have been characterized by historically frequent stand maintaining fires (i.e. fires in the NDT4, as discussed in 4.2) 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.

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, such as dead Ponderosa pine needles, often accumulate 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.

The FBP fuel types for most interface areas in Lake Country are classified as either Grass or Ponderosa Pine Douglas-fir; termed the O1 and C7 fuel types, respectively (Table 14). The C7 fuel type lends itself well to manual fuel treatments that target the small diameter understory conifers and retains the larger diameter overstory layer. However, a C7 fuel type that undergoes this type of treatment (often referred to as “thinning from below”), ultimately remains a C7 fuel type since the FBP system has limited options for modifying C7 predictions.

At higher elevations, in the MS and ICH zones and certain IDF subzones, C-3 and M-1/2 fuel types are more or less the best (but far from perfect) fit. These areas are more typical of a stand replacement fire regime, whereby high-severity fire results in a relatively higher proportion of tree mortality. Wet belt ecosystems, such as the ICH are notoriously challenging to classify according to fuel type. Often the best option is the M-2 or C-5 fuel types, though these are nowhere near a perfect match. The ICH zone is often typical of a mixed-severity fire regime,

whereby examples of both relatively low-intensity and stand-replacing fires can be found on the landscape.

The FBP fuel type distribution for the AOI is presented in Table 14 and a generalized classification of all FBP fuel types, according to spotting potential, is provided in Table 15.

Table 14 Distribution of CFFDRS fuel types in Lake Country AOI.

FBP Fuel Type	Area (ha)	%
Non-fuel (water, urban, cultivation etc.)	8,668	37%
C-7 Ponderosa Pine/Douglas-fir	8,257	36%
O-1a Matted/Cut Grass O-1b Standing Grass	4,669	20%
C-3 Mature Jack or Lodgepole Pine	868	4%
M-1 Boreal Mixedwood - Leafless M-2 Boreal Mixedwood - Green	317	1%
S-1 Jack or Lodgepole Pine Slash	305	0.3%
D-1 Leafless Aspen D-2 Green Aspen	66	0.3%
C-4 Immature Jack or Lodgepole Pine Stands	20	0.09%
C-5 Red and White Pine	6.0	0.03%
C-2 Boreal Spruce	2.8	0.01%
	23,180	100.0%

Table 15 Fuel type categories and crown fire spotting potential.

Fuel Type Categories	**Fuel Type - Crown Fire/ Spot Potential**
1: C1, C2, C4, M3-M4 (>50% C/DF)	High
2: C3, C7, M3-M4 (<50% C/DF) M1-M2 >50% Conifer	Moderate
3: C5, C6, O1a/b, S1- S3[1] M1-M2 (26-49% Conifer)	Low
4: D1, D2, M1-M2 (<26% Conifer)	Very Low

4.3.2 Proximity of Fuel to the Community

Wildland fuels closest to built-up areas usually represent the highest hazard to communities. The common recommended approach (i.e. SWPI, CRI, FireSmart and others) is to reduce fuel hazards from the value or structure outward, ensuring mitigation continuity. Untreated areas adjacent to the value or structure may allow a wildfire to build in intensity and rate of spread, which can increase the risk to the value. To capture the importance of fuel proximity in the local wildfire threat assessment, the WUI is weighted more heavily from the value or structure outwards. Fuels adjacent to the values and/or structures at risk receive the highest rating followed by progressively lower ratings moving out.

The local wildfire threat assessment process subdivides the WUI into three areas – the first 100 meters (WUI 100), 101 to 500 meters (the WUI 500), and 501 to 2000 meters (the WUI 2000). These zones provide guidance for classifying threat levels and subsequent priorities of treatments (Table 16).

Table 16 Proximity to the Interface.

Proximity to the Interface	Descriptor	Explanation
WUI 100	(0-100 m)	This Zone is always located adjacent to the value at risk. Treatment would modify the wildfire behaviour near or adjacent to the value. Treatment effectiveness would be increased when the value is FireSmart.
WUI 500	(101-500m)	Treatment would affect wildfire behaviour approaching a value, as well as the wildfire's ability to impact the value with short- to medium- range spotting; should also provide suppression opportunities near a value.
WUI 2000	(501-2000 m)	Treatment would be effective in limiting long - range spotting but short- range spotting may fall short of the value and cause a new ignition that could affect a value.
	>2 000 m	This should form part of a landscape assessment and is generally not part of the zoning process. Treatment is relatively ineffective for threat mitigation to a value, unless used to form a part of a larger fuel break / treatment.

Where fuel treatments are intended to reduce the risk to values in the built environment, the generally accepted practice is to begin treatments at the values and progress outwards. This strategy most often straddles the boundaries between private and public land and requires a coordinated effort to have any meaningful result. When gaps of untreated fuel are left, regardless of land status, the overall effectiveness of adjacent fuel treatments can become reduced or completely negated.

4.3.3 Fire Spread Patterns

The BCWS has prepared *ISI roses* for each of its fire weather stations across the province, with the expectation that they be included in community wildfire protection planning. Similar to a

wind rose, the ISI rose uses the direction and magnitude of ISI, which is a numeric rating of expected rate of fire spread that combines the effect of wind and the fine fuel moisture code (FFMC). The ISI roses for Fintry and Ida Bell 3 are provided in Figures 16 and 17, though extreme caution is needed when interpreting the plots for anywhere but the immediate station area. No ISI rose for the West Kelowna fire weather station is available from the BCWS at present.

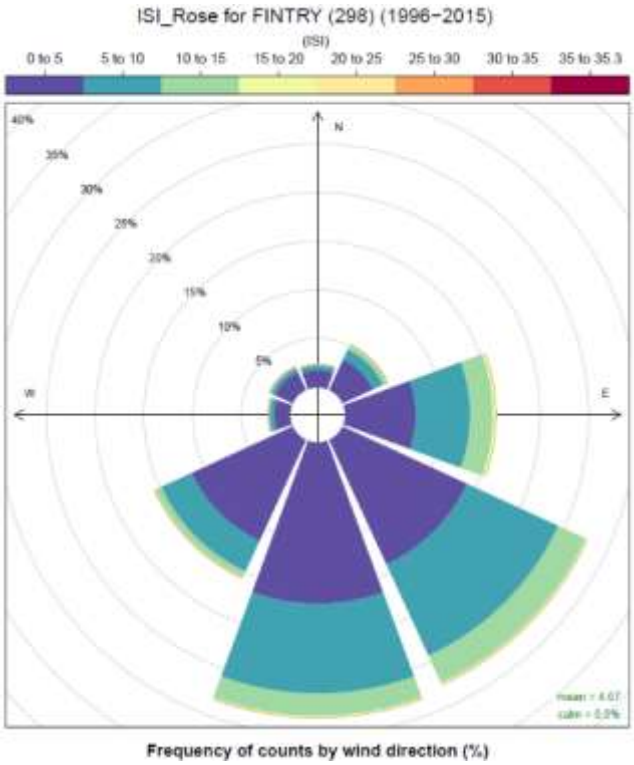


Figure 16 ISI rose for the Fintry fire weather station, 1996-2015. Provided by BCWS.

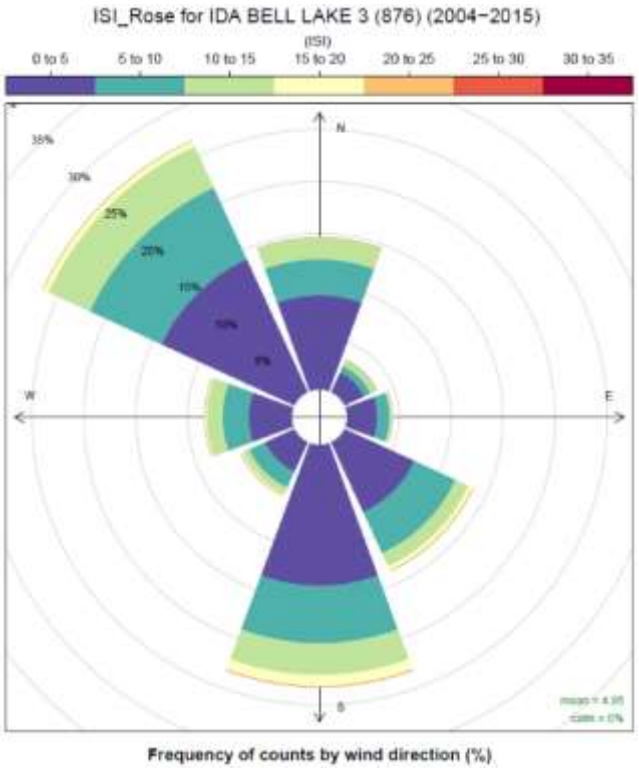


Figure 17 ISI rose for the Ida Bell 3 fire weather station, 2004 – 2015. Provided by BCWS.

4.3.4 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.

The 2012 Wildfire Threat Assessment Guide (used for this CWPP) classifies slope slightly differently than the 2017 Wildfire Risk Classification process, but the intended outcome is similar – to characterize slope steepness in terms of how a wildfire will spread and behave on a given slope. The classifications ultimately attempt to reflect the role of slope as a primary input of the Canadian Forest Fire Behaviour Prediction System (FBP), which underpins much of the threat characterization and mitigation work in BC and elsewhere.

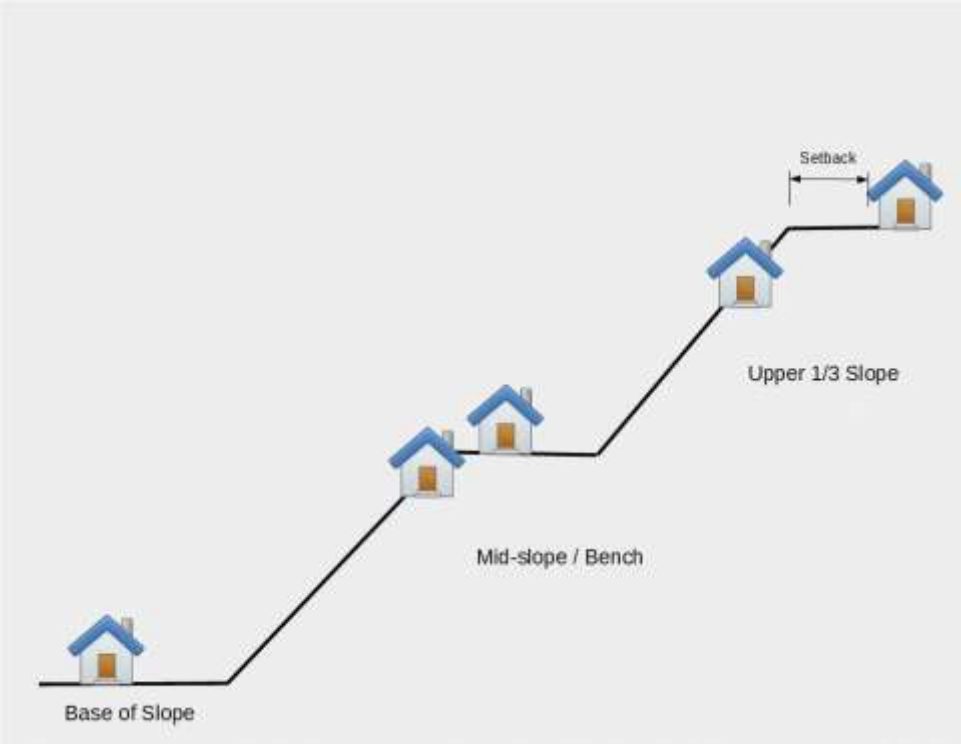


Figure 18 Relative slope position of values.

When structures (i.e. values) are situated on or near a slope, the position of the value in relation to the slope corresponds to the relative WUI threat rating. Where a slope is characterized by continuous and available fuel, values situated at the base of the slope are at less risk than values situated on the mid or upper slope (Figure 18). The risk to values that are situated on slope benches is dependant on the degree to which the value is "set back" from the crest of the slope. Adequate setback is where the value is far enough back from the crest of the slope, such that the value is not subjected to the full effects of upslope fire spread coming up from below. FireSmart Canada broadly defines adequate set back as 10 m for a single-story building, with set back increased proportionally for multi-story buildings (Partners in Protection, 2003). Set back is further illustrated in Figure 19.

Figure 19 Structure set back in relation to the steep slope below Nighthawk Road.

4.4 Summary of Section 4 Recommendations

- **Recommendation 1 (Public Engagement):** When developing wildfire-related communications for the public, consider including the ecological and cultural role that fire has played on the regional landscape.
- **Recommendation 2 (Prevention and Preparedness):** Consider approaching the BC Wildfire Service to explore the possibility of re-establishing a fire weather station on the Aberdeen Plateau to provide improved fire weather information related to important watershed values.
- **Recommendation 3 (Prevention and Public Engagement):** Maintain the link from the District of Lake Country website to the BC Wildfire Service Fire Danger Rating webpage to enable the public to maintain awareness of potential wildfire conditions. If possible, integrate an API into the Lake Country website that enables display of the current Fintry and West Kelowna Danger Class directly on the Lake Country website.
- **Recommendation 4 (Preparedness and Governance):** On an annual basis, consider preparing a Danger Class report for the Fintry, West Kelowna and Ida Bell 3 fire weather stations to help characterize fire danger trends year over year and assist decision makers in representing wildfire-related challenges faced by Lake Country.

5. Risk Management and Mitigation Factors

When considering the risk of wildland urban interface fires the issue can be viewed in terms of the probable frequency of a fire occurring, and the probable magnitude of the resulting losses. Wildfire occurrence directly relates to fire cause and is the focus of fire prevention planning and education, which is a fundamental element of wildfire management. As discussed in 4.2.4 fire cause in the AOI is attributed predominantly towards people. This fact illustrates the importance of an all-encompassing approach to managing wildland urban interface fire threats: although prevention programs can reduce the occurrence of person-caused fires, we will never be able to completely eliminate the probability of a wildfire occurring, so we also need to attempt to reduce the magnitude of each occurrence and it's associated probable future losses.

5.1 Fuel Management

Managing wildland fuels is one aspect of reducing the risk to communities in the wildland urban interface. In the drier portions of the AOI, as previously discussed, the predominant fuel type in the interface is C7 Ponderosa Pine Douglas-fir. This fuel type, exemplified in the Interior Douglas-fir and Ponderosa Pine biogeoclimatic zones, is particularly well-suited to certain fuel management treatments, owing to its typical fire-maintained structure of well-spaced and pruned fire adapted conifer overstory (Figure 20).

A variety of treatment methods are available for this particular fuel type, depending on treatment intensity, treatment timing, site sensitivity and public support, among other factors. Treatments in the C7 have traditionally been carried out by hand crews, whereby thinning and pruning have been undertaken with a variety of tools and techniques, including power saws, brush saws, pole-pruners etc. Debris disposal is typically carried out either through pile and burn, chipping or hauling off-site. These types of hand treatments can be labour intensive, depending on stand density, surface fuel loading and terrain limitations. Hand treatments are well suited to sites with thin and sensitive soils that would be otherwise degraded through ground-based equipment.

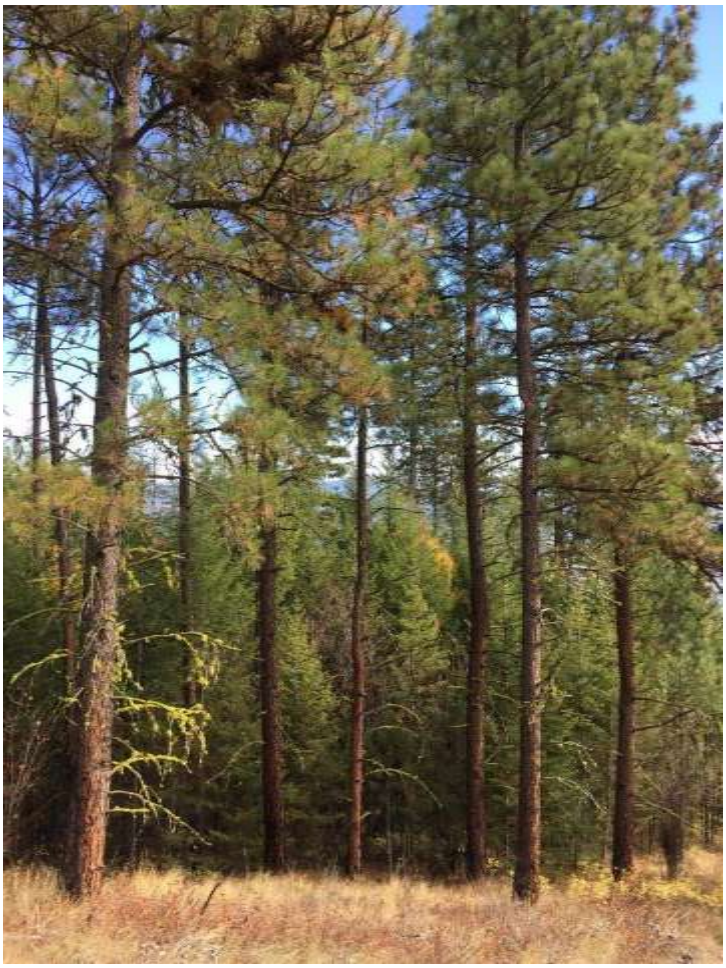


Figure 20 This photo from Spion Kop is typical of the post-1985 fire stand conditions in the area. Dense stands of juvenile Ponderosa pine have established in the understory, increasing the vertical fuel continuity (i.e. ladder fuels) within the stand.

Fuel treatments can also be carried out with mechanized equipment, such as feller bunchers and various types of mulchers. Conventional timber harvesting is also a viable form of fuel management in certain timber types, with the added benefit of at least partial recovery of costs through log utilization. The use of machinery enables the land manager to realize higher production rates compared to hand crew treatments alone. Site sensitivities are a significant factor when considering the use of mechanized methods – thin soils, common to lower elevation hot/dry sites can be significantly degraded if treatments aren't designed and carried out professionally.

Regardless of the method for reducing fuel loading on any particular forested site, surface fuels must be considered and attended to. During hand falling/bucking or mechanical harvesting, processing and yarding, surface fine fuel loading can increase with disturbance. In many cases, particularly in Ponderosa pine and interior Douglas-fir stands, the use of low-intensity prescribed fire can be an effective means of both reducing surface fine fuel loads and realizing beneficial ecological fire effects.

Fuel management treatments, particularly on NDT4 sites, should not be viewed as one-time actions. Rather, fuel treatments require periodic maintenance entries to maintain the integrity and purpose of the treatment area. In the absence of maintenance, or periodic low-intensity fire, treated NDT4 sites will trend back towards pre-treatment structure and conditions.

Fuel breaks on Crown Land immediately adjacent to private land and in close proximity to the wildland urban interface and/or intermix areas, are termed *interface fuel breaks*. Interface fuel breaks are designed to modify fire behaviour, create fire suppression options and a safe place from which to anchor crews and tactics, and improve suppression outcomes. The dimensions of interface fuel breaks are dependant on the forest/fuel type and associated fire behaviour, but generally this type of fuel break will occupy, at minimum, the WUI 100 zone. The design of an interface fuel break should incorporate existing natural features, where they exist, that offer a similar modification or impediment to fire behaviour. These can be areas of low fuel loading, no fuel loading or a fuel type with less potential fire behaviour.

Fuel breaks created through stand modification are not intended to be impenetrable barriers to fire spread; rather they are intended to modify and decrease fire behaviour. Similarly, the presence of an interface fuel break alone does not ensure the survivability of adjacent structures, especially if those properties are not FireSmart. The combination of a well designed and maintained interface fuel break *and* adjacent private property and structures that are FireSmart, is a proven method of achieving real risk reduction.

Fuel breaks located beyond interface fuel breaks (i.e. beyond the WUI 100 zone) are termed *primary fuel breaks.* The location of primary fuel breaks is contingent on land ownership (Crown vs. private), existing natural and man-made features, fuel types, and prevailing wind patterns. As with interface fuel breaks, primary fuel breaks are intended to modify fire behaviour and create fire suppression options that reduce the risk of high intensity wildfire reaching a community or other built-up areas.

Primary fuel breaks may be located to completely surround a community or be strategically placed upwind of communities and perpendicular to fire season winds. Primary fuel breaks need to have sufficient width and fuel modification to minimize horizontal and vertical fuel continuity to effectively reduce the head fire intensity as a wildfire enters into the fuel break.

As with interface fuel breaks, primary fuel breaks should not be viewed as impenetrable barriers to fire spread. The potential for ember transport and spot fires on the community side of any fuel break is a very real concern and may negate the effectiveness of any fuel break if not designed and treated in a manner that attempts to reduce this risk.

Five broad potential primary fuel break areas have been identified and are summarized in Table 18, representing 121.5 ha in total. Within the WUI four possible interface fuel breaks have been identified through GIS analysis (detailed in Appendix 5) followed by site assessments using the 2012 WUI Wildfire Threat Assessment process (Morrow, et al., 2013). These proposed interface fuel breaks are summarized in Table 17 and total 20.2 ha.

Table 17 Interface Fuel Breaks

Poly	Reference Plot	Wildfire Behav. Threat Class	WUI Threat Class	Geographic Area	Area (ha)	Feature Type	Priority Rank
1	LC_099	EXTREME	EXTREME	Nighthawk Rd	4.6	Interface Fuel Break	Priority 1
2	LC_003	HIGH	EXTREME	Spion Kop Peak	8.6	Interface Fuel Break	Priority 2
7	LC_098	HIGH	EXTREME	Nighthawk Rd 2	0.9	Interface Fuel Break	Priority 7
9	LC_012	HIGH	High	Jack Seaton Park 1	6.1	Interface Fuel Break	Priority 9
					20.2		

Table 18 Primary Landscape Level Fuel Breaks

Poly	Reference Plot	Wildfire Behav. Threat Class	WUI Threat Class	Geographic Area	Area (ha)	Feature Type	Priority Rank
3	LC_002	EXTREME	MOD	Spion Kop 2	29.5	Landscape Fuel Break	Priority 3
4	LC_005	EXTREME	HIGH	Spion Kop 3	23.1	Landscape Fuel Break	Priority 4
5	LC_010	EXTREME	MOD	Oyama Lake FSR	31.5	Landscape Fuel Break	Priority 5
6	LC_001	EXTREME	HIGH	Spion Kop Apex Trailhead	26.0	Landscape Fuel Break	Priority 6
8	LC_006	HIGH	HIGH	Spion Kop 4	11.4	Landscape Fuel Break	Priority 8
					121.5		

5.2 FireSmart Planning and Activities

The FireSmart Canada program is administered by Partners in Protection, a national non-profit association comprised of national, provincial and local government agencies with fire protection mandates. Modelled after the FireWise Communities USA program in the United States, FireSmart Canada has developed a comprehensive planning and assessment process to mitigate wildfire hazards to existing communities, as well as guide new development. Although the FireSmart program is primarily focused towards residential homes, the principles have been adapted for application in mixed-use areas, industrial activities and elsewhere. For this reason,

although home or house are the terms most often used when describing FireSmart principles, structure or building are equally appropriate and more broadly applicable.

5.2.1 FireSmart Goals and Objectives

The FireSmart program seeks to strike a reasonable balance between the aesthetic values of living in WUI areas with the need to make communities more resilient to the effects of wildfire. At the core of the FireSmart program is the relationship between a home and the surrounding natural areas and whether this relationship can result in the transfer of fire between the two. Hazards are assessed and mitigated by giving priority to the structure and immediate surroundings and then working progressively outwards. This is accomplished through the establishment of three zones around a structure:

- Priority Zone 1a: The area within 1.5m of a building
- Priority Zone 1: The area within 10 m of a building
- Priority Zone 2: The area 10-30 m from a building
- Priority Zone 3: The area 30-100 m from a building

On sites with relatively higher building densities, multiple sets of priority zones invariably overlap. One building's Zone 2 may be an adjacent building's Zone 1 and so forth. This characteristic is common in all but the most rural of WUI settings and speaks to the shared nature of wildfire hazard and collective resilience.

The general goal of FireSmart is to encourage private land owners to adopt and conduct FireSmart practices to reduce the fuel hazard and implement other measure to minimize damages to assets on their property from wildfire. These include:

- Reduce the potential for an active crown fire to move through private land.
- Reduce the potential for ember transport through private land and structures.
- Create landscape conditions around properties where fire suppression efforts can be effective and safe for responders and resources.
- Treat fuels adjacent and nearby to structures to reduce the probability of ignition from radiant heat, direct flame contact, and/or ember transport.
- Implement measures to structures and assets that reduce the probability of ignition and loss.

Research and post-fire reviews have shown that when values have been constructed, retrofitted or treated in accordance with FireSmart principles, they stand a greater chance of survival compared to those that haven't (Westhaver, 2017; Partners in Protection, 2003). The spatial scale that determines home ignitions corresponds more to the specific site and characteristics of homes and property than to landscape scale wildfire management and fuel modification strategies (Cohen, 2000). In order to truly reduce the threat of homes and other values being destroyed in wildland urban interface fire disasters, homeowners and governments alike must take deliberate and concerted steps to properly assess and mitigate hazards. An excellent example of private property fuel reduction was observed in the Nighthawk Road area (Figure 21).

Figure 21 This photo illustrates good fuel management practices employed by some homeowners in the Nighthawk Road area. These private property efforts should be complemented by fuel management treatment on adjacent municipal lands.

5.2.2 Key Aspects of FireSmart for Local Governments

The FireSmart program is wholly dependent on interest and participation from residents who live in fire prone environments. Obviously, while local governments can't force residents to take an active interest in any particular cause or issue, they can conduct public education and awareness campaigns and support FireSmart projects, with the goal of building a critical mass of motivated residents who are committed to reducing the ignitability of their homes.

The challenge that local governments continue to face is how to deal with private landowners who are either unable or unwilling to mitigate fuel hazards on their property. Publicly funded programs such as FireSmart are not permitted to be used directly for work on private property, and there is little recourse for local governments to compel private landowners to undertake mitigation actions. Even if most homes in a residential area undertake meaningful FireSmart actions, when unmitigated private properties are interspersed among them, the overall threat to mitigated property remains, due to the threat of structure to structure ignition and propagation. Suggested FireSmart activities that have been successful with other local governments are presented in Table 19.

Table 19 FireSmart practices and activities.

FireSmart Theme	Suggested Activities
Communication, Education & Partnerships	• Host a FireSmart day • Use local government newsletters and social media • Undertake FireSmart Local Representative or Community Champion training • Continue to pursue CRI funding for FireSmart projects • Form a community-wide FireSmart committee • Encourage homeowners and/or neighborhoods to undertake FireSmart site assessments and area assessments
Vegetation management	• Develop FireSmart demonstration areas in public spaces, such as parks and municipal facilities • Strengthen landscaping requirements in zoning and development permits to require fire resistive landscaping and replacement of legacy high-flammability plants. • Facilitate treatment debris disposal for landowners
Planning & Development	• Strengthen policies and practices for FireSmart construction and maintenance of public buildings • Maintain the Development Permit Areas for Wildfire Interface in order to require FireSmart exterior finishing, landscaping and professional assessments and recommendations

5.2.3 Priority Areas within the Area of Interest for FireSmart

Lake Country could benefit from a program of FireSmart projects, with the goal of achieving FireSmart Canada Community Recognition for a number of neighbourhoods. Based on assessments of Lake Country, the following neighbourhood areas are suggested for FireSmart Community Recognition projects:

- Nighthawk Road;
- Jack Seaton Park area;
- Apex Drive area;
- Lakehill Drive area;
- Forest Hills;
- Juniper Cove;
- Oyama Lake Road.

5.3 Community Communication and Education

The following community engagement strategies would be of benefit to Lake Country and its residents in furthering wildland urban interface fire awareness and education:

- Establish a community wildfire safety page on Lake Country webpage, that includes:
    - the current CWPP;
    - completed FireSmart Community Assessment Reports;
    - information for residents on how to conduct their own FireSmart Structure and Site Hazard Assessment Forms, and steps they can take to lower their hazard scores;
- Host wildfire or FireSmart public education workshops or information sessions prior to and during fire season

5.4 Summary of Section 5 Recommendations

- **Recommendation 5 (Prevention):** The application of prescribed fire in and around Lake Country should be supported as a proactive method of fuels management that can result in less smoke output than similar areas burning under wildfire conditions.
- **Recommendation 6 (Prevention and Public Engagement):** Wildland urban interface threat reduction should be promoted as a mutually beneficial strategy between private property owners and governments. Private property owners and governments alike need to take responsibility for the wildland fuel under their ownership.
- **Recommendation 7 (Prevention and Governance):** Maintain the Wildland Fire Development Permit Area requirements as drafted in the 2018 – 2038 District of Lake Country Official Community Plan. As various development permit requirements are amended from time to time, ensure that requirements and guidelines complement the Wildland Fire Development Permit Area requirements.
- **Recommendation 8 (Prevention and Public Engagement):** Lake Country should consider initiating FireSmart projects, as it is one of the best available options for generating public interest and action regarding hazard reduction on private property. Suggested neighbourhoods are listed in 5.2.3.
- **Recommendation 9 (Prevention and Public Engagement):** Establish a wildfire safety and hazard reduction page on the Lake Country Fire Department website to highlight the FireSmart program and simple actions that homeowners can take to reduce their homes' susceptibility to ignition during a wildfire. Engage in public education information sessions throughout Lake Country associated with wildfire management and/or FireSmart.
- **Recommendation 10 (Prevention):** Consider the landscape and interface fuel breaks referenced in Tables 17 and 18 for fuel mitigation treatments, followed by periodic maintenance.

6. Wildfire Response Resources

The BC Wildfire Service, as a branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), has responsibility to respond to wildfires outside local fire protection areas and to provide assistance to local fire departments on wildfires within their fire protection area, when requested. Fire departments are responsible for their own costs incurred while responding to wildfires within their jurisdiction. Costs incurred by the BCWS to undertake firefighting assistance within a fire department protection area are borne by the Province. In situations where the BCWS requests a fire department to respond to a wildfire outside their fire protection area, the fire department is compensated according to the Inter-Agency Operational Procedures and Reimbursement Rates agreement (The Office of the Fire Commissioner, The Fire Chiefs Association of BC, BC Wildfire Service, 2017).

6.1 Local Government Firefighting Resources

When the District of Lake Country was incorporated in 1995, the Winfield, Carr's Landing and Oyama volunteer fire departments were amalgamated to form the Lake Country Fire Department. The department provides emergency medical, firefighting and rescue services to the community and is party to the Regional District of Central Okanagan mutual aid agreement. Regionally, the department participates in extrication, rope and marine rescue.

6.1.1 Fire Department and Equipment

The Lake Country Fire Department has a complement of seven career staff and 54 paid-on-call firefighters. The department is situated in three fire stations: Station 91 (Oyama); Station 81 (Carr's Landing); and Station 71 (Winfield), which is also headquarters for the Fire Chief, Deputy Fire Chief, Emergency Services Clerk and the Fire Inspector. The department's complement of apparatus is listed in Table 20.

During the 2018 municipal elections a referendum question was posed to voters regarding the replacement of Station 71. The referendum passed and will enable Lake Country to borrow up to $6.6 million to fund the replacement of Station 71.

Table 20 Lake Country Fire Department apparatus.

Station	Designator	Type	Description
Station 71 - Winfield	Engine 71	Engine	2013 Freightliner
	Mini 71	Mini Pumper	2000 Ford F550
	Ladder 71	Ladder truck	2011 Smeal
	Pumper 71	Pumper	2004 Spartan
	Tender 71	Water Tender	1998 International
	Rescue 71	Rescue truck	2018 Freightliner
	Mule 71	UTV & Wagon	2007 Kawasaki
Station 81 - Carr's Landing	Engine 81	Engine	2013 Freightliner
	Pumper 81	Pumper	1998 International
Station 91 - Oyama	Engine 91	Engine	2007 Freightliner
	Pumper 91	Pumper	1990 Pierce
	Bush 91	Bush truck	2015 Ford F450
	Marine Rescue 91	Regional rescue boat	2014 Kanter Marine

6.1.2 Water Availability for Wildfire Suppression

Water for fire suppression in the District of Lake Country is referenced variously in Bylaw 985, 2016, which draws upon the Fire Underwriters Survey (FUS) guidelines on water supply for public fire protection (Fire Underwriters Survey, 1999).

6.1.3 Access and Evacuation

The District of Lake Country Bylaw 985, 2016, Section G references road classifications and specifications for hillside collector, local, public/private lanes and cul-de-sacs, including widths and geometry (District of Lake Country, 2016). All road specifications are within the guidelines recommended by FireSmart Canada for road widths and radii.

Lake Country has a comprehensive emergency evacuation plan that delineates 39 evacuation zones throughout the district (District of Lake Country, 2016).

6.1.4 Training

In addition to the S-100 basic wildfire training, a number of additional wildland firefighting course exist within the BCWS training catalogue that have been difficult for non-BCWS fire personnel to access. Owing to the frequency of wildland and wildland urban interface firefighting that Lake Country departments undertake, there should also be increased opportunities for local fire services personnel to undertake wildfire agency training normally reserved for BCWS employees. Possible training includes:

- Basic and Intermediate Wildland Fire Behaviour (S-290 and S-390, respectively);
- Wildfire Scene Preservation for First Responders (FI-110);
- Aviation safety and awareness training;
- Ignition operations and prescribed burn training;

6.2 Structure Protection

There are recent examples of wildland urban interface fires in the Okanagan (e.g. Glenrosa 2009, Seclusion Bay 2010, Trepanier Creek 2012, Okanagan Centre 2017 etc.) where the deployment of structure protection sprinkler systems was not possible or practical during the initial attack. In some cases, structures were impacted so quickly after a wildfire started that it would have been unlikely to achieve successful deployment of an SPU. While engaged in the critical initial attack phase of suppression, finite resources are often exclusively dedicated to life safety (i.e. rescues and evacuation) and fire control assignments. The ability to undertake structure assessments, plan and deploy structure protection sprinklers is often not possible during the emergent stages of a developing WUI fire. Structure protection units and SPU crews and specialists are most often deployed to fires that either already or have the potential to become longer duration project fires where extensive areas require SPU capability. In these cases, Type 1 SPU trailers are often deployed.

Homeowners should not rely on whether SPU capabilities can be installed on their home in time to save it. Rather, an active and concerted effort needs to be taken by residents to assess and mitigate hazards that affect the ignitability of their homes *before* a wildland urban interface fire disaster unfolds. It will never be possible to dedicate sprinklers and firefighters to protect every home in BC from wildfire – homeowners need to take action themselves ahead of time.

There are, however, scenarios when a local SPU that can be deployed in a timely manner can offer a tactical advantage to the local fire service. One such scenario is a small inaccessible wildfire that is forecasted to exhibit substantial growth due to a pending wind event but suppression options are limited (e.g. darkness precluding air operations etc.). Another possible scenario is a large persistent project fire burning beyond the Lake Country fire protection area and Lake Country wants to prepare structure protection ahead of a wind event (e.g. cold front passage).

Some fire departments in BC have procured their own SPUs to complement their suppression capabilities. In many cases, it has proven to be a useful tool for local suppression needs. Additionally, it can also prove to be a significant source of income during the fire season when provided to the BCWS. Such income can help subsidize the fire department and reduce the budgetary needs or burden on the Local Government.

6.3 Summary of Section 6 Recommendations

- **Recommendation 11 (Operations):** As interagency partners in wildfire suppression operations, Lake Country Fire Department should consider pursuing seats in basic and intermediate wildfire training opportunities with the BC Wildfire Service.
- **Recommendation 12 (Operations and Preparedness):** Lake Country should consider acquiring a Type 2 Structure Protection Unit for the Lake Country Fire Department that can be used locally or deployed under cost recovery elsewhere in the province when conditions allow.

7. References

AECOM, 2009. *District of Lake Country - Liquid Waste Management Plan - Amendment Stage 1 - Final Report.* [Online]
Available at: https://lakecountry.civicweb.net/document/36262
[Accessed 8 December 2018].

Alexander, M. E., Lawson, B. D., Stocks, B. J. & Van Wagner, C. E., 1984. *User Guide to the Canadian Forest Fire Behaviour Prediction System: Rate of Spread Relationships - Interim Edition,* Ottawa: Canadian Forestry Service Fire Danger Group.

BC Conservation Data Centre, 2018. *BC Species and Ecosystems Explorer.* [Online]
Available at: http://a100.gov.bc.ca/pub/eswp/

BC Government News, 2018. *Government partners with communities on wildfire risks.* [Online]
Available at: https://news.gov.bc.ca/releases/2018FLNR0259-001733

BC Hydro, 2016. *Transmission System Map.* [Online]
Available at: https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/suppliers/transmission-system/maps/transplt.pdf

BC Wildfire Service, 2015. *Provincial Strategic Threat Analysis 2015 Wildfire Threat Analysis Component,* Victoria: Province of British Columbia.

BCCDC, 2018. *BC Centre for Disease Control, Smoky skies in B.C. can create health problems for some.* [Online]
Available at: http://www.bccdc.ca/about/news-stories/stories/2018-wildfire-smoke
[Accessed 8 November 2018].

BCUC, 2016. *BC Utilities Commission - Application for Approval of 2016 Rates - FortisBC.* [Online]
Available at:
https://www.fortisbc.com/About/RegulatoryAffairs/GasUtility/NatGasBCUCSubmissions/Documents/G-202-15_FBC_Annual_Review_2016_Rates_DECISION_REASONS.pdf
[Accessed 8 November 2018].

City of Kelowna, 2016. *Regional Emergency Program.* [Online]
Available at: https://www.kelowna.ca/city-services/emergency-services/regional-emergency-program

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.

Data BC, 2018. *BC Wildfire Active Weather Stations.* [Online]
Available at: https://catalogue.data.gov.bc.ca/dataset/bc-wildfire-active-weather-stations

Deacon, C., 2017. *Fires a burden on tourism.* [Online]
Available at: https://news.totabc.org/2017/08/02/fires-a-burden-on-tourism/

District of Lake Country, 2008. *Burning Bylaw 612 - 2007.* [Online]
Available at: https://lakecountry.civicweb.net/filepro/documents/958?preview=5074
[Accessed 6 December 2018].

District of Lake Country, 2010. *Hydroelectric Generating Station. GMF Project Completion Report.* [Online]
Available at: https://lakecountry.civicweb.net/document/5030
[Accessed 9 December 2018].

District of Lake Country, 2015. *Water Operations 2015 Annual Report.* [Online]
Available at: https://lakecountry.civicweb.net/document/57904
[Accessed 8 December 2018].

District of Lake Country, 2016. *Lake Country Evacuation Plan.* [Online]
Available at: https://lakecountry.civicweb.net/document/57070
[Accessed 14 December 2018].

District of Lake Country, 2016. *Subdivision and Development Servicing Bylaw 985, 2016.* [Online]
Available at:
https://lakecountry.civicweb.net/filepro/document/62213/Subdivision%20and%20Development%20Servicing%20Bylaw%20985%2C%202016.pdf
[Accessed 4 January 2019].

District of Lake Country, 2018. *Draft Official Community Plan 2018 - 2038.* [Online]
Available at: https://lakecountry.civicweb.net/document/76772
[Accessed 2 January 2019].

Duran, S., 2014. *Evidence Review: Wildfire smoke and public health risk,* Vancouver: BC Centre for Disease Control.

Filmon, G., 2004. *Firestorm 2003 Provincial Review.* [Online]
Available at: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/wildfire-management/governance/bcws_firestormreport_2003.pdf

Fire Underwriters Survey, 1999. *Water Supply for Public Fire Protection.* [Online]
Available at:
http://www.fireunderwriters.ca/docs/FUS_Water%20Supply%20for%20Public%20Fire%20Protection_v2006.pdf

FortisBC, 2004. *Transmission and Distribution System Development Plan.* [Online]
Available at: https://www.bcuc.com/Documents/Proceedings/2010/DOC_24309_B-3-3-2_FortisBC-ResponsesIR-No-1-BCMEU-Appendix-A15.1a.pdf
[Accessed 8 November 2018].

FortisBC, 2007. *An Application for a CPCN - Distribution Substation Automation Program.* [Online]
Available at:
https://www.fortisbc.com/About/RegulatoryAffairs/ElecUtility/Documents/FortisBC%20Distribution%20Substation%20Automation%20CPCN%20Application.pdf
[Accessed 8 November 2018].

FortisBC, 2009. *FortisBC Pipeline System.* [Online]
Available at:
https://www.fortisbc.com/NaturalGas/Business/TransportationServiceOption/Documents/WINS_FortisBC_Pipeline_System_Map_2593.pdf

FortisBC, 2011. *Service Areas.* [Online]
Available at: https://www.fortisbc.com/About/ServiceAreas/Pages/default.aspx
[Accessed 4 November 2018].

FortisBC, 2016. *Corporate Emergency Response Plan.* [Online]
Available at:
https://www.fortisbc.com/Safety/EmergencyPreparedness/Documents/Corporate_Emergency_Response_Plan_2016.pdf

Government of Canada, 2016. *Census Profile, 2016 Census - Lake Country.* [Online]
Available at: https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CSD&Code1=5935016&Geo2=PR&Code2=59&Data=Count&SearchText=Lake%20Country&SearchType=Begins&SearchPR=01&B1=All&TABID=1

HealthLinkBC, 2017. *Wildfires and Your Health.* [Online]
Available at: https://www.healthlinkbc.ca/health-feature/wildfires

Interior Health, 2018. *Kelowna General Hospital.* [Online]
Available at:
https://www.interiorhealth.ca/FindUs/_layouts/FindUs/info.aspx?type=Location&loc=Kelowna%20General%20Hospital&svc=&ploc=

Interior Health, 2018. *South Similkamee Health Centre.* [Online]
Available at:
https://www.interiorhealth.ca/FindUs/_layouts/FindUs/info.aspx?type=Location&loc=South%20Similkameen%20Health%20Centre&svc=&ploc=
[Accessed 8 November 2018].

Lake Country Fire Department, 2018. *LCFD.* [Online]
Available at: https://www.lakecountry.bc.ca/en/living-in-our-community/fire-department.aspx
[Accessed 5 December 2018].

Lawson, B. D., Stocks, B. J., Alexander, M. E. & Van Wagner, C. E., 1985. *A System for Predicting Fire Behaviour in Canadian Forests.* Detroit, Society of American Foresters, pp. 6-16.

Morrow, B., Johnston, K. & Davies, J., 2013. *Wildland Urban Interface Wildfire Threat Assessments in B.C..* [Online]
Available at: http://fness.bc.ca/wp-content/uploads/2017/07/WTA-Guide-2012-Update.pdf
[Accessed 12 June 2018].

Naeher, L. et al., 2007. Woodsmoke health effects: a review. *Inhalation Toxicology,* 19(1), pp. 67-106.

Nikkel, S., 2018. *Canadian Cellular Towers Location.* [Online]
Available at: https://www.ertyu.org/steven_nikkel/cancellsites.html?lat=49.854897&lng=-

119.664226&zoom=12&type=hybrid&layers=a&pid=0
[Accessed 7 November 2018].

Pacific Climate Impacts Consortium, 2013. *Analysis Tools: Plan2Adapt.* [Online]
Available at: https://pacificclimate.org/analysis-tools
[Accessed 8 January 2018].

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

PCIC, 2018. *BC Station Data.* [Online]
Available at: http://tools.pacificclimate.org/dataportal/pcds/map/

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

Province of British Columbia, 2001. *Okanagan Shuswap Land and Resource Management Plan.* [Online]
Available at:
https://www.for.gov.bc.ca/tasb/slrp/lrmp/kamloops/okanagan/plan/files/oslrmpfull.pdf

Province of British Columbia, 2007. *Plan related legal direction.* [Online]
Available at: https://www.for.gov.bc.ca/tasb/slrp/legal-direction/

RCMP, 2017. *News Release - Lake Country interface wildfire confirmed as arson.* [Online]
Available at: http://bc.rcmp-grc.gc.ca/ViewPage.action?siteNodeId=2100&languageId=1&contentId=51992
[Accessed 22 December 2018].

RCMP, 2018. *News Release - Investigation into deliberately set wildfires ongoing, information sought.* [Online]
Available at: http://bc.rcmp-grc.gc.ca/ViewPage.action?siteNodeId=2100&languageId=1&contentId=55935
[Accessed 22 December 2018].

RDNO, 2004. *Official Community Plan for the Community of Silver Star, Electoral Area "C".* [Online]
Available at: http://www.rdno.ca/bylaws/BL_1925_C.pdf
[Accessed 4 December 2018].

RDNO, 2011. *Open Burning - Fire Regulation Bylaw 2514, 2011.* [Online]
Available at: http://www.rdno.ca/bylaws/2514_open_burning.pdf
[Accessed 6 December 2018].

RDNO, 2012. *Official Community Plan for Electoral Areas "D" and "E".* [Online]
Available at: http://www.rdno.ca/bylaws/BL_2485_SCH_A_TEXT_C_with_index.pdf
[Accessed 3 December 2018].

RDNO, 2014. *Official Community Plan for Electoral Areas "B" and "C".* [Online]
Available at: http://www.rdno.ca/bylaws/_BL_2626_no_maps_C1.pdf
[Accessed 3 December 2018].

RDNO, 2016. *Official Community Plan for Electoral Area "F".* [Online]
Available at: http://www.rdno.ca/bylaws/BL_2702_wo_maps.pdf
[Accessed 4 December 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.

The Office of the Fire Commissioner, The Fire Chiefs Association of BC, BC Wildfire Service, 2017. *Inter-Agency Operational Procedures and Reimbursement Rates.* [Online]
Available at: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/fire-safety/wildfire/reimburs.pdf
[Accessed 14 November 2018].

Union of BC Municipalities, 2018. *2017 SWPI Program.* [Online]
Available at:
http://www.ubcm.ca/assets/Funding~Programs/LGPS/SWPI/Applications2017/swpi-2017-CWPP-template.docx

Union of BC Municipalities, 2018. *Community Resiliency Investment Program.* [Online]
Available at: https://www.ubcm.ca/EN/main/funding/lgps/community-resiliency-investment.html
[Accessed 20 September 2018].

Union of BC Municipalities, 2018. *Strategic Wildfire Prevention.* [Online]
Available at: http://www.ubcm.ca/EN/main/funding/lgps/strategic-wildfire-prevention.html

Urban Systems, 2012. *District of Lake Country Water Master Plan.* [Online]
Available at:
https://lakecountry.civicweb.net/document/36297/Water%20Master%20Plan%20-%20November%202012.pdf
[Accessed 7 December 2018].

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

APPENDIX 1: Wildfire Threat Assessment – FBP Fuel Type Change Rationale

No fuel type changes are recommended.

APPENDIX 2: Wildfire Threat Assessment Worksheets and Photos

Table 21 Summary of WUI wildfire threat assessment worksheets.

Plot ID	Geographic	UTM_Zone	Easting	Northing	Elevation_m	Fuel_1	Fuel_2	Fuel_3	Fuel_4	Fuel_5	Fuel_6	Fuel_7	Fuel_8	Fuel_9	Fuel_10	Fuel_11	Fuel_Sub_Tota	Weather_12	Weather_13	Weather_Sub_Tota	Topograpgy_14	Topograpgy_15	Topograpgy_16	Topograpgy_17	Topography_Sub_Tota	Wildfire_Behaviour_Threat_Score	Structural_18	Structural_19	Structural_20	WUI_Wildfire_Threat_Score	Total_Wildfire_Threat_Score	Wildfire_Behaviour_Threat_Class	WUI_Threat_Class
LC_099	Nighthawk Road	11U	324911	5545765	442	5	5	4	10	10	10	3	10	2	10	5	74	15	15	30	12	10	10	15	47	151	15	5	30	50	201	Extreme	Extreme
LC_003	Spion Kop Peak	11U	326608	5550926	865	3	5	3	7	7	10	5	10	5	10	10	75	15	15	30	12	5	7	15	39	144	15	10	30	55	199	High	Extreme
LC_002	Spion Kop	11U	326887	5550324	683	3	5	5	10	2	15	5	15	30	5	10	104	15	15	30	12	10	7	10	39	173	12	3	10	25	198	Extreme	Moderate
LC_005	Raven Ridge Trailhead	11U	325774	5550607	601	3	5	4	10	10	10	5	10	2	20	10	89	15	15	30	12	10	7	10	44	163	12	3	20	35	198	Extreme	High
LC_010	Start of Oyama Lake FSR	11U	333408	5553465	927	3	5	4	5	2	15	5	15	2	30	10	96	15	15	30	12	10	7	15	44	170	12	8	1	21	191	Extreme	Moderate
LC_001	Spion Kop Apex Drive Trailhead	11U	326980	5550260	637	3	5	4	10	10	5	5	10	10	10	10	82	15	15	30	12	10	5	10	40	152	12	3	20	35	187	Extreme	High
LC_098	Nighthawk Road	11U	325049	5545682	482	3	5	4	7	2	2	0	7	2	0	5	37	15	15	30	15	15	10	15	55	122	15	5	30	50	172	High	Extreme
LC_008	Lower East Spion Kop	11U	327561	5550411	580	3	5	4	7	7	5	5	7	2	5	10	60	15	15	30	12	10	7	10	39	129	12	3	12	27	156	High	High
LC_006	Lower East Spion Kop	11U	327682	5550623	576	3	5	4	7	5	10	5	5	2	5	10	61	15	15	30	12	5	5	10	32	123	12	3	12	27	150	High	High
LC_012	Jack Seaton Park	11U	325450	5545734	553	3	5	4	10	5	10	5	10	2	5	10	64	15	15	30	12	1	5	10	23	117	10	3	20	33	150	High	High
LC_009	Lower East Spion Kop	11U	327336	5550287	579	3	5	4	5	2	5	5	5	5	5	10	54	15	15	30	10	1	5	10	26	110	10	3	25	38	148	High	High
LC_004	Spion Kop Upper East	11U	326725	5550838	811	5	5	4	7	7	15	5	5	10	5	10	78	15	15	30	5	5	5	5	20	128	5	3	10	18	146	High	Moderate
LC_007	Lower East Spion Kop	11U	327672	5550500	584	3	5	4	7	5	5	5	7	2	5	10	58	15	15	30	10	1	3	15	29	117	10	3	12	25	142	High	Moderate
LC_011	Jack Seaton Park	11U	325525	5545743	562	3	5	4	10	2	5	0	7	2	0	5	43	15	15	30	10	1	3	2	16	89	0	0	0	0	89	Moderate	Low

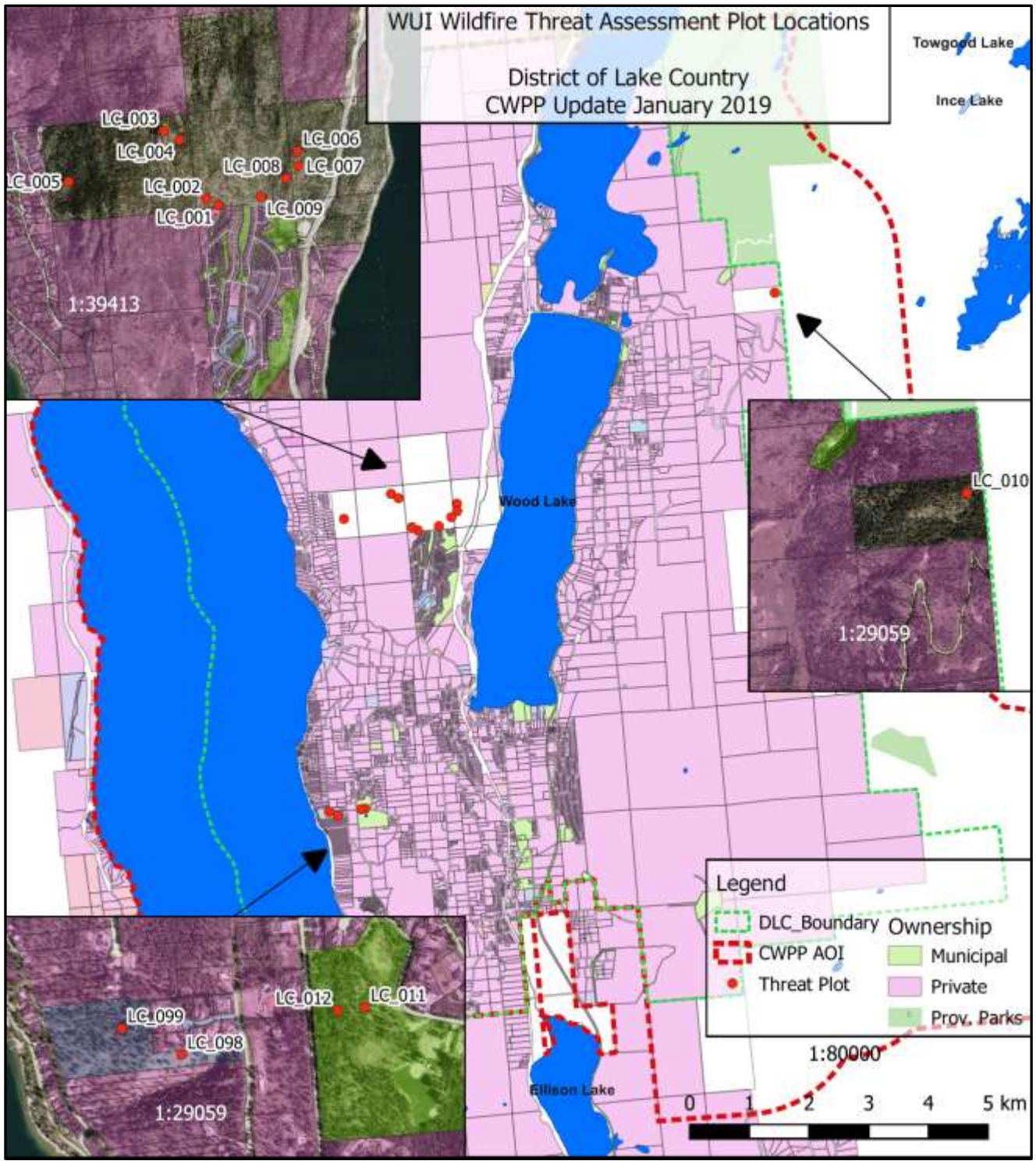
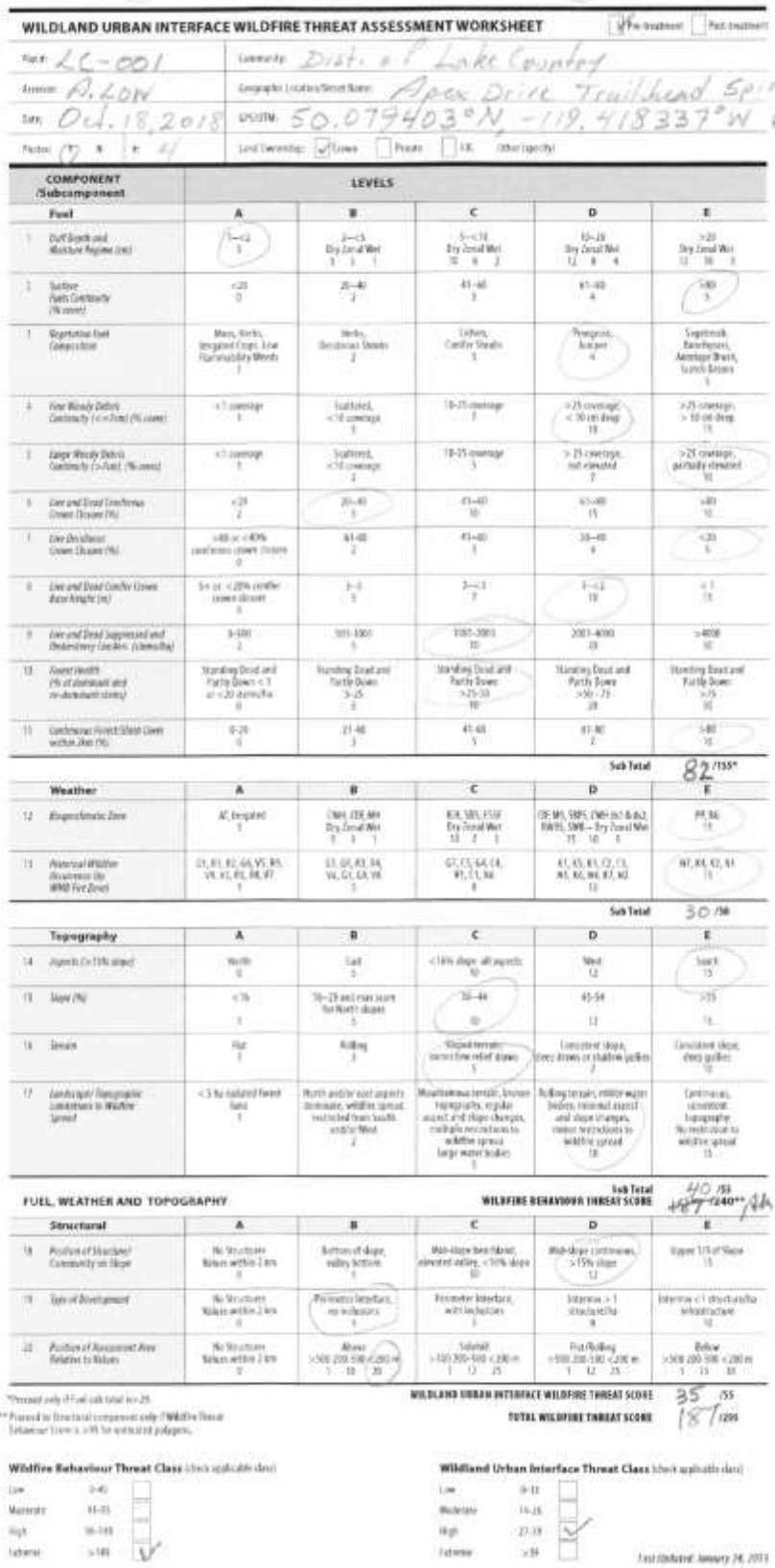


Figure 22 Map of WUI wildfire threat assessment plot locations.

APPENDIX



WILDLAND URBAN INTERFACE WILDFIRE THREAT ASSESSMENT WORKSHEET

Plot #: LC-001 — Community: Dist. of Lake Country

Assessor: A. Low — Geographic Location/Street Name: Apex Drive Trailhead Spirit Ridge

Date: Oct. 18, 2018 — UTM: 50.079403°N, -119.418337°W 637m

Photos: — Land Ownership: Crown / Private / UK / Other (specify)

	COMPONENT /Subcomponent	LEVELS				
	Fuel	**A**	**B**	**C**	**D**	**E**
1	Duff Depth and Moisture Regime (cm)	1–<2 Dry Zonal Wet 3 1 1	2–<5 Dry Zonal Wet 5 3 1	5–<10 Dry Zonal Wet 10 6 2	10–20 Dry Zonal Wet 12 8 4	>20 Dry Zonal Wet 12 10 5
2	Surface Fuels Continuity (% cover)	<20 0	20–40 2	41–60 3	61–80 4	>80 5
3	Vegetation Fuel Composition	Moss, Herbs, Irrigated Crops, Low Flammability Weeds 1	Herbs, Deciduous Shrubs 2	Heathers, Conifer Shrubs 3	Pinegrass, Juniper 4	Sagebrush, Bunchgrasses, Antelope Brush, Scrub Oceans 5
4	Fine Woody Debris Continuity (<=7cm) (% cover)	<1 coverage 1	Scattered, <10 coverage 3	10–25 coverage 7	>25 coverage; < 10 cm deep 10	>25 coverage; > 10 cm deep 15
5	Large Woody Debris Continuity (>7cm) (% cover)	<1 coverage 1	Scattered, <10 coverage 2	10–25 coverage 5	> 25 coverage, not elevated 7	>25 coverage, partially elevated 10
6	Live and Dead Coniferous Crown Closure (%)	<20 2	20–40 5	41–60 10	61–80 15	>80 20
7	Live Deciduous Crown Closure (%)	>40 or <40% coniferous crown closure 0	61–80 2	41–60 3	20–40 4	<20 5
8	Live and Dead Conifer Crown Base Height (m)	5+ or <20% conifer crown closure 0	3–5 1	2–<3 2	1–<2 10	<1 15
9	Live and Dead Suppressed and Understorey Conifers (stems/ha)	1–500 2	501–1000 5	1001–2000 10	2001–4000 20	>4000 30
10	Forest Health (% of dominant and co-dominant stems)	Standing Dead and Partly Down < 1 or <20 stems/ha 0	Standing Dead and Partly Down 1–25 5	Standing Dead and Partly Down >25–50 10	Standing Dead and Partly Down >50–75 20	Standing Dead and Partly Down >75 30
11	Coniferous Forest Shade Cover within 20m (%)	0–20 0	21–40 3	41–60 5	61–80 7	>80 10
						Sub Total 82 /155*
	Weather	**A**	**B**	**C**	**D**	**E**
12	Biogeoclimatic Zone	AT, Irrigated 1	CWH, CDF, MH Dry Zonal Wet 0 5 1	BWK, SBS, ESSF Dry Zonal Wet 10 7 5	CDF MH, SBPS, CWH (xm1 & dk2, BWBS, SWB — Dry Zonal Wet 15 10 5	PP, BG 15
13	Historical Wildfire Occurrence (by WMD Fire Zone)	C1, K1, K2, G6, V5, K5, V4, K3, K5, K6, K7 1	C1, G5, K3, S4, V4, G1, G4, V6 3	G7, C5, G4, C4, K1, C3, K6 8	K1, K5, K3, C2, C3, K5, K6, K4, K7, K2 13	K7, K4, K2, K1 15
						Sub Total 30 /50
	Topography	**A**	**B**	**C**	**D**	**E**
14	Aspects (>15% slope)	North 0	East 5	<16% slope, all aspects 10	West 12	South 15
15	Slope (%)	<16 1	16–29 and steep south for North slopes 5	30–44 10	45–54 13	>55 15
16	Terrain	Flat 1	Rolling 3	Steep/moderate; some/few relief draws 5	Consistent slope, many draws or shallow gullies 7	Consistent slope, steep gullies 10
17	Landscape/Topographic Constraints to Wildfire Spread	< 5 ha isolated forest fuel 1	North and/or east aspects dominate, wildfire spread restricted from South and/or West 2	Miscellaneous terrain, broken topography, regular aspect and slope changes, multiple restrictions to wildfire spread, large water bodies 5	Rolling terrain, milder aspect, broken, minimal aspect and slope changes, minor restrictions to wildfire spread 10	Continuous, consistent topography. No restriction to wildfire spread 15
						Sub Total 40 /55
	FUEL, WEATHER AND TOPOGRAPHY					**WILDFIRE BEHAVIOUR THREAT SCORE** ~~187~~ /240** NA 152
	Structural	**A**	**B**	**C**	**D**	**E**
18	Position of Structure/ Community on Slope	No Structures Values within 2 km 0	Bottom of slope, valley bottom 1	Mid-slope (not Ridge), elevated valley, <16% slope 10	Mid-slope continuous, >15% slope 12	Upper 1/3 of Slope 15
19	Type of Development	No Structures Values within 2 km 0	Perimeter Interface, no inclusions 1	Perimeter Interface, with inclusions 3	Intermix > 1 structure/ha 8	Intermix < 1 structure/ha or Intact 10
20	Position of Assessment Area Relative to Values	No Structures Values within 2 km 0	Above >500 200-500 <200 m 1 10 20	Same/all >500 300–500 <200 m 1 12 25	Flat/Rolling >500 200-500 <200 m 1 12 25	Below >500 200-500 <200 m 1 15 30
						WILDLAND URBAN INTERFACE WILDFIRE THREAT SCORE 35 /55
						TOTAL WILDFIRE THREAT SCORE 187 /295

*Proceed only if Fuel sub total is >25

** Proceed to Structural component only if Wildfire Threat Behaviour Score is >95 for untreated polygons.

Wildfire Behaviour Threat Class (check applicable class)

Low	0–45	
Moderate	45–95	
High	96–149	
Extreme	>149	✓

Wildland Urban Interface Threat Class (check applicable class)

Low	0–11	
Moderate	11–26	
High	27–59	✓
Extreme	>59	

Last Updated: January 24, 2013

Figure 23 Plot LC_001 threat assessment worksheet.

Figure 24 Plot LC_001 photos from plot centre.

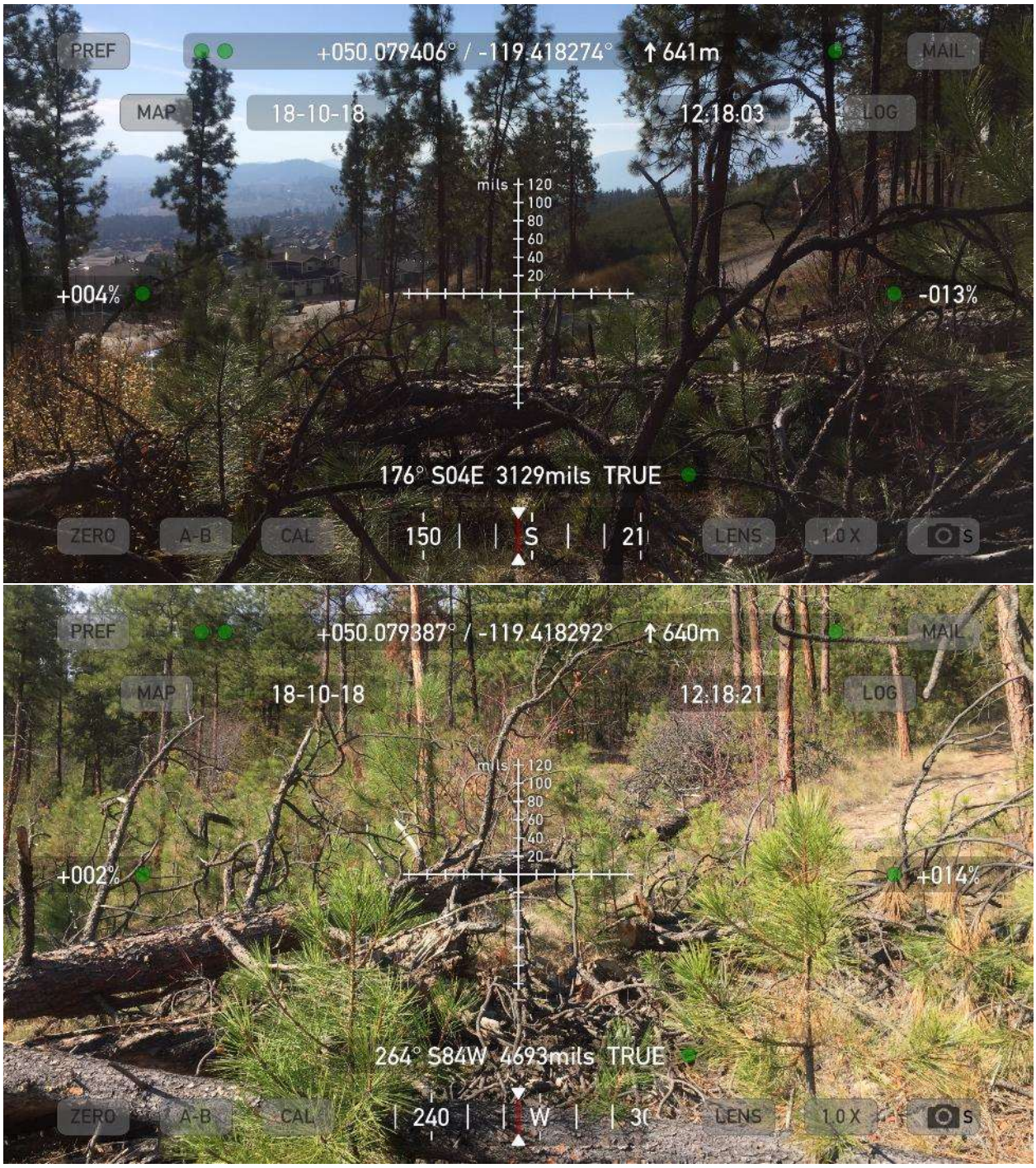
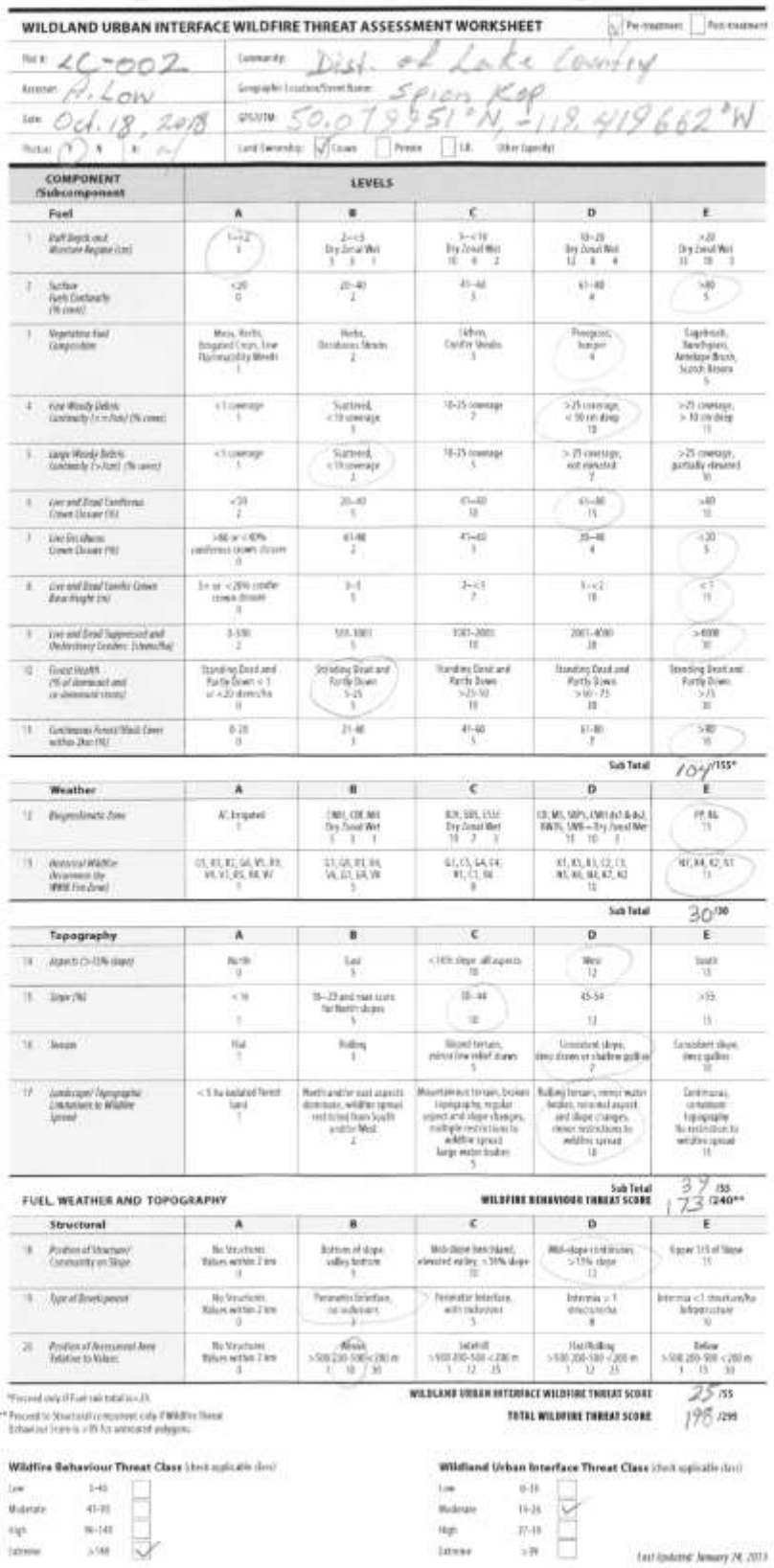


Figure 25 Figure 24 Plot LC_001 photos from plot centre.

Figure 26 Plot LC_001 canopy closure.

APPENDIX



WILDLAND URBAN INTERFACE WILDFIRE THREAT ASSESSMENT WORKSHEET

Plot #: LC-002 Assessor: R. Low Date: Oct. 18, 2018 Photos: Y N #: 4

Community: Dist. of Lake Country Geographic Location/Street Name: Spion Kop GPS/UTM: 50.079951°N -119.419662°W 683m Land Ownership: Crown Private I.R. Other (specify)

	COMPONENT /Subcomponent	LEVELS				
	Fuel	**A**	**B**	**C**	**D**	**E**
1	*Fuel Depth and Moisture Regime (cm)*	1–<2 1	2–<5 Dry Zonal Wet 3 2 1	5–<10 Dry Zonal Wet 10 6 2	10–20 Dry Zonal Wet 12 8 4	>20 Dry Zonal Wet 15 10 5
2	*Surface Fuels Continuity (% cover)*	<20 0	20–40 2	41–60 3	61–80 4	>80 5
3	*Vegetation Fuel Composition*	Moss, Herbs, Irrigated Crops, Low Flammability Shrubs 1	Herbs, Deciduous Shrubs 2	Lichen, Conifer Shrubs 3	Pinegrass, Juniper 4	Sagebrush, Ponderosa, Antelope Brush, Scotch Broom 5
4	*Fine Woody Debris Continuity (<1 cm Size) (% cover)*	<1 coverage 1	Scattered, <10 coverage 3	10–25 coverage 7	>25 coverage, <50 cm deep 10	>25 coverage, >50 cm deep 15
5	*Large Woody Debris Continuity (>1cm) (% cover)*	<1 coverage 1	Scattered, <10 coverage 2	10–25 coverage 5	>25 coverage, not elevated 7	>25 coverage, partially elevated 10
6	*Live and Dead Coniferous Crown Closure (%)*	<10 2	20–40 5	41–60 10	61–80 15	>80 20
7	*Live Deciduous Crown Closure (%)*	>80 or <40% coniferous crown closure 0	61–80 2	41–60 3	20–40 4	<20 5
8	*Live and Dead Conifer Crown Base Height (m)*	3+ or <25% conifer crown closure 0	1–3 5	2–<3 7	1–<2 10	<1 15
9	*Live and Dead Suppressed and Understorey Conifers (stems/ha)*	1–500 2	501–1001 5	1001–2001 10	2001–4000 20	>4000 30
10	*Forest Health (% of dominant and co-dominant stems)*	Standing Dead and Partly Down: <1 or <20 stems/ha 0	Standing Dead and Partly Down: 5–25 5	Standing Dead and Partly Down: >25–50 10	Standing Dead and Partly Down: >50 – 75 20	Standing Dead and Partly Down: >75 30
11	*Continuous Forest Weak Crown within 2km (%)*	0–20 0	21–40 3	41–60 5	61–80 7	>80 10
					Sub Total	104/155*
	Weather	**A**	**B**	**C**	**D**	**E**
12	*Biogeoclimatic Zone*	AC Irrigated 1	IDF, CDF, MH Dry Zonal Wet 1 1 1	BUNCH, SBPS, ESSF Dry Zonal Wet 10 7 3	CD, MS, SBPS, CWH dm1 & dk2, BWBS, SWB—Dry Zonal Wet 15 10 5	PP, BG 15
13	*Historical Wildfire Occurrence (by WHUI Fire Zone)*	G1, H1, H2, G4, V5, H3, V4, V1, H5, H8, W 1	G3, G6, H3, H4, V6, G5, G8, V8 5	G2, C5, G4, C4, H1, C1, H4 8	K1, K3, K5, C2, C3, K5, K6, K4, K7, K2 10	K9, K4, K7, K1 15
					Sub Total	30/30
	Topography	**A**	**B**	**C**	**D**	**E**
14	*Aspect (S>15% slope)*	North 0	East 5	<10% slope all aspects 10	West 12	South 15
15	*Slope (%)*	<10 1	10–20 and most score for North slopes 5	20–44 10	45-59 12	>55 15
16	*Terrain*	Flat 1	Rolling 3	Sloped terrain, minor low relief draws 5	Consistent slope, deep draws or shallow gullies 7	Consistent slope, deep gullies 10
17	*Landscape/Topographic Limitations to Wildfire Spread*	< 5 ha isolated forest land 1	Month and/or east aspects dominate, wildfire spread restricted from South and/or West 2	Mountainous terrain, broken topography, regular aspect and slope changes, multiple restrictions to wildfire spread large water bodies 5	Rolling terrain, minor water bodies, seasonal aspect and slope changes, minor restrictions to wildfire spread 10	Continuous, consistent topography No restriction to wildfire spread 15
					Sub Total	37/55
	FUEL, WEATHER AND TOPOGRAPHY				**WILDFIRE BEHAVIOUR THREAT SCORE**	173/240**
	Structural	**A**	**B**	**C**	**D**	**E**
18	*Position of Structure/ Community on Slope*	No Structures Values within 2 km 0	Bottom of slope, valley bottom 5	Mid-slope benchland, elevated valley, <30% slope 10	Mid-slope continuous, >15% slope 13	Upper 1/3 of Slope 15
19	*Type of Development*	No Structures Values within 2 km 0	Perimeter Interface, no subdivision 3	Perimeter Interface, with subdivision 5	Intermix > 1 structure/ha 8	Intermix <1 structure/ha Isolated structure 10
20	*Position of Assessment Area Relative to Values*	No Structures Values within 2 km 0	Alluvial >500 250–500 <250 m 1 10 30	Foothill >500 200–500 <200 m 1 12 35	Flat/Rolling >500 200–500 <200 m 1 12 35	Below >500 250–500 <250 m 1 15 30
					WILDLAND URBAN INTERFACE WILDFIRE THREAT SCORE	25/55
					TOTAL WILDFIRE THREAT SCORE	198/295

*Proceed only if Fuel sub total is >35.

** Proceed to Structural component only if WHUI Fire Threat Behaviour score is >35 for associated polygons.

Wildfire Behaviour Threat Class (check applicable class)

Low	0–40	
Moderate	41–95	
High	96–140	
Extreme	>140	✓

Wildland Urban Interface Threat Class (check applicable class)

Low	0–10	
Moderate	11–26	✓
High	27–50	
Extreme	>50	

Last Updated: January 24, 2013

Figure 27 Plot LC_002 threat assessment worksheet.

Figure 28 Plot LC_002 photos from plot centre.

Figure 29 Plot LC_002 photos from plot centre.

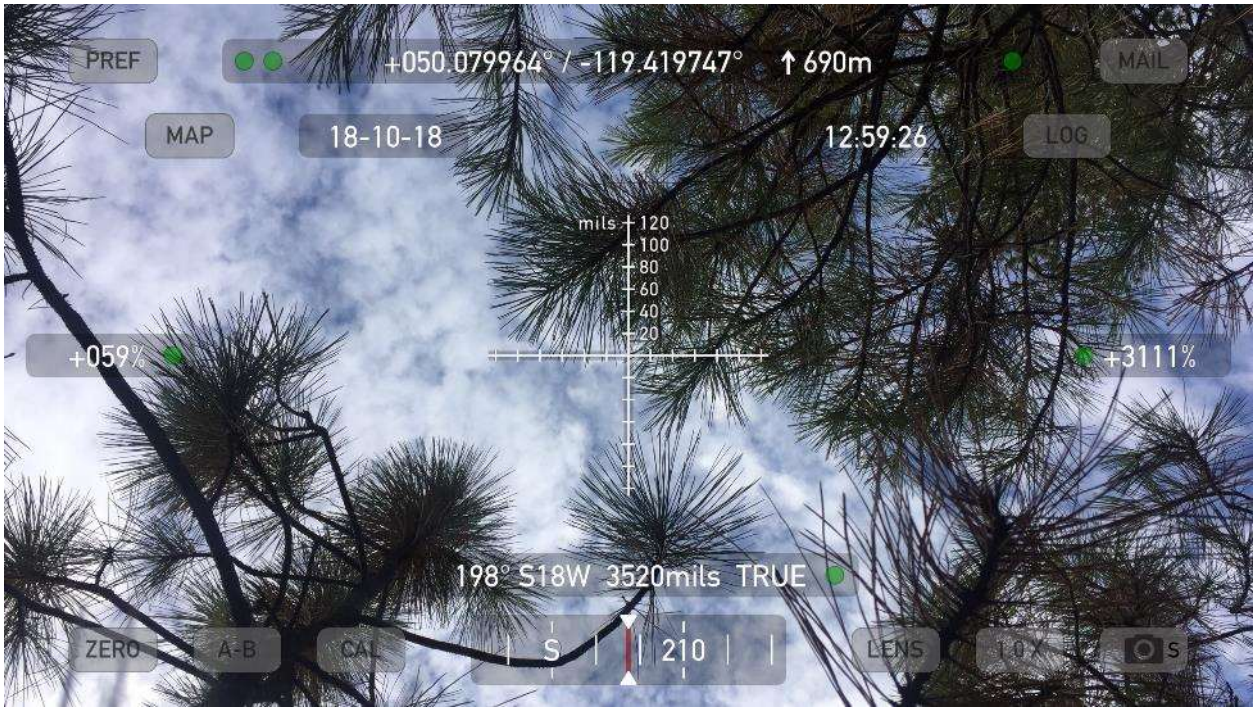
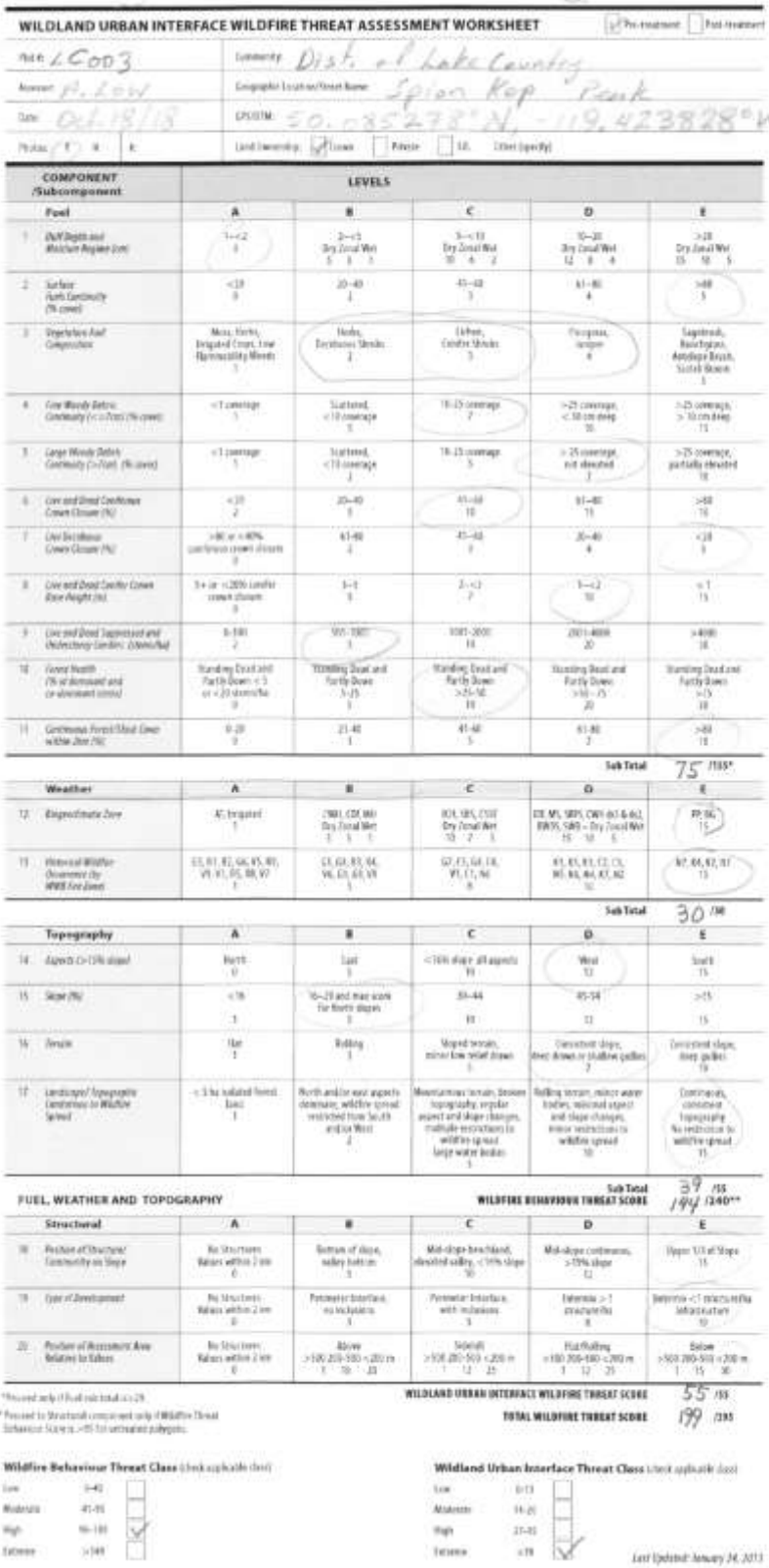


Figure 30 Plot LC_002 canopy closure.

APPENDIX



WILDLAND URBAN INTERFACE WILDFIRE THREAT ASSESSMENT WORKSHEET

Pre-treatment ☑ Post-treatment ☐

Plot #: LC003 Community: Dist. of Lake Country

Assessor: P. Low Geographic Location/Street Name: Spion Kop Peak

Date: Oct. 18/13 UTM: 50.085278° N, -119.423828° W 865m

Photos: F R E Land Ownership: ☑ Crown ☐ Private ☐ I.R. ☐ Other (specify)

COMPONENT /Subcomponent	LEVELS				
Fuel	**A**	**B**	**C**	**D**	**E**
1 Duff Depth and Moisture Regime Zone	1–<2 3	2–<5 Dry Zonal Wet 5 3 1	5–<10 Dry Zonal Wet 10 6 2	10–20 Dry Zonal Wet 12 8 4	>20 Dry Zonal Wet 15 10 5
2 Surface Fuels Continuity (% cover)	<10 0	20–40 1	41–60 3	61–80 4	>80 5
3 Vegetation Fuel Composition	Moss, Forbs, Irrigated Crops, Low Flammability Weeds 1	Herbs, Deciduous Shrubs 2	Lichen, Conifer Shrubs 3	Pasgrass, Juniper 4	Sagebrush, Bunchgrass, Antelope Brush, Scotch Broom 5
4 Low Woody Debris Continuity (<=3.7cm) (% cover)	<1 coverage 1	Scattered, <10 coverage 3	10–25 coverage 7	>25 coverage, < 50 cm deep 10	>25 coverage, > 50 cm deep 13
5 Large Woody Debris Continuity (>=7cm) (% cover)	<1 coverage 1	Scattered, <10 coverage 3	10–25 coverage 5	> 25 coverage, not elevated 7	>25 coverage, partially elevated 10
6 Live and Dead Coniferous Crown Closure (%)	<10 2	20–40 5	41–60 10	61–80 15	>80 16
7 Live Deciduous Crown Closure (%)	>80, or <40% coniferous crown closure 0	61–80 3	41–60 7	20–40 4	<20 3
8 Live and Dead Conifer Crown Base Height (m)	3+ or <20% conifer crown closure 0	3–1 5	2–<1 7	1–<2 10	<1 15
9 Live and Dead Suppressed and Understorey Conifers (stems/ha)	0–500 2	501–1500 5	1001–2000 10	2001–4000 20	>4000 30
10 Forest Health (% or dominant and co-dominant stems)	Standing Dead and Partly Down: < 5 or < 20 stems/ha 0	Standing Dead and Partly Down: 5–15 3	Standing Dead and Partly Down: >25–50 10	Standing Dead and Partly Down: >50 – 75 20	Standing Dead and Partly Down: >75 30
11 Continuous Forest Edge within 2km (%)	0–20 0	21–40 1	41–60 5	61–80 7	>80 10
					Sub Total 75 /155*
Weather	**A**	**B**	**C**	**D**	**E**
12 Biogeoclimatic Zone	AT, Irrigated 1	CWH, CDF, MH Dry Zonal Wet 3 5 7	ICH, SBS, CDF Dry Zonal Wet 10 7 5	CDF, MS, SBPS, CWH (xk1 & xk2), BWBS, SWB – Dry Zonal Wet 15 10 5	PP, BG, IDF 15
13 Historical Wildfire Occurrence (by WMB Fire Zone)	CS, K1, K2, GA, K5, K9, V9, K1, K5, K8, V7 1	CS, G3, K3, K4, V6, G3, K8, V9 5	G7, F3, G4, F8, V5, F1, N4 8	K1, K5, K3, C2, C3, M2, K6, K4, K7, K2 10	N7, K6, K7, K1 15
					Sub Total 30 /30
Topography	**A**	**B**	**C**	**D**	**E**
14 Aspects (>15% slope)	North 0	East 3	<16% slope, all aspects 10	West 12	South 15
15 Slope (%)	<16 3	16–29 and max score for North slopes 5	30–44 10	45–54 12	>55 15
16 Terrain	Flat 1	Rolling 3	Sloped terrain, minor low relief draws 5	Consistent slope, deep draws or shallow gullies 7	Consistent slope, deep gullies 10
17 Landscape/ Topographic Continuity to Wildfire Spread	< 5 ha isolated forest Basic 1	North and/or east aspects dominate, wildfire spread restricted from South and/or West 2	Mountainous terrain, broken topography, irregular aspect and slope changes, multiple restrictions to wildfire spread Large water bodies 5	Rolling terrain, minor water bodies, minimal aspect and slope changes, minor restrictions to wildfire spread 10	Continuous, consistent topography No restriction to wildfire spread 15
					Sub Total 39 /55
FUEL, WEATHER AND TOPOGRAPHY				**WILDFIRE BEHAVIOUR THREAT SCORE**	194 /240**
Structural	**A**	**B**	**C**	**D**	**E**
18 Position of Structure/ Community on Slope	No Structures Values within 2 km 0	Bottom of slope, valley bottom 1	Mid-slope benchland, elevated valley, <15% slope 10	Mid-slope continuous, >15% slope 12	Upper 1/3 of Slope 15
19 Type of Development	No Structures Values within 2 km 0	Perimeter Interface, no inclusions 1	Perimeter Interface, with inclusions 5	Extensive, > 1 structure/ha 8	Extensive, <1 structure/ha Infrastructure 10
20 Position of Assessment Area Relative to Values	No Structures Values within 2 km 0	Above >100, 200–500, <200 m 1 10 20	Same/all >100, 200–500, <200 m 1 12 25	Flat/Rolling <100, 200–500, <200 m 1 12 25	Below >500, 200–500, <200 m 1 15 30
				WILDLAND URBAN INTERFACE WILDFIRE THREAT SCORE	55 /55
				TOTAL WILDFIRE THREAT SCORE	199 /295

*Proceed only if Fuel rate total is >29.

**Proceed to Structural component only if Wildfire Threat Behaviour Score is >95 for untreated polygons.

Wildfire Behaviour Threat Class (check applicable box)

Low	0–40	☐
Moderate	41–95	☐
High	96–185	☑
Extreme	>185	☐

Wildland Urban Interface Threat Class (check applicable box)

Low	0–13	☐
Moderate	14–26	☐
High	27–51	☐
Extreme	>51	☑

Last Updated: January 24, 2013

Figure 31 Plot LC_003 threat assessment worksheet.

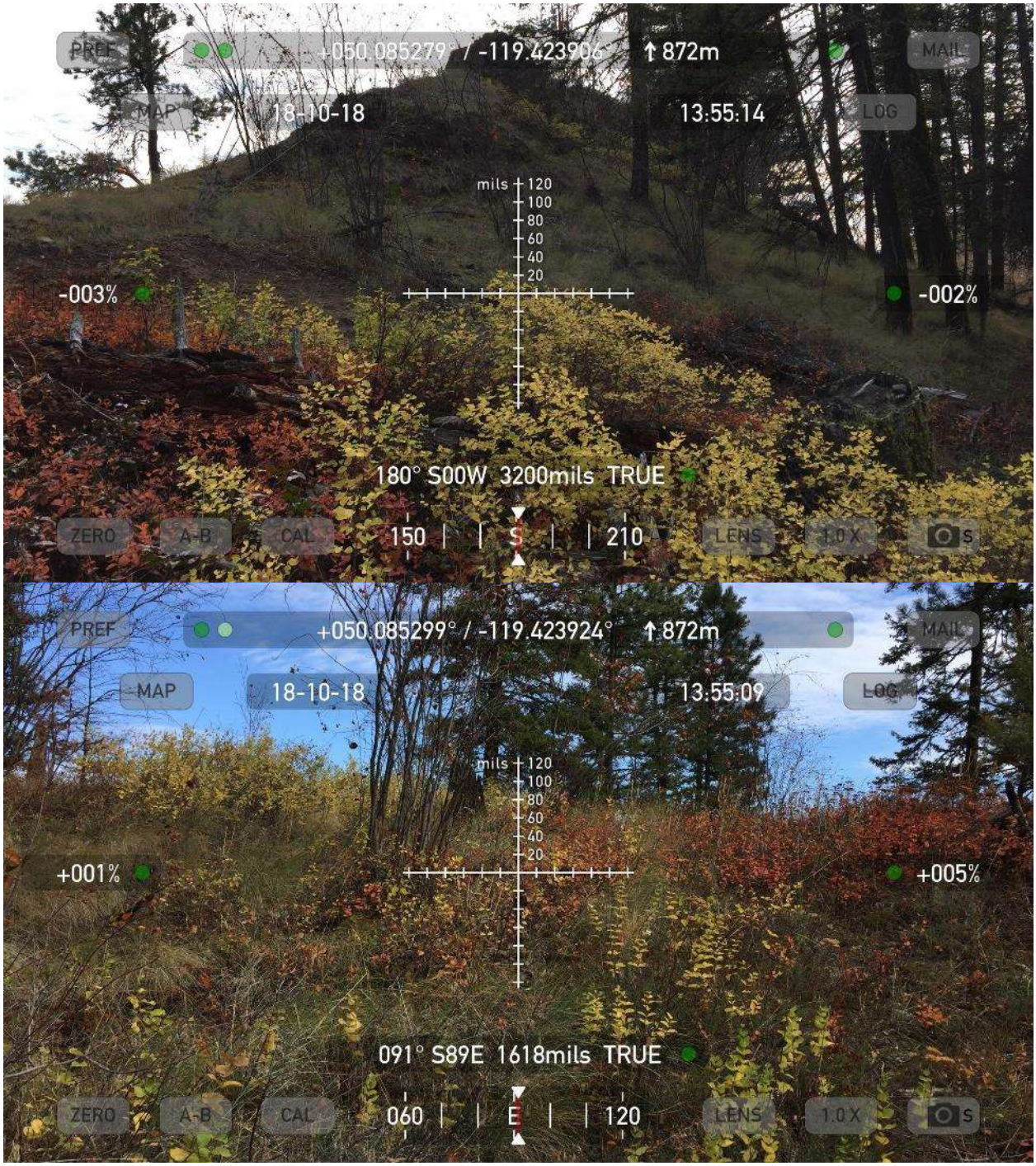


Figure 32 Plot LC_003 photos from plot centre.

Figure 33 Plot LC_003 photos from plot centre.

Figure 34 Plot LC_003 canopy closure.

Figure 35 Plot LC_004 threat assessment worksheet.

Figure 36 Plot LC_004 photos from plot centre.

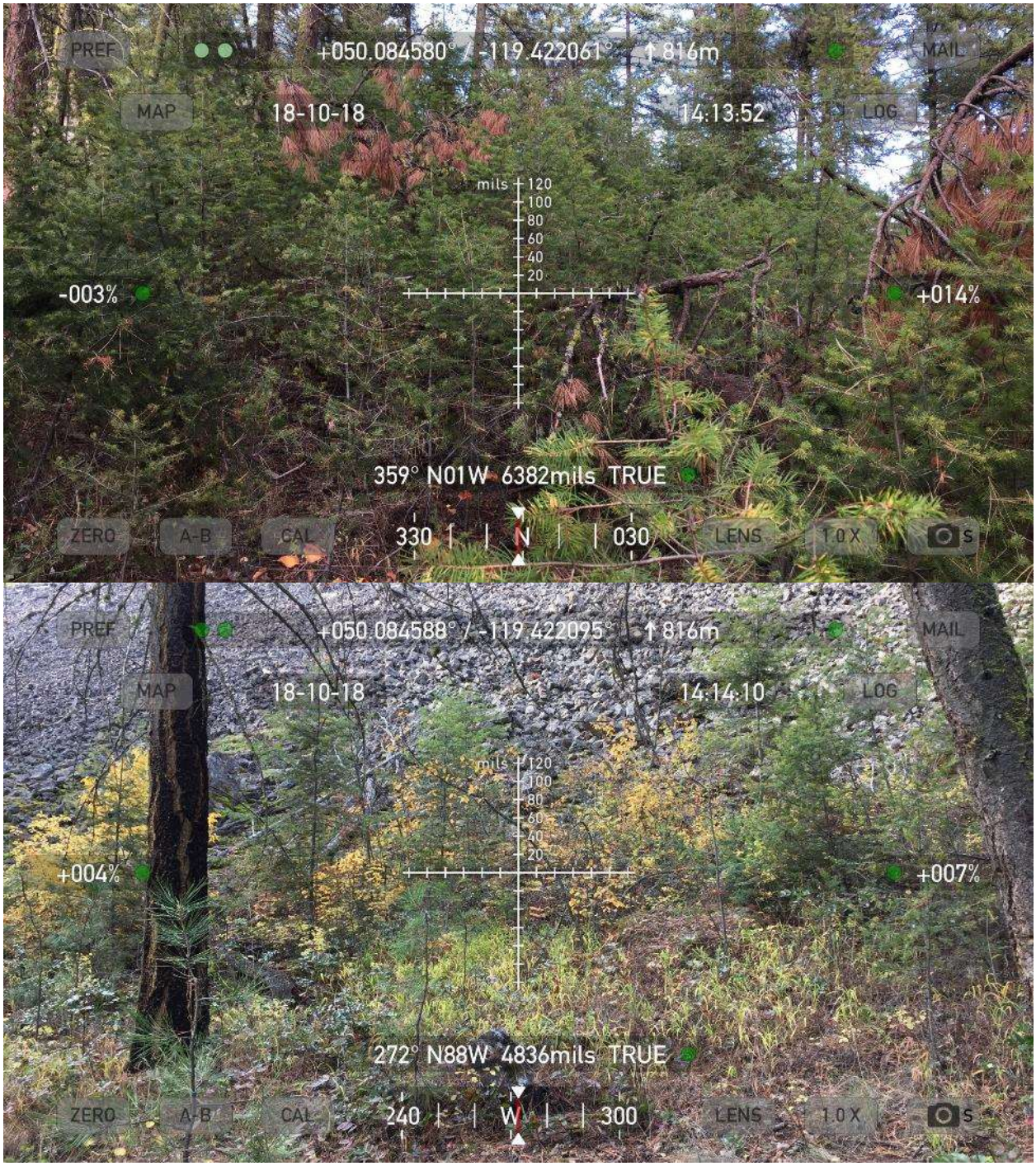
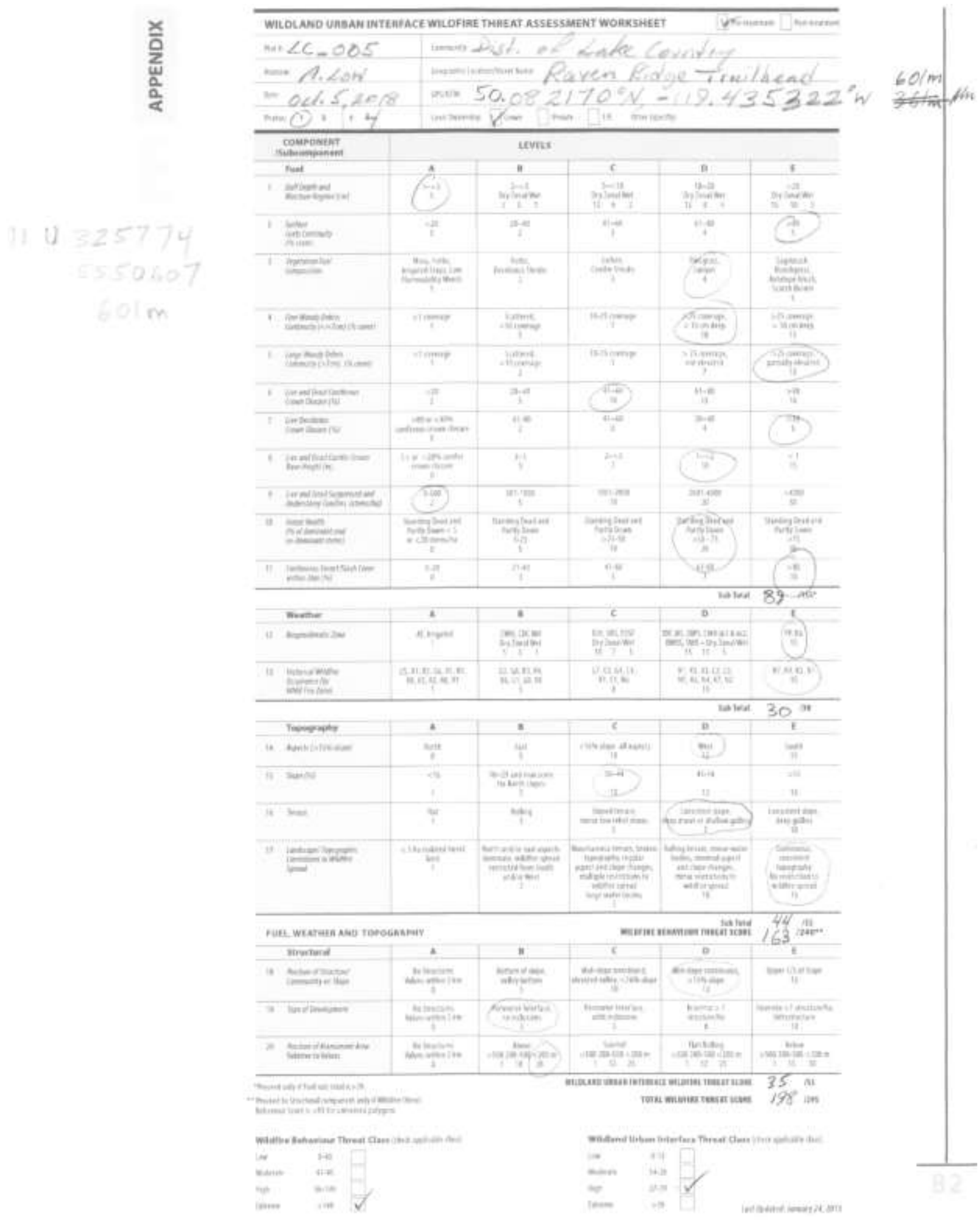


Figure 37 Plot LC_004 photos from plot centre.

Figure 38 Plot LC_004 canopy closure.


APPENDIX

WILDLAND URBAN INTERFACE WILDFIRE THREAT ASSESSMENT WORKSHEET

Plot #: LC_005
Community: Dist. of Lake Country
Assessor: A. Low
Geographic Location/Street Name: Raven Ridge Trailhead
Date: Oct. 5, 2018
GPS/UTM: 50.082170°N, -119.435322°W
60/m

11 U 325774
5550607
601m

COMPONENT (Subcomponent) | LEVELS A B C D E

Fuel — Sub Total 83
Weather — Sub Total 30
Topography — Sub Total 44
FUEL, WEATHER AND TOPOGRAPHY — WILDFIRE BEHAVIOUR THREAT SCORE 163
Structural — WILDLAND URBAN INTERFACE WILDFIRE THREAT SCORE 35
TOTAL WILDFIRE THREAT SCORE 198

Wildfire Behaviour Threat Class: Extreme ✓
Wildland Urban Interface Threat Class: High ✓

B2

Figure 39 Plot LC_005 threat assessment worksheet.

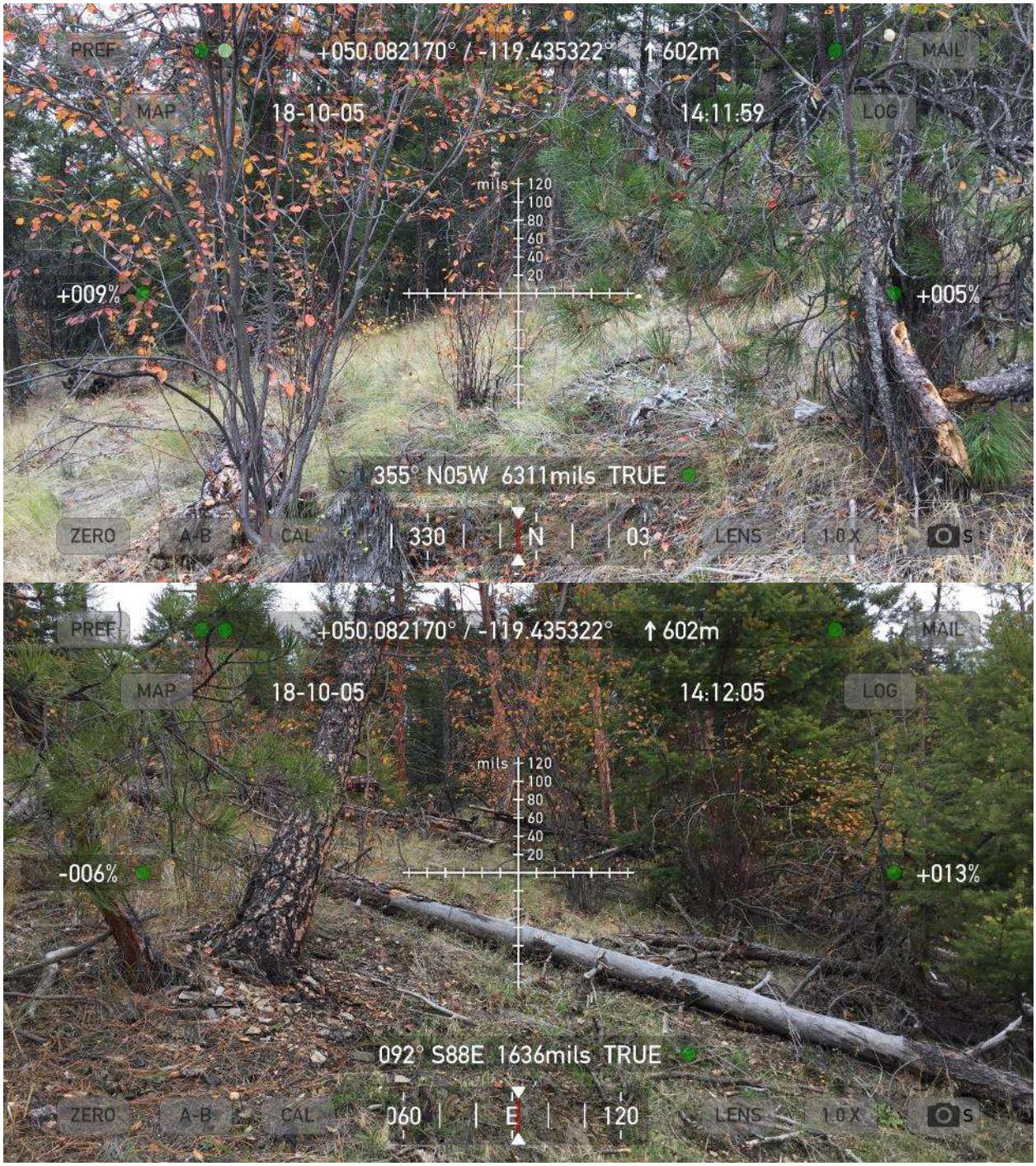


Figure 40 Plot LC_005 photos from plot centre.

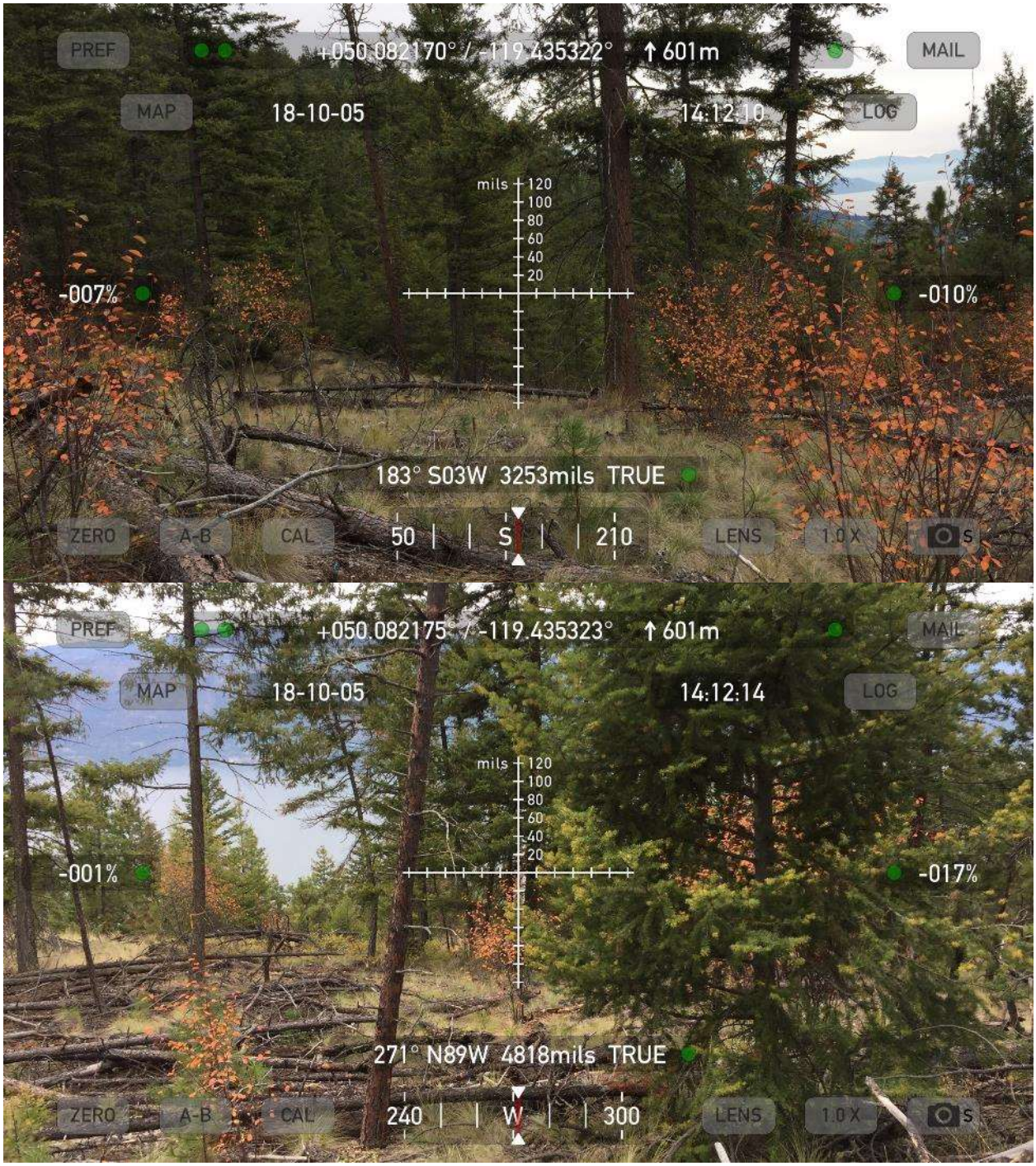
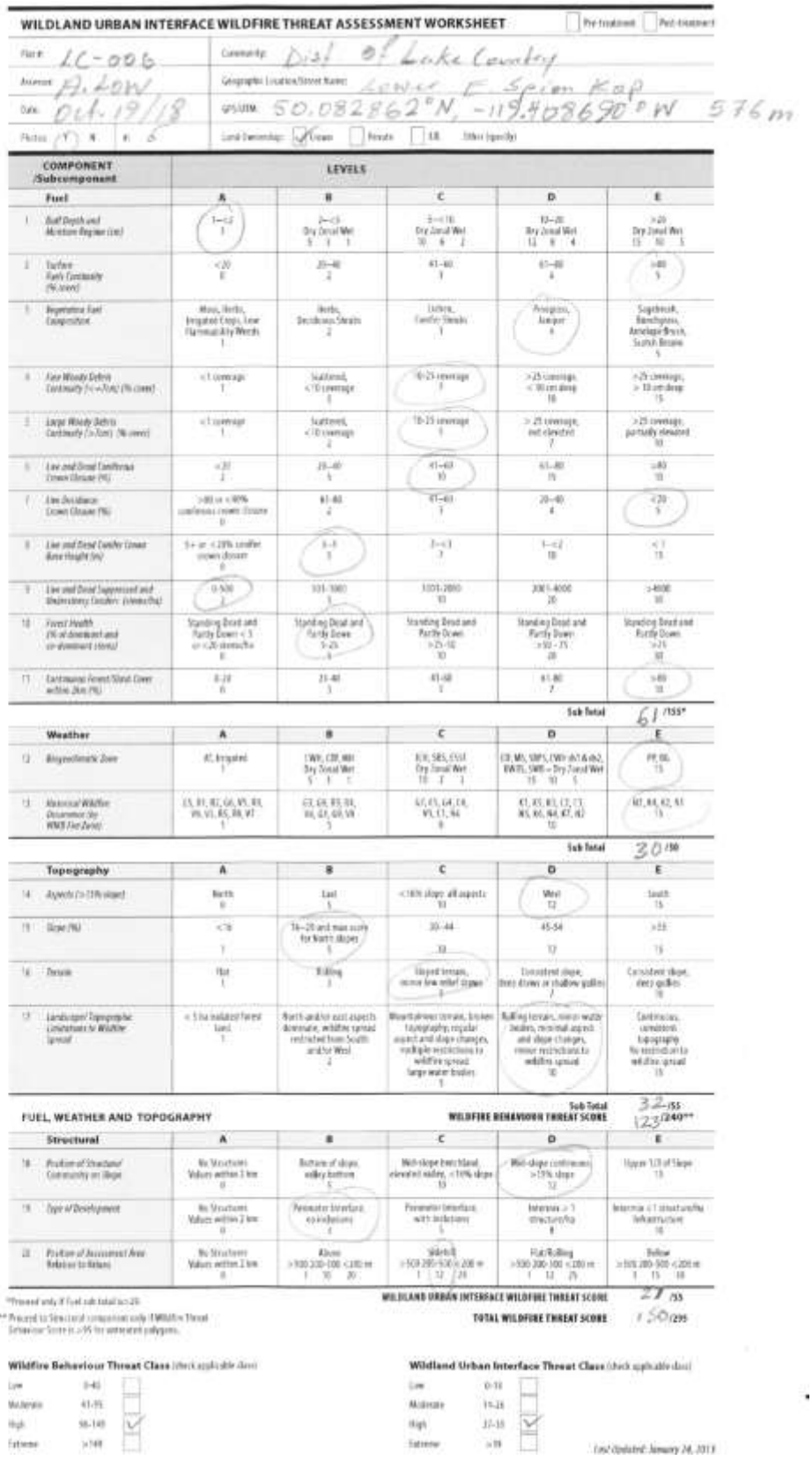


Figure 41 Plot LC_005 photos from plot centre.

APPENDIX



WILDLAND URBAN INTERFACE WILDFIRE THREAT ASSESSMENT WORKSHEET

Plot #: LC-006 | Community: Dist of Lake Country
Assessor: A. Low | Geographic Location/Street Name: Lower E Spion Kop
Date: Oct. 19/18 | UTM: 50.082862°N, -119.408690°W 576m
Photos: Y N # 6 | Land Ownership: Crown | Private | LR | Other (specify)

COMPONENT /Subcomponent	LEVELS				
Fuel	**A**	**B**	**C**	**D**	**E**
1 Bui Depth and Moisture Regime (cm)	1–<2 1	2–<3 Dry Zonal Wet 3 1 1	3–<10 Dry Zonal Wet 10 6 2	10–20 Dry Zonal Wet 12 8 4	>20 Dry Zonal Wet 15 10 5
2 Surface Fuels Continuity (% cover)	<20 0	20–40 2	41–60 3	61–80 4	>80 5
3 Vegetative Fuel Composition	Moss, Herbs, Irrigated Crops, Low Flammability Weeds 1	Herbs, Deciduous Shrubs 2	Lichen, Conifer Shrubs 3	Ponderosa, Juniper 4	Sagebrush, Bunchgrass, Antelope Brush, Scotch Broom 5
4 Fine Woody Debris Continuity (<1–<7cm) (% cover)	<1 coverage 1	Scattered, <10 coverage 2	10–25 coverage 3	>25 coverage, <10 cm deep 10	>25 coverage, >10 cm deep 15
5 Large Woody Debris Continuity (>7cm) (% cover)	<1 coverage 1	Scattered, <10 coverage 2	10–25 coverage 3	> 25 coverage, not clustered 7	>25 coverage, partially elevated 10
6 Live and Dead Coniferous Crown Closure (%)	<20 2	20–40 5	41–60 10	61–80 15	>80 20
7 Live Deciduous Crown Closure (%)	>80 or <10% coniferous crown closure 0	61–80 2	41–60 3	20–40 4	<20 5
8 Live and Dead Conifer Crown Base Height (m)	5+ or <10% conifer crown closure 0	3–5 5	2–<3 7	1–<2 10	<1 15
9 Live and Dead Suppressed and Understorey Conifers (stems/ha)	0-500 0	501-1000 5	1001-2000 10	2001-4000 20	>4000 30
10 Forest Health (% of dominant and co-dominant stems)	Standing Dead and Partly Down < 5 or <20 stems/ha 0	Standing Dead and Partly Down 5–25 5	Standing Dead and Partly Down >25–50 10	Standing Dead and Partly Down >50 – 75 20	Standing Dead and Partly Down >75 30
11 Continuous Forest Stand Cover within 2km (%)	0–20 0	21–40 3	41–60 5	61–80 7	>80 10
				Sub Total	61 /155*
Weather	**A**	**B**	**C**	**D**	**E**
12 Biogeoclimatic Zone	BG Irrigated 1	CWH, CDF, MH Dry Zonal Wet 5 3 1	ICH, SBS, ESSF Dry Zonal Wet 10 7 3	CDF, MS, IDFx, CWH dh1 & dh2, BWBS, SWB – Dry Zonal Wet 15 10 5	PP, BG 15
13 Historical Wildfire Occurrence (by WMB Fire Zone)	L5, X1, X2, G6, X9, X3, X5, V1, X5, X8, X7 1	G2, G9, X3, X4, X6, G1, G3, G8, V8 5	G7, K5, G4, C4, X5, C1, X4 8	K1, X3, X3, C2, C3, X5, X6, X4, K7, X2 10	X7, X4, X2, X3 15
				Sub Total	30 /50
Topography	**A**	**B**	**C**	**D**	**E**
14 Aspects (>15% slope)	North 0	East 5	<15% slope: all aspects 10	West 12	South 15
15 Slope (%)	<16 1	16–29 and max score for North slopes 5	30–44 10	45-54 12	>55 15
16 Terrain	Flat 1	Rolling 3	Sloped terrain, some low relief slopes 8	Consistent slope, long draws or shallow gullies 11	Consistent slope, deep gullies 15
17 Landscape/ Topographic Limitations to Wildfire Spread	< 5 ha isolated Forest Land 1	North and/or east aspects dominate, wildfire spread restricted from South and/or West 2	Mountainous terrain, broken topography, regular aspect and slope changes, multiple restrictions to wildfire spread large water bodies 5	Rolling terrain, minor water bodies, minimal aspect and slope changes, minor restrictions to wildfire spread 10	Continuous, consistent topography No restrictions to wildfire spread 15
				Sub Total	32 /55
FUEL, WEATHER AND TOPOGRAPHY				**WILDFIRE BEHAVIOUR THREAT SCORE**	123 /240**
Structural	**A**	**B**	**C**	**D**	**E**
18 Position of Structure/ Community on Slope	No Structures/ Values within 2 km 0	Bottom of slope, valley bottom 5	Mid-slope benchland, elevated valley, <10% slope 10	Mid-slope continuous >15% slope 12	Upper 1/3 of Slope 15
19 Type of Development	No Structures/ Values within 2 km 0	Perimeter interface, no subdivisions 4	Perimeter interface with subdivisions 5	Intermix > 1 structure/ha 8	Intermix < 1 structure/ha Infrastructure 10
20 Position of Assessment Area Relative to Values	No Structures/ Values within 2 km 0	Above >100 200–300 <300 m 1 10 20	Sidehill >100 200–300 <200 m 1 12 23	Flat/Rolling >100 200–300 <200 m 1 12 23	Below >100 200–300 <200 m 1 15 30
				WILDLAND URBAN INTERFACE WILDFIRE THREAT SCORE	27 /55
				TOTAL WILDFIRE THREAT SCORE	150 /295

*Proceed only if Fuel sub-total is >20

** Proceed to Structural component only if Wildfire Threat Behaviour Score is >95 for assessment polygons.

Wildfire Behaviour Threat Class (check applicable class)

Low	0-40	
Moderate	41-95	
High	96-140	✓
Extreme	>140	

Wildland Urban Interface Threat Class (check applicable class)

Low	0-11	
Moderate	11-21	
High	22-33	✓
Extreme	>33	

Last Updated: January 24, 2013

Figure 42 Plot LC_006 threat assessment worksheet.

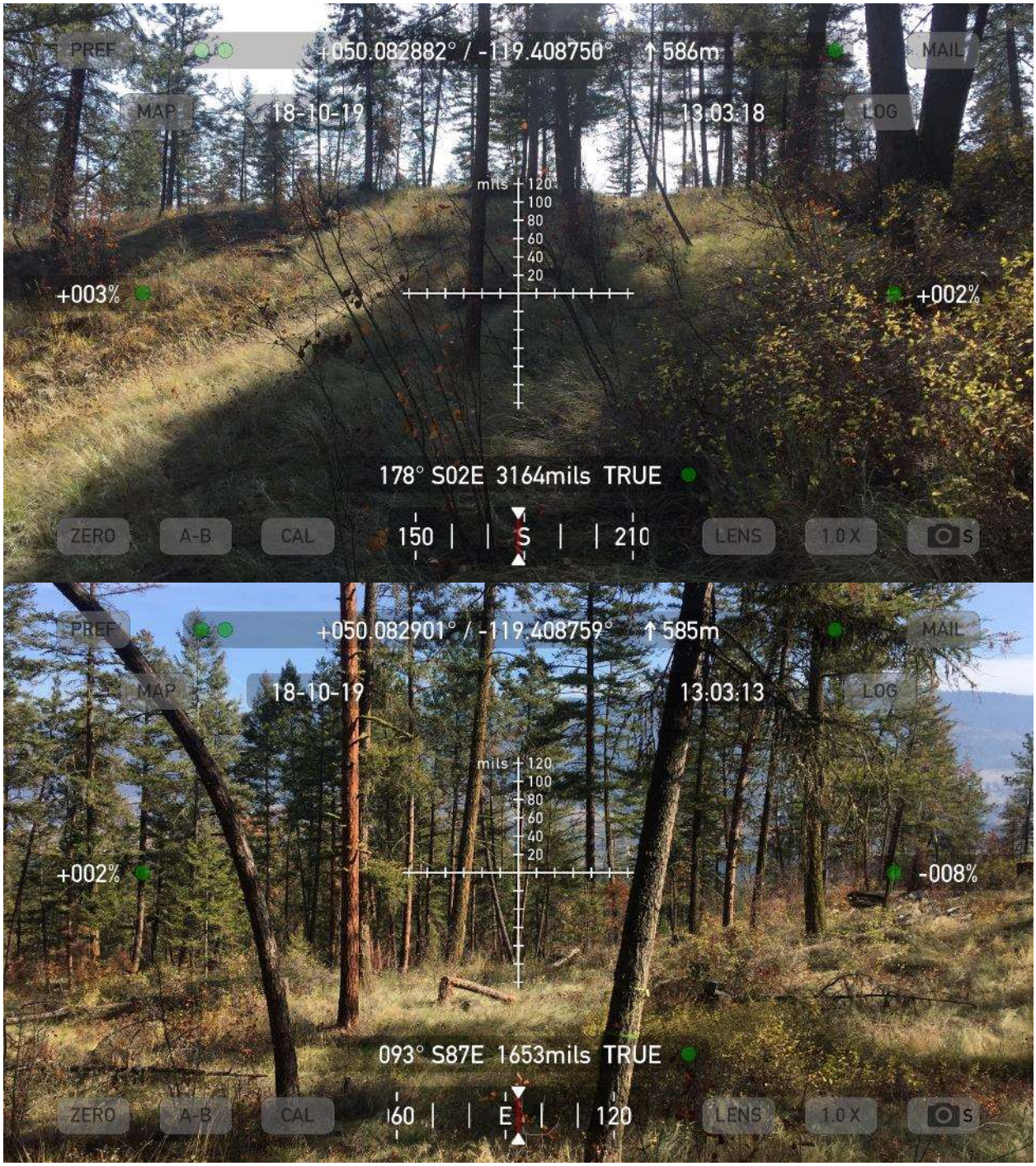


Figure 43 Plot LC_006 photos from plot centre.

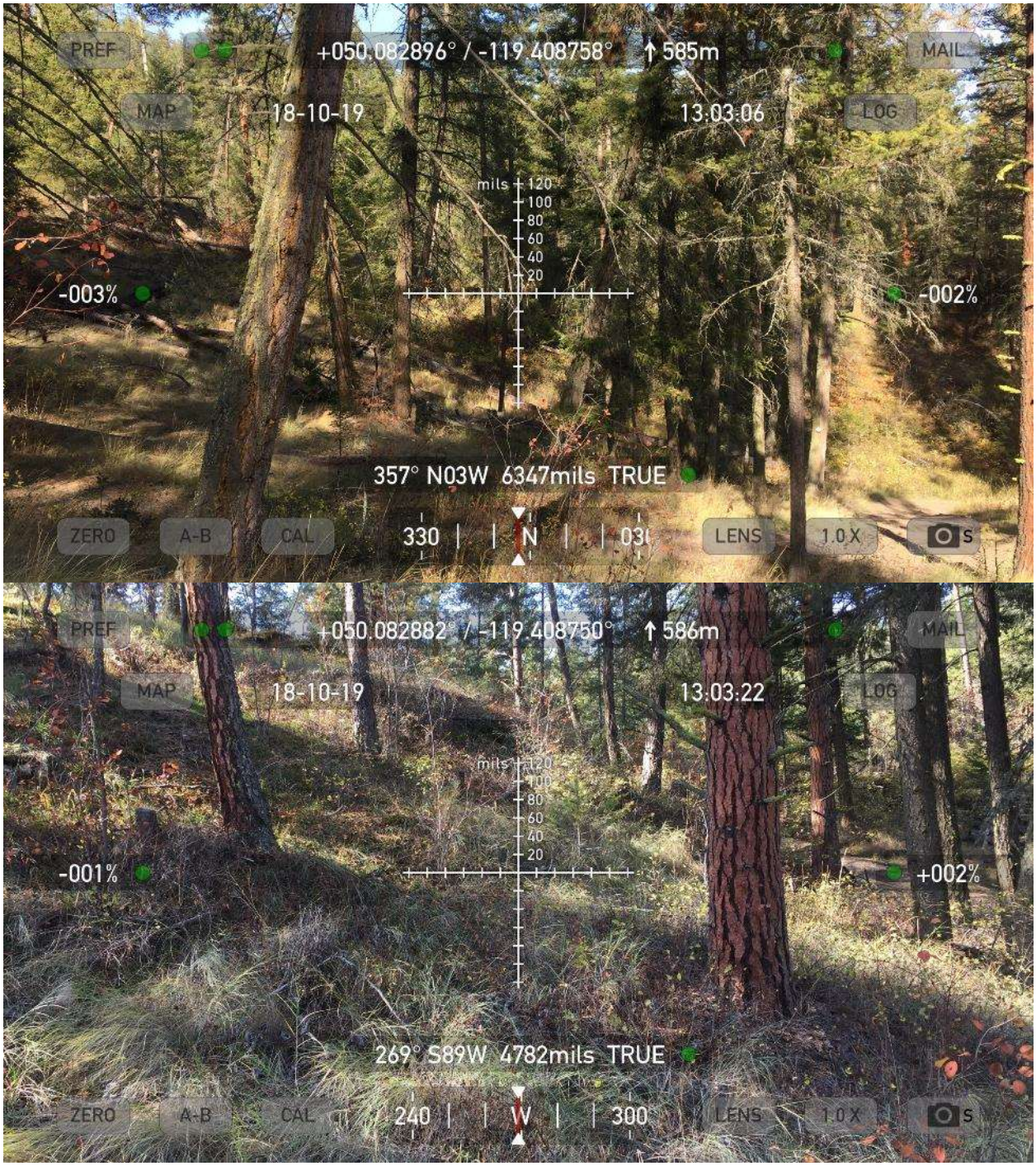
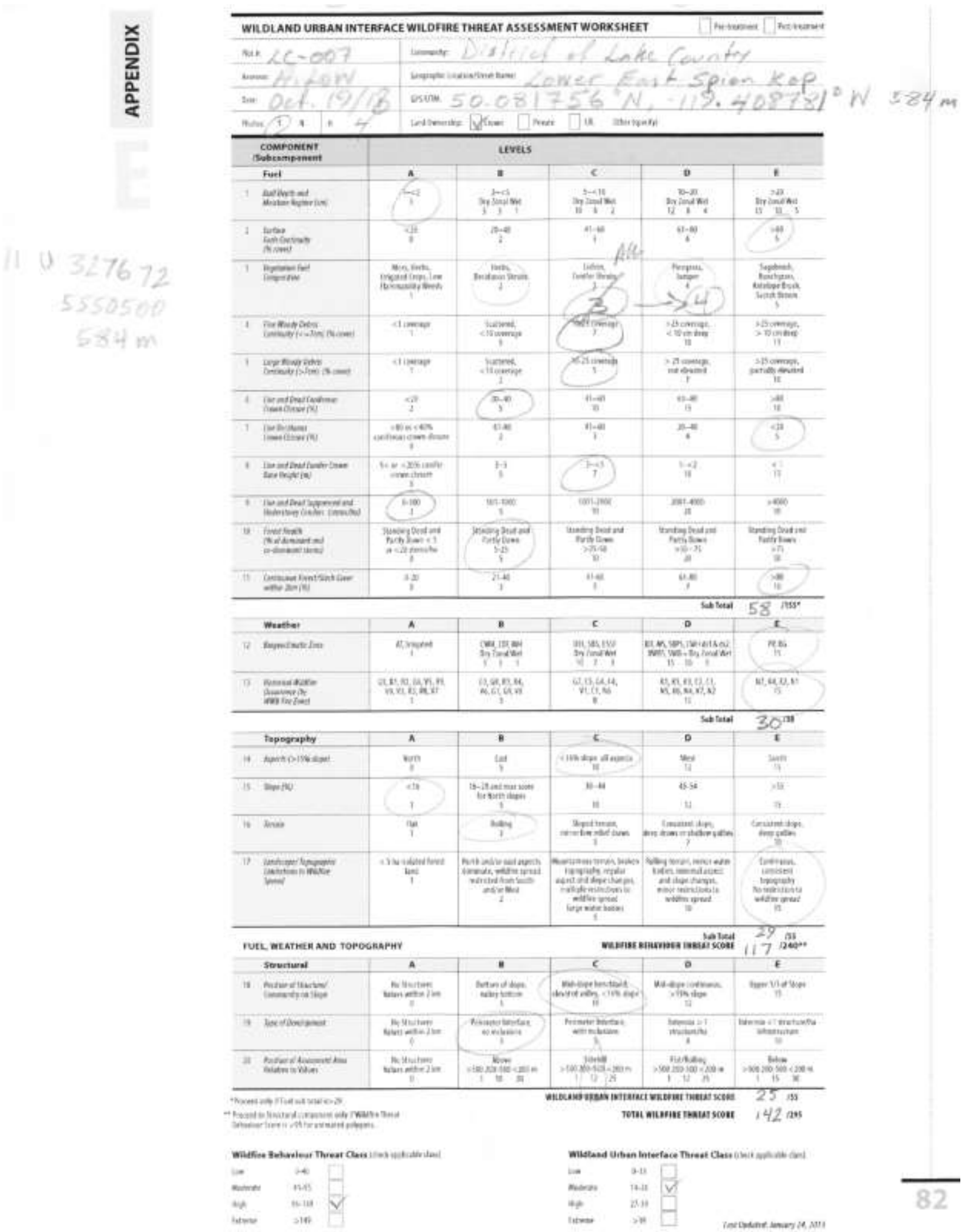


Figure 44 Plot LC_006 photos from plot centre.

Figure 45 Plot LC_006 canopy closure.


APPENDIX E

WILDLAND URBAN INTERFACE WILDFIRE THREAT ASSESSMENT WORKSHEET

Plot #: LC-007

Community: District of Lake Country

Geographic Location/Street Name: Lower East Spion Kop

Date: Oct. 19/18

GPS/UTM: 50.081756 °N, -119.408781 °W 584 m

11 U 327672 5550500 584 m

COMPONENT /Subcomponent — LEVELS: A, B, C, D, E

Fuel — Sub Total: 58 /155*

Weather — Sub Total: 30 /38

Topography — Sub Total: 29 /55

FUEL, WEATHER AND TOPOGRAPHY — WILDFIRE BEHAVIOUR THREAT SCORE: 117 /240**

Structural

WILDLAND URBAN INTERFACE WILDFIRE THREAT SCORE: 25 /55

TOTAL WILDFIRE THREAT SCORE: 142 /295

Wildfire Behaviour Threat Class: High

Wildland Urban Interface Threat Class: Moderate

82

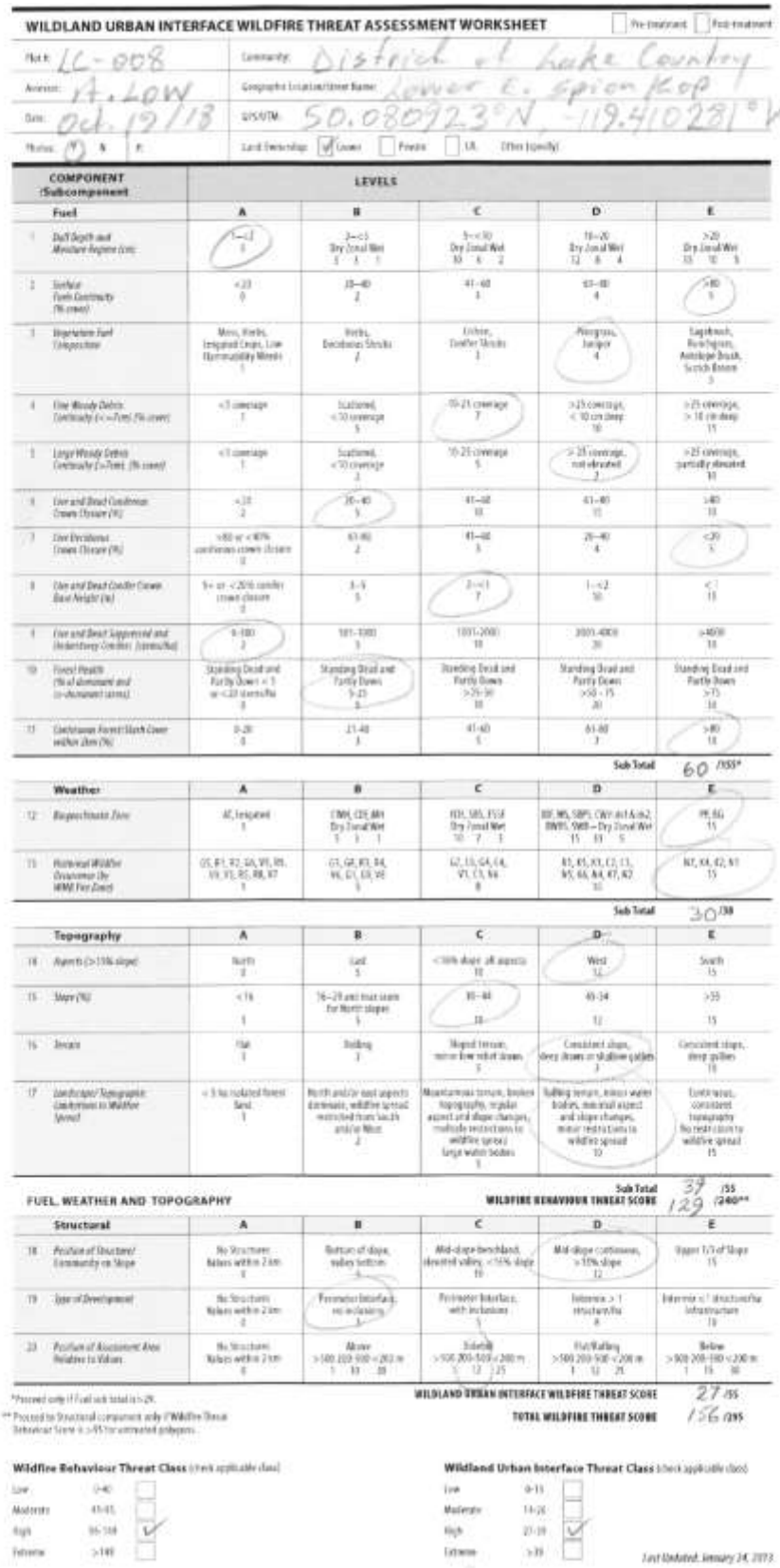
Figure 46 Plot LC_007 threat assessment worksheet.

Figure 47 Plot LC_007 photos from plot centre.

Figure 48 Plot LC_007 photos from plot centre.

Figure 49 Plot LC_007 canopy closure.

APPENDIX



WILDLAND URBAN INTERFACE WILDFIRE THREAT ASSESSMENT WORKSHEET

Plot #: LC-008 Community: District of Lake Country

Assessor: A. Low Geographic Location/Street Name: Lower E. Spion Kop

Date: Oct. 19/18 GPS/UTM: 50.080923°N -119.410281°W 580m

Photos: Y N # Land Ownership: Crown Private UR Other (specify)

COMPONENT / Subcomponent	A	B	C	D	E
Fuel					
1 Duff Depth and Moisture Regime (cm)	1–<2 1	2–<3 Dry Zonal Wet 3 3 1	3–<10 Dry Zonal Wet 10 6 2	10–20 Dry Zonal Wet 12 8 4	>20 Dry Zonal Wet 13 12 5
2 Surface Fuels Continuity (% cover)	<25 0	25–40 2	41–60 3	61–80 4	>80 5
3 Vegetation Fuel Composition	Moss, Herbs, Irrigated Crops, Low Flammability Weeds 1	Herbs, Deciduous Shrubs 2	Lichen, Conifer Shrubs 3	Pinegrass, Juniper 4	Sagebrush, Rockgrass, Antelope Brush, Scotch Broom 5
4 Fine Woody Debris Continuity (<=7cm) (% cover)	<1 coverage 1	Scattered, <10 coverage 3	10-25 coverage 7	>25 coverage, < 10 cm deep 10	>25 coverage, > 10 cm deep 15
5 Large Woody Debris Continuity (>7cm) (% cover)	<1 coverage 1	Scattered, <10 coverage 3	10-25 coverage 5	> 25 coverage, not vibrated 7	>25 coverage, partially elevated 10
6 Live and Dead Coniferous Crown Closure (%)	<25 2	26–40 5	41–60 10	61–80 15	>80 20
7 Live Deciduous Crown Closure (%)	<80 or < 40% coniferous crown closure 0	61-80 2	41–60 5	26–40 8	<20 10
8 Live and Dead Conifer Crown Base Height (m)	5+ or <20% conifer crown closure 0	3–5 5	2–<3 7	1–<2 10	<1 15
9 Live and Dead Suppressed and Understorey Conifers (stems/ha)	0-500 2	501–1000 5	1001–2000 10	2001–4000 20	>4000 30
10 Forest Health (% of dominant and co-dominant stems)	Standing Dead and Partly Down < 5 or <220 stems/ha 0	Standing Dead and Partly Down 5–25 5	Standing Dead and Partly Down >25–50 10	Standing Dead and Partly Down >50 – 75 20	Standing Dead and Partly Down >75 30
11 Coniferous Forest Stand Cover within 2km (%)	0–20 0	21–40 3	41–60 5	61–80 7	>80 10
					Sub Total 60 /155*
Weather	**A**	**B**	**C**	**D**	**E**
12 Biogeoclimatic Zone	AT, Integrated 1	CWH, CDF, BWH Dry Zonal Wet 5 3 1	ICH, SBS, ESSF Dry Zonal Wet 10 7 3	IDF, MS, SBPS, CWH dm1 & mh2, BWBS, SWB — Dry Zonal Wet 15 13 5	PP, BG 15
13 Historical Wildfire Occurrence (by WMU Fire Zone)	(2, 81, 92, GA, V1, V5, V9, V3, V5, R8, K7 1	(1, G8, K1, K4, W, C1, G3, V6 5	G2, I3, GA, I4, V1, I3, K4 8	K1, K5, K3, C2, I3, K5, GA, K4, K7, K2 10	K7, K4, K2, K1 15
					Sub Total 30 /30
Topography	**A**	**B**	**C**	**D**	**E**
14 Aspects (>15% slope)	North 2	East 5	<10% slope, all aspects 10	West 12	South 15
15 Slope (%)	<16 1	16–29 and most south for North slopes 5	30–40 10	40-54 12	>55 15
16 Terrain	Flat 1	Rolling 3	Sloped terrain, some low relief draws 5	Consistent slope, deep draws or shallow gullies 7	Consistent slope, deep gullies 10
17 Landscape/Topographic Conditions to Wildfire Spread	< 5 ha isolated forest land 1	North and/or east aspects dominate, wildfire spread restricted from South and/or West 2	Mountainous terrain, broken topography, irregular aspect and slope changes, multiple restrictions to wildfire spread, large water bodies 5	Rolling terrain, minor water bodies, minor/all aspect and slope changes, minor restrictions to wildfire spread 10	Continuous, consistent topography No restrictions to wildfire spread 15
					Sub Total 37 /55
FUEL, WEATHER AND TOPOGRAPHY					WILDFIRE BEHAVIOUR THREAT SCORE 129 /240**
Structural	**A**	**B**	**C**	**D**	**E**
18 Position of Structure/ Community on Slope	No Structures Values within 2 km 0	Bottom of slope, valley bottom 5	Mid-slope benchland, elevated valley, <16% slope 10	Mid-slope continuous, >15% slope 12	Upper 1/3 of Slope 15
19 Type of Development	No Structures Values within 2 km 0	Perimeter Interface, no inclusions 3	Perimeter Interface, with inclusions 5	Intermix > 1 structure/ha 8	Intermix < 1 structure/ha Infrastructure 10
20 Position of Assessment Area Relative to Values	No Structures Values within 2 km 0	Above >500 200–500 <200 m 1 10 20	Adjacent >500 200–500 <200 m 5 12 25	Flat/Rolling >500 200–500 <200 m 1 12 25	Below >500 200–500 <200 m 1 15 30
					WILDLAND URBAN INTERFACE WILDFIRE THREAT SCORE 27 /55
					TOTAL WILDFIRE THREAT SCORE 156 /295

*Proceed only if Fuel sub total is > 29.

** Proceed to Structural component only if Wildfire Threat Behaviour Score is >49 for untreated polygons.

Wildfire Behaviour Threat Class (check applicable class)

Low	0-40	
Moderate	41-85	
High	86-168	✓
Extreme	>168	

Wildland Urban Interface Threat Class (check applicable class)

Low	0-15	
Moderate	16-26	
High	27-39	✓
Extreme	>39	

Last Updated: January 24, 2013

Figure 50 Plot LC_008 threat assessment worksheet.

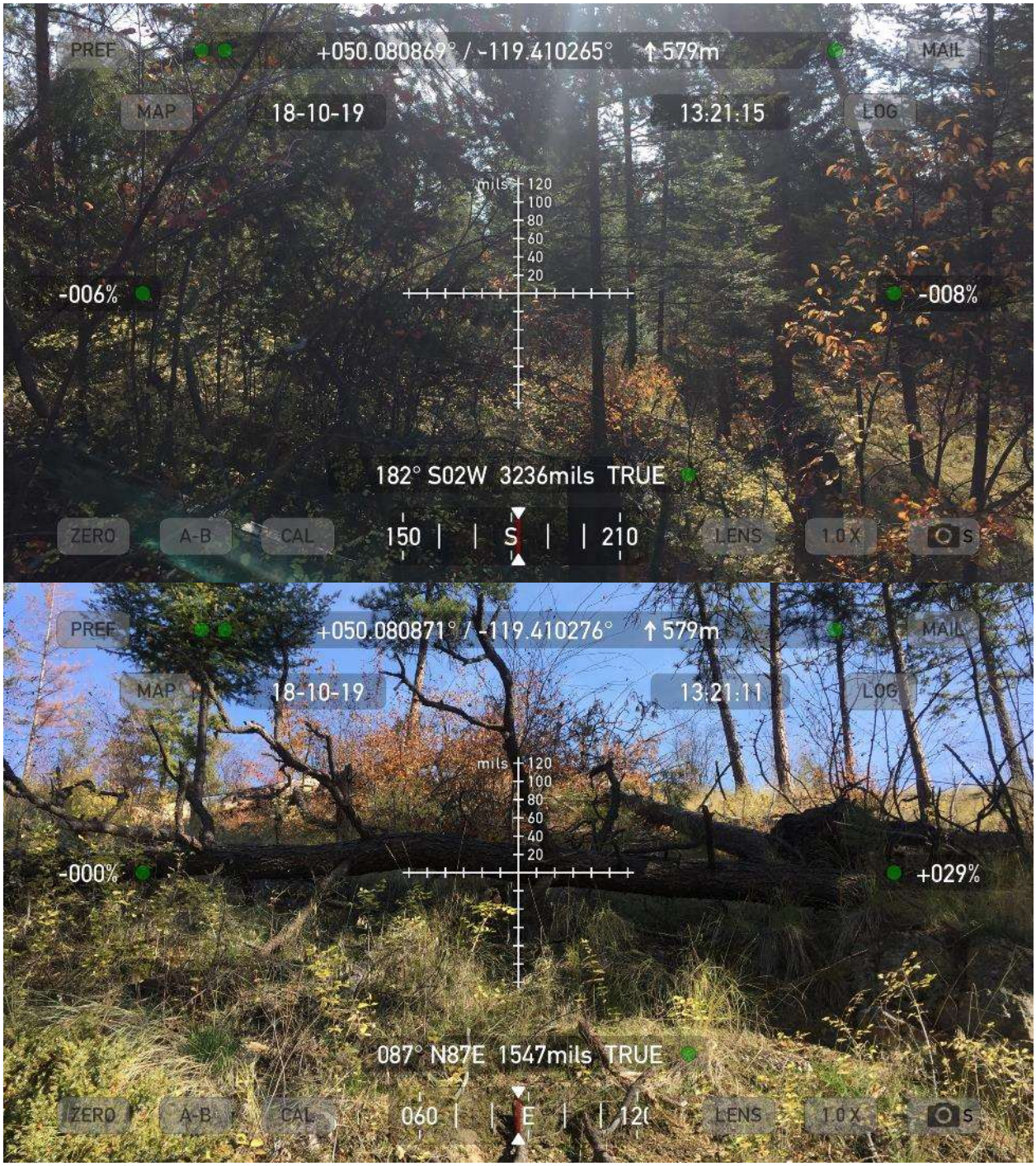
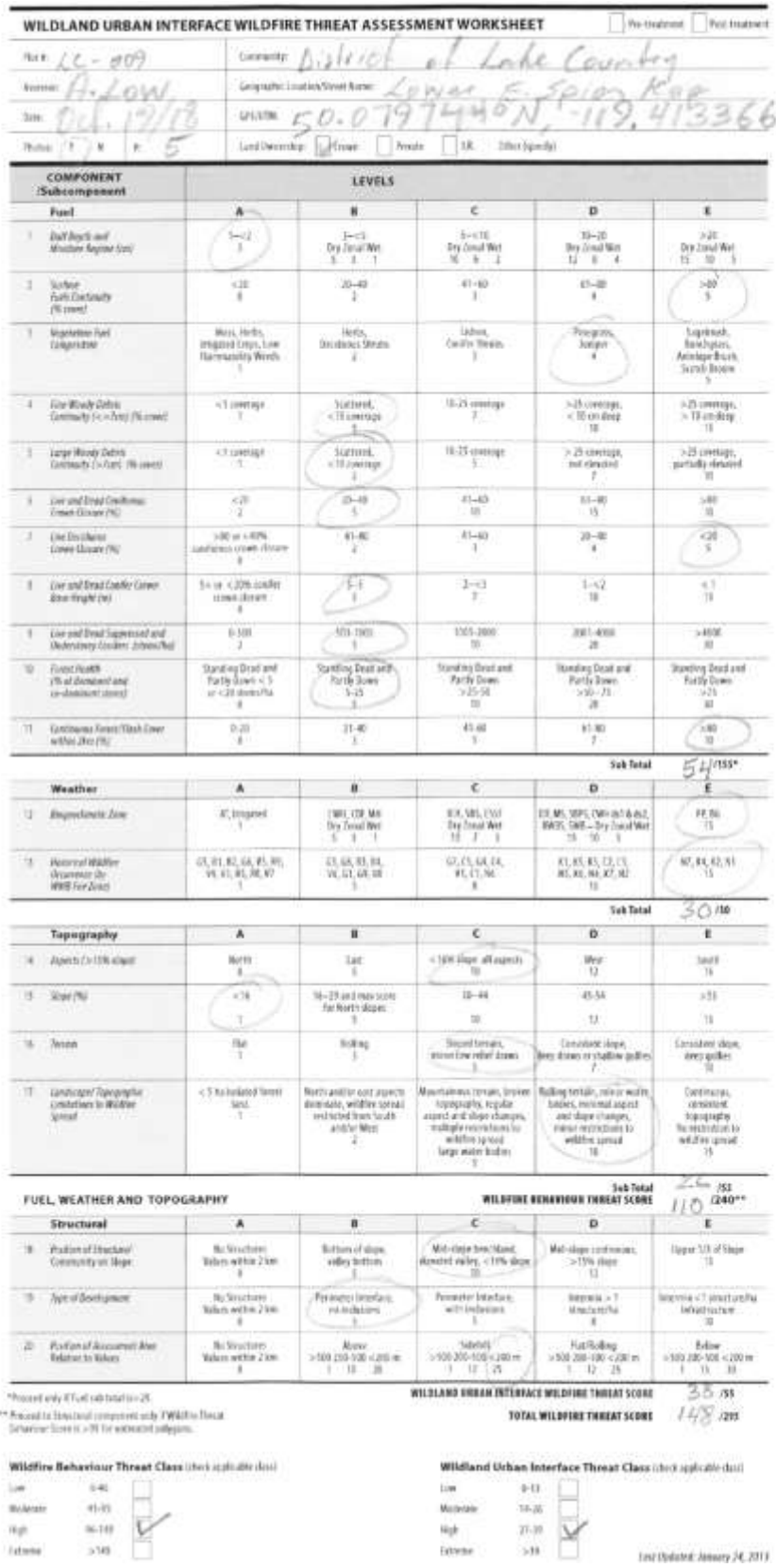


Figure 51 Plot LC_008 photos from plot centre.

Figure 52 Plot LC_008 photos from plot centre.

Figure 53 Plot LC_008 canopy closure.

APPENDIX



WILDLAND URBAN INTERFACE WILDFIRE THREAT ASSESSMENT WORKSHEET

Pre-treatment ☐ Post-treatment ☐

Plot #: LC-009 | Community: District of Lake Country

Assessor: A. Low | Geographic Location/Street Name: Lower E. Spion Kop

Date: Oct. 12/18 | GPS/UTM: 50.079744°N, -119.413366°W 579m

Photos: Y / N # 5 | Land Ownership: ☑ Crown ☐ Private ☐ I.R. ☐ Other (specify)

COMPONENT /Subcomponent	LEVELS				
Fuel	**A**	**B**	**C**	**D**	**E**
1 Bui Boy & and Moisture Regime (cm)	1–<2 1	2–<5 Dry / Zonal / Wet 3 2 1	5–<10 Dry / Zonal / Wet 10 6 2	10–20 Dry / Zonal / Wet 12 8 4	>20 Dry / Zonal / Wet 15 10 5
2 Surface Fuels Continuity (% cover)	<20 0	20–40 2	41–60 3	61–80 4	>80 5
3 Vegetation Fuel Categories	Moss, Herbs, Irrigated Crops, Low Flammability Weeds 1	Herbs, Deciduous Shrubs 2	Lichen, Conifer Shrubs 3	Pinegrass, Juniper 4	Sagebrush, Rose/Aspen, Antelope Brush, Saskatoon, Bunchgrass 5
4 Fine Woody Debris Continuity (<=7cm) (% cover)	<1 coverage 1	Scattered, <10 coverage 3	10–25 coverage 7	>25 coverage, <10 cm deep 10	>25 coverage, >10 cm deep 15
5 Large Woody Debris Continuity (>7cm) (% cover)	<1 coverage 1	Scattered, <10 coverage 3	10–25 coverage 5	> 25 coverage, not elevated 7	>25 coverage, partially elevated 10
6 Live and Dead Coniferous Crown Closure (%)	<20 2	20–40 5	41–60 10	61–80 15	>80 20
7 Live Deciduous Crown Closure (%)	>80 or <40% coniferous crown closure 0	61–80 2	41–60 3	20–40 4	<20 5
8 Live and Dead Conifer Crown Base Height (m)	5+ or <20% conifer crown closure 0	3–5 1	2–<3 2	1–<2 10	<1 15
9 Live and Dead Suppressed and Understorey Conifers (stems/ha)	0-500 2	501-1500 5	1501-2000 10	2001-4000 20	>4000 30
10 Forest Health (% of dominant and co-dominant stems)	Standing Dead and Partly Down < 5 or <20 stems/ha 0	Standing Dead and Partly Down 5–25 5	Standing Dead and Partly Down >25-50 10	Standing Dead and Partly Down >50 - 75 20	Standing Dead and Partly Down >75 30
11 Continuous Forest/Slash Cover within 2km (%)	0-20 0	21-40 5	41-60 5	61-80 7	>80 10
					Sub Total 54 /155*
Weather	**A**	**B**	**C**	**D**	**E**
12 Biogeoclimatic Zone	AT, Unspecified 1	IDFdk, IDFdk Mk Dry / Zonal / Wet 5 3 1	BGxh, MSdk, CWHdm Dry / Zonal / Wet 10 7 3	ESSFdk, MSdk, SBPSdk, CWHdm/h & dk2, BWBSdk, SWBmk — Dry / Zonal / Wet 15 10 5	PP, BG 15
13 Historical Wildfire Occurrence (2x WMB Fire Zone)	C1, D1, B2, GA, B5, B9, V4, G1, B5, B8, W7 1	C5, GA, B3, B4, V4, G1, GA, B8 5	G7, C5, GA, C4, B5, C7, N4 8	K1, K5, K5, C2, C5, K5, K6, N4, K7, N2 10	N7, B4, K2, K5 15
					Sub Total 30 /30
Topography	**A**	**B**	**C**	**D**	**E**
14 Aspects (>15% slope)	North 0	East 5	<10% slope, all aspects 10	West 12	South 15
15 Slope (%)	<16 1	16–29 and max score for North slopes 5	30–44 10	45-54 12	>55 15
16 Terrain	Flat 1	Rolling 3	Sloped terrain, minor low relief draws 5	Consistent slope, deep draws or shallow gullies 7	Consistent slope, steep gullies 10
17 Landscape/Topographic Limitations to Wildfire Spread	< 5 % Isolated forest land 1	North and/or east aspects dominate, wildfire spread restricted from south and/or West 2	Mountainous terrain, broken topography, irregular aspect and slope changes, multiple restrictions to wildfire spread large water bodies 5	Rolling terrain, minor water bodies, minimal aspect and slope changes, minor restrictions to wildfire spread 10	Continuous, consistent topography. No restriction to wildfire spread 15
					Sub Total 24 /53
FUEL, WEATHER AND TOPOGRAPHY				**WILDFIRE BEHAVIOUR THREAT SCORE**	110 /240**
Structural	**A**	**B**	**C**	**D**	**E**
18 Position of Structure/ Community on Slope	No Structures/ Values within 2 km 0	Bottom of slope, valley bottom 3	Mid-slope benches/bowl, elevated valley, <10% slope 10	Mid-slope continuous, >15% slope 12	Upper 1/3 of Slope 15
19 Age of Development	No Structures/ Values within 2 km 0	Pre-urban/ Interface, no indicators 1	Perimeter Interface, with indicators 5	Intermix > 1 structure/ha 8	Intermix <1 structure/ha Infrastructure 10
20 Position of Assessment Area Relative to Values	No Structures/ Values within 2 km 0	Above >100 200-500 <200 m 1 10 20	Isolated/ >100 200-500 <200 m 1 12 25	Flat/Rolling >100 200-500 <200 m 1 12 25	Below >100 200-500 <200 m 1 15 30
				WILDLAND URBAN INTERFACE WILDFIRE THREAT SCORE	38 /55
				TOTAL WILDFIRE THREAT SCORE	148 /295

*Proceed only if Fuel sub total is >25.

** Proceed to Structural component only if Wildfire Threat Behaviour Score is >99 for assessed polygons.

Wildfire Behaviour Threat Class (check applicable class)

Low	0-40	☐
Moderate	41-95	☐
High	96-149	☑
Extreme	>149	☐

Wildland Urban Interface Threat Class (check applicable class)

Low	0-13	☐
Moderate	14-26	☐
High	27-39	☑
Extreme	>39	☐

Last Updated: January 24, 2013

Figure 54 Plot LC_009 threat assessment worksheet.

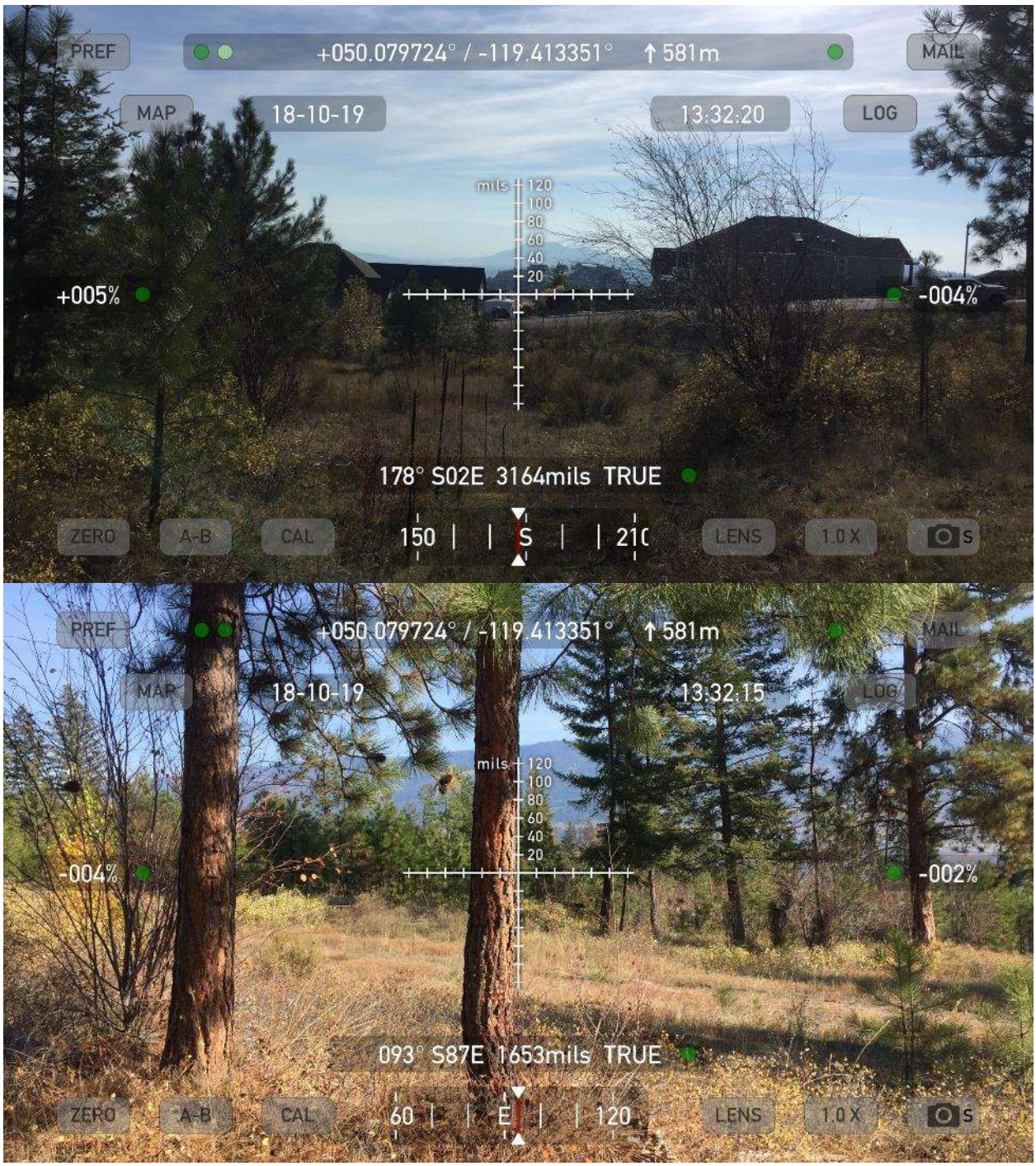
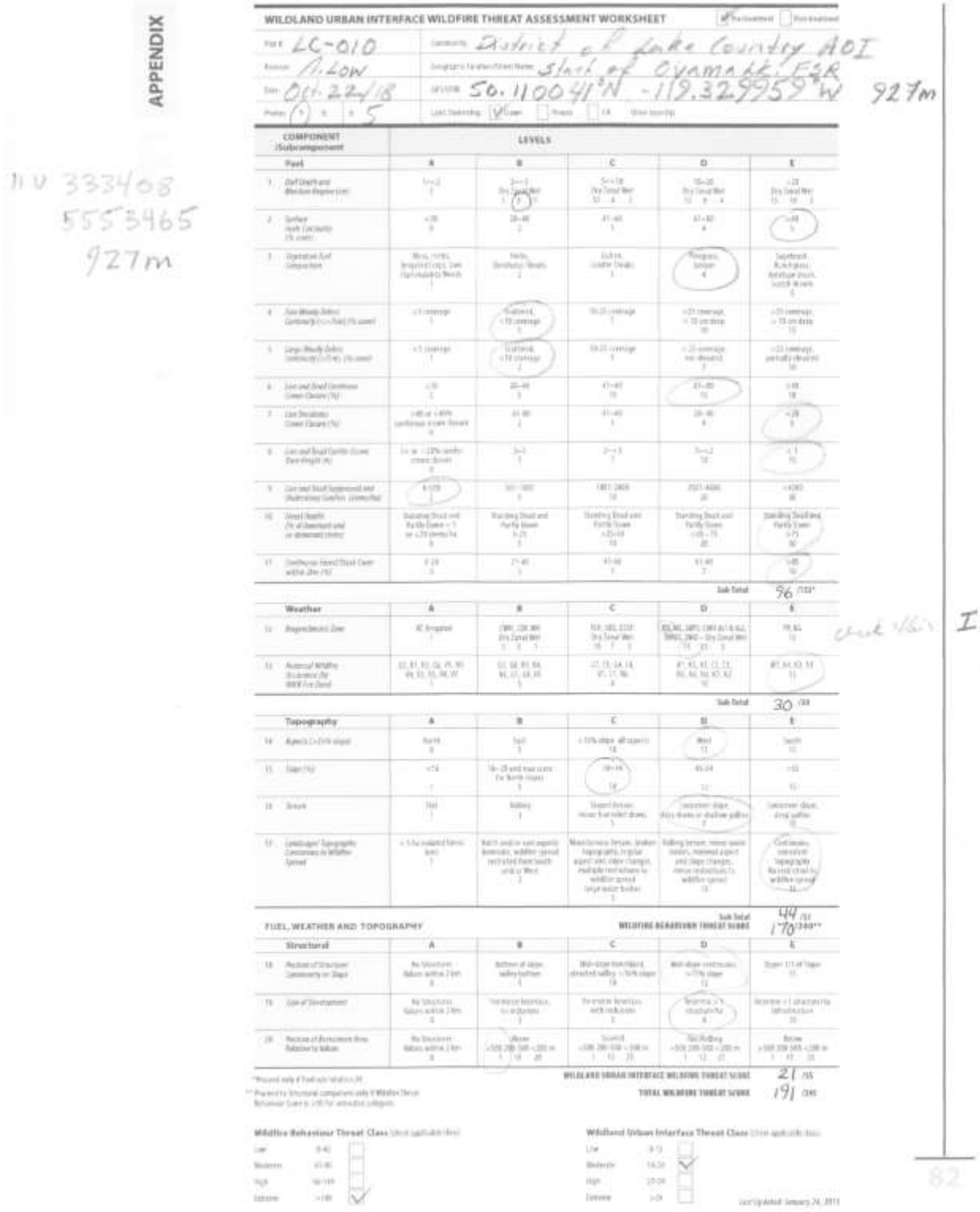


Figure 55 Plot LC_009 photos from plot centre.

Figure 56 Plot LC_009 photos from plot centre.

Figure 57 Plot LC_009 canopy closure.

APPENDIX



WILDLAND URBAN INTERFACE WILDFIRE THREAT ASSESSMENT WORKSHEET

Plot LC-010 — District of Lake Country AOI

A. Low — Stack of Cyamaka E&R

Oct. 22/18 — 50.110041°N -119.329959°W — 927m

Photo(s) 1 to 5

COMPONENT / Subcomponent | LEVELS | A | B | C | D | E

Fuel

Weather — Sub Total 96 /133* — IDFxh1

Topography — Sub Total 30 /33

FUEL, WEATHER AND TOPOGRAPHY — WILDFIRE BEHAVIOUR THREAT SCORE 44 /51 — 170 /240**

Structural

WILDLAND URBAN INTERFACE WILDFIRE THREAT SCORE 21 /55

TOTAL WILDFIRE THREAT SCORE 191 /295

Wildfire Behaviour Threat Class — Extreme ✓

Wildland Urban Interface Threat Class — Moderate ✓

Last Updated: January 24, 2011

Figure 58 Plot LC_010 threat assessment worksheet.

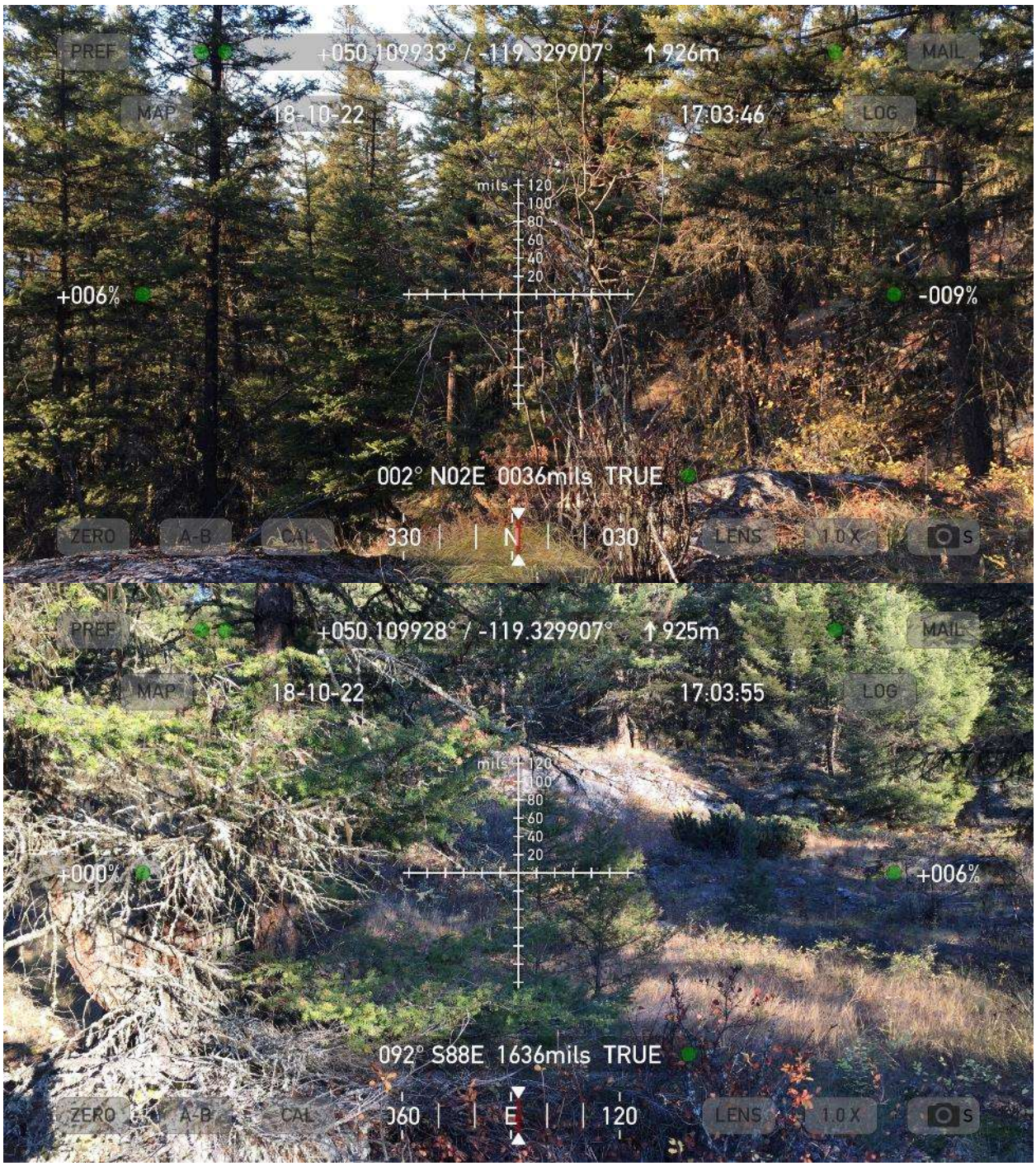


Figure 59 Plot LC_010 photos from plot centre.

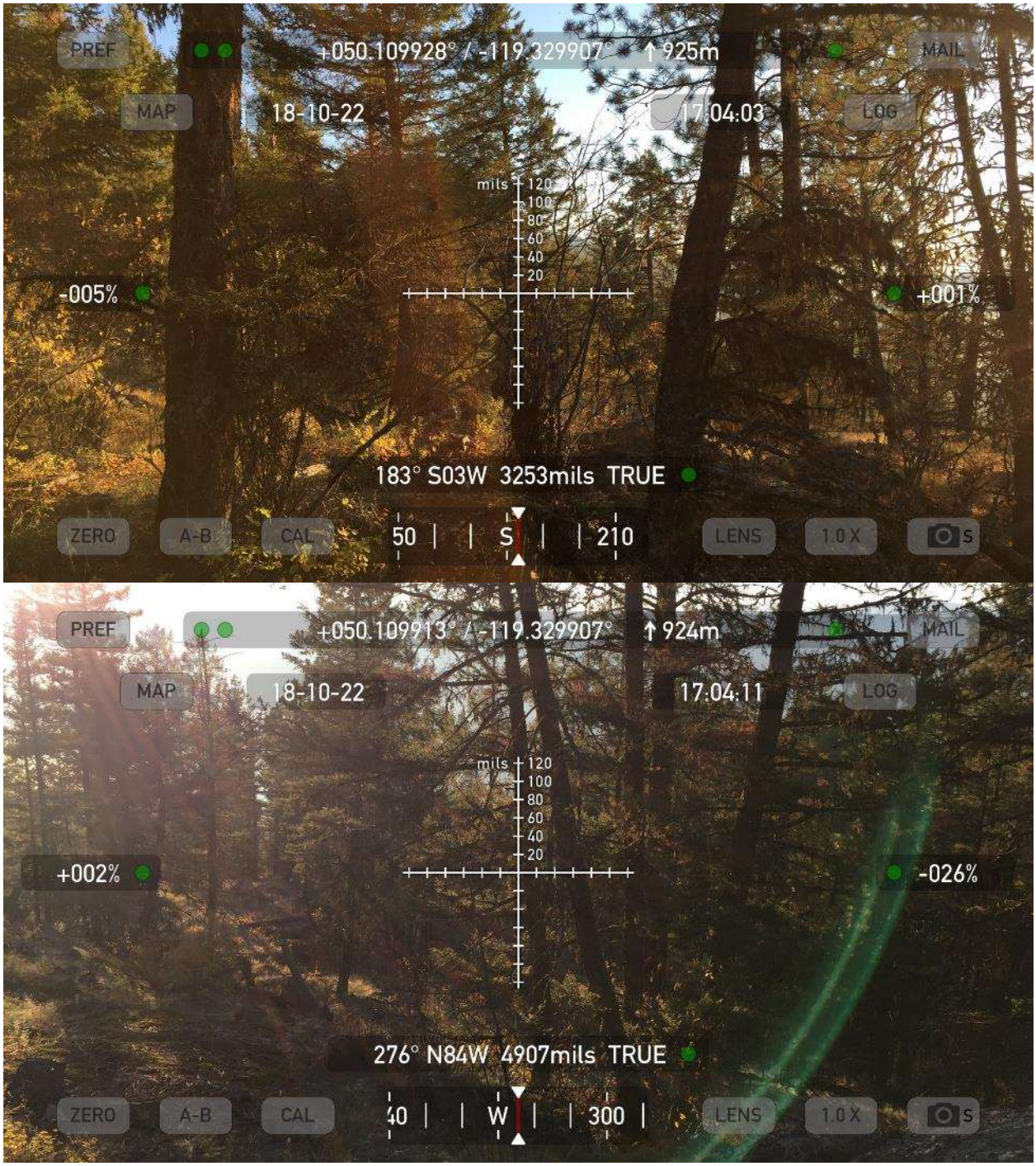


Figure 60 Plot LC_010 photos from plot centre.

Figure 61 Plot LC_010 canopy closure.

APPENDIX

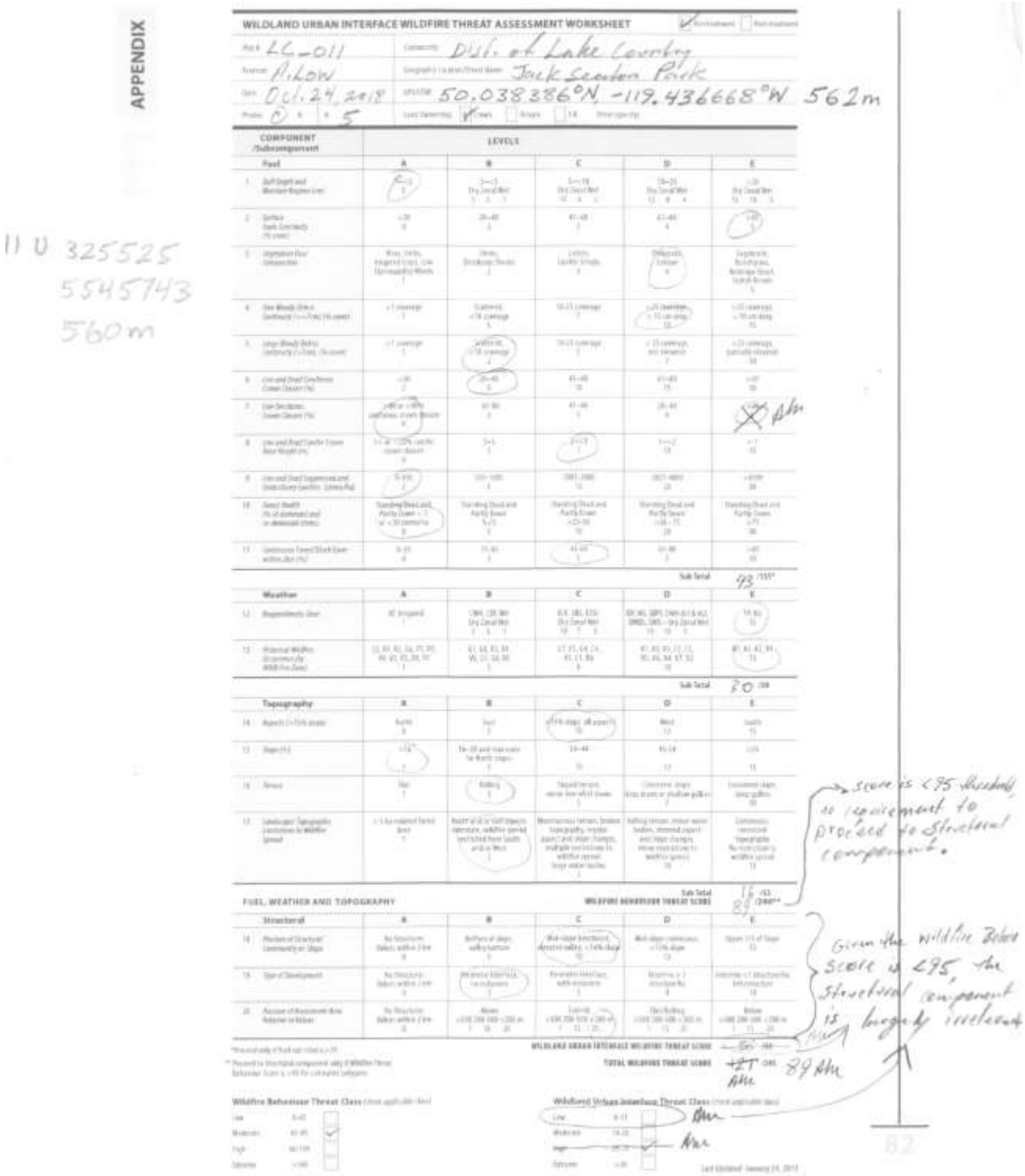


Figure 62 Plot LC_011 threat assessment worksheet.

Figure 63 Plot LC_011 photos from plot centre.

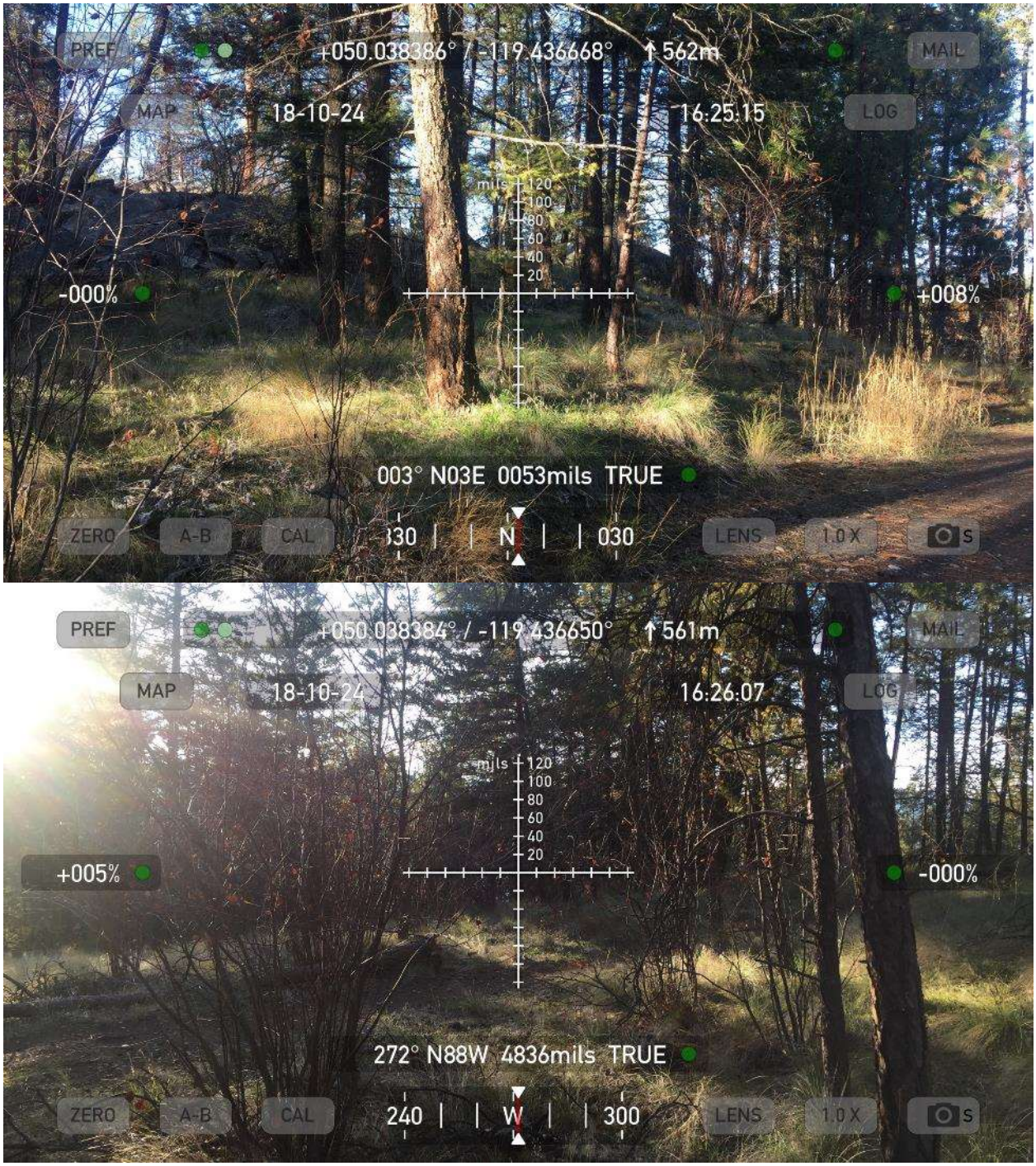


Figure 64 Plot LC_011 photos from plot centre.

Figure 65 Plot LC_011 canopy closure.

Figure 66 Plot LC_012 threat assessment worksheet.

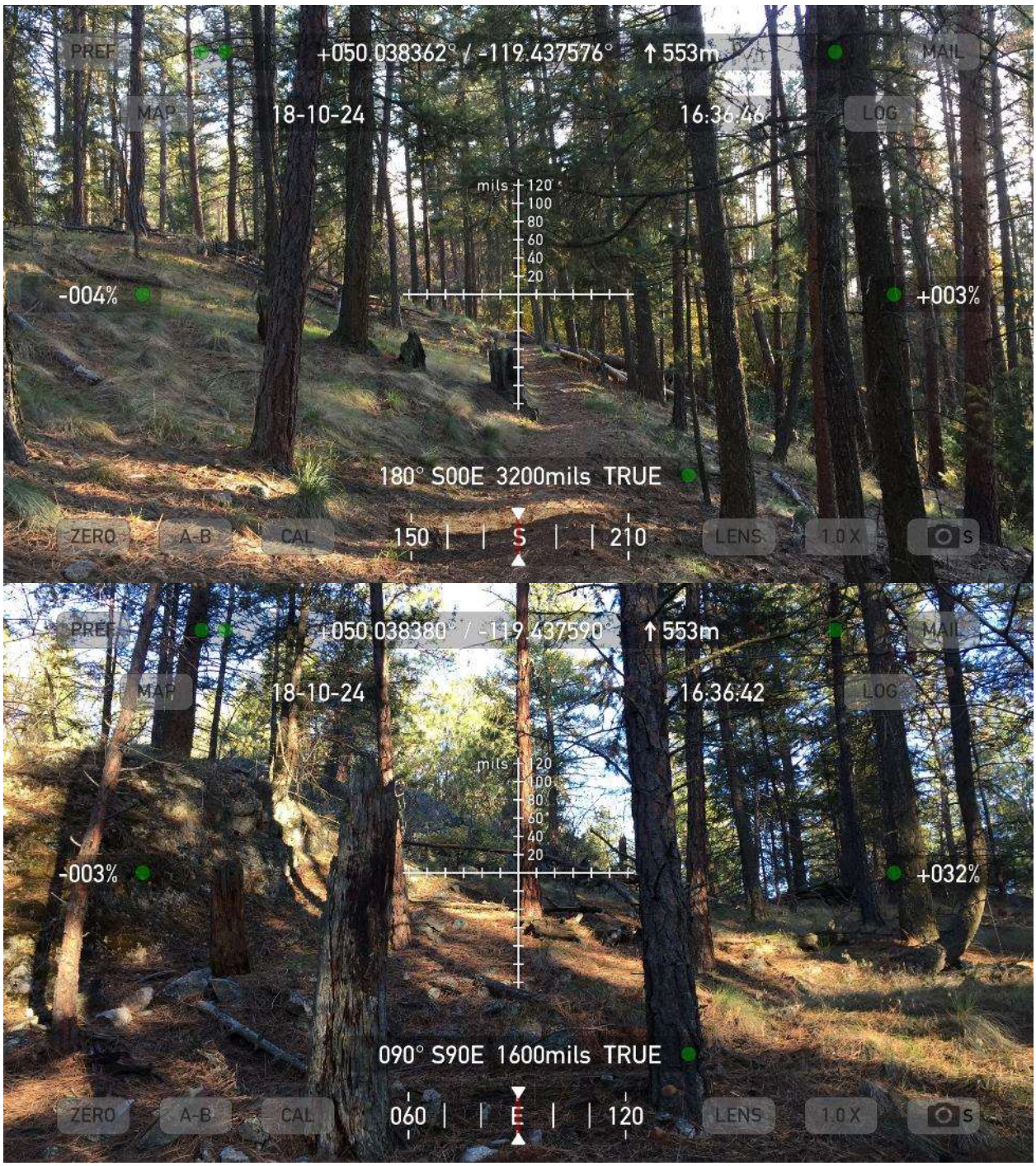


Figure 67 Plot LC_012 photos from plot centre.

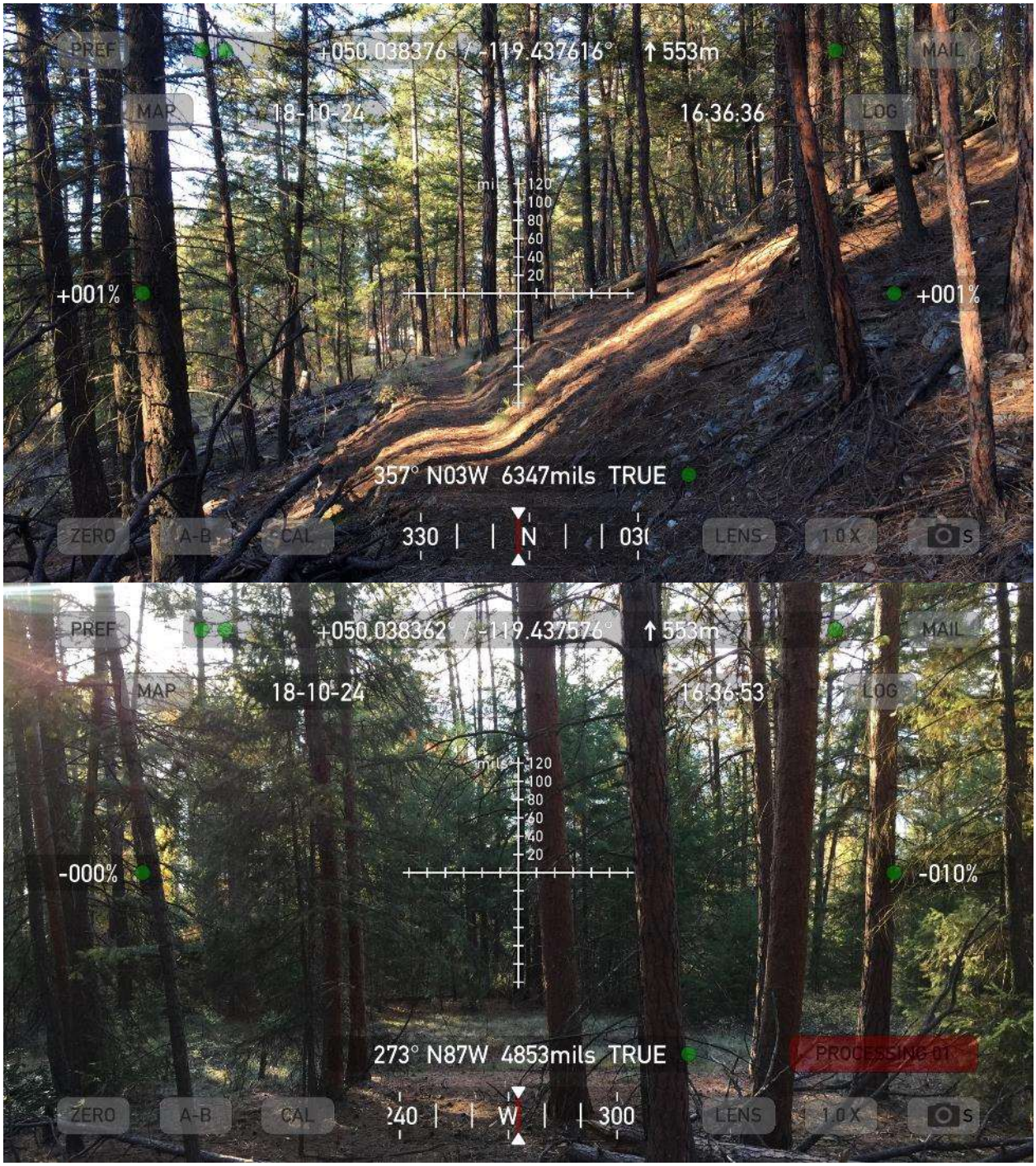


Figure 68 Plot LC_012 photos from plot centre.

Figure 69 Plot LC_012 canopy closure.

11 U 325049
5545682
482m

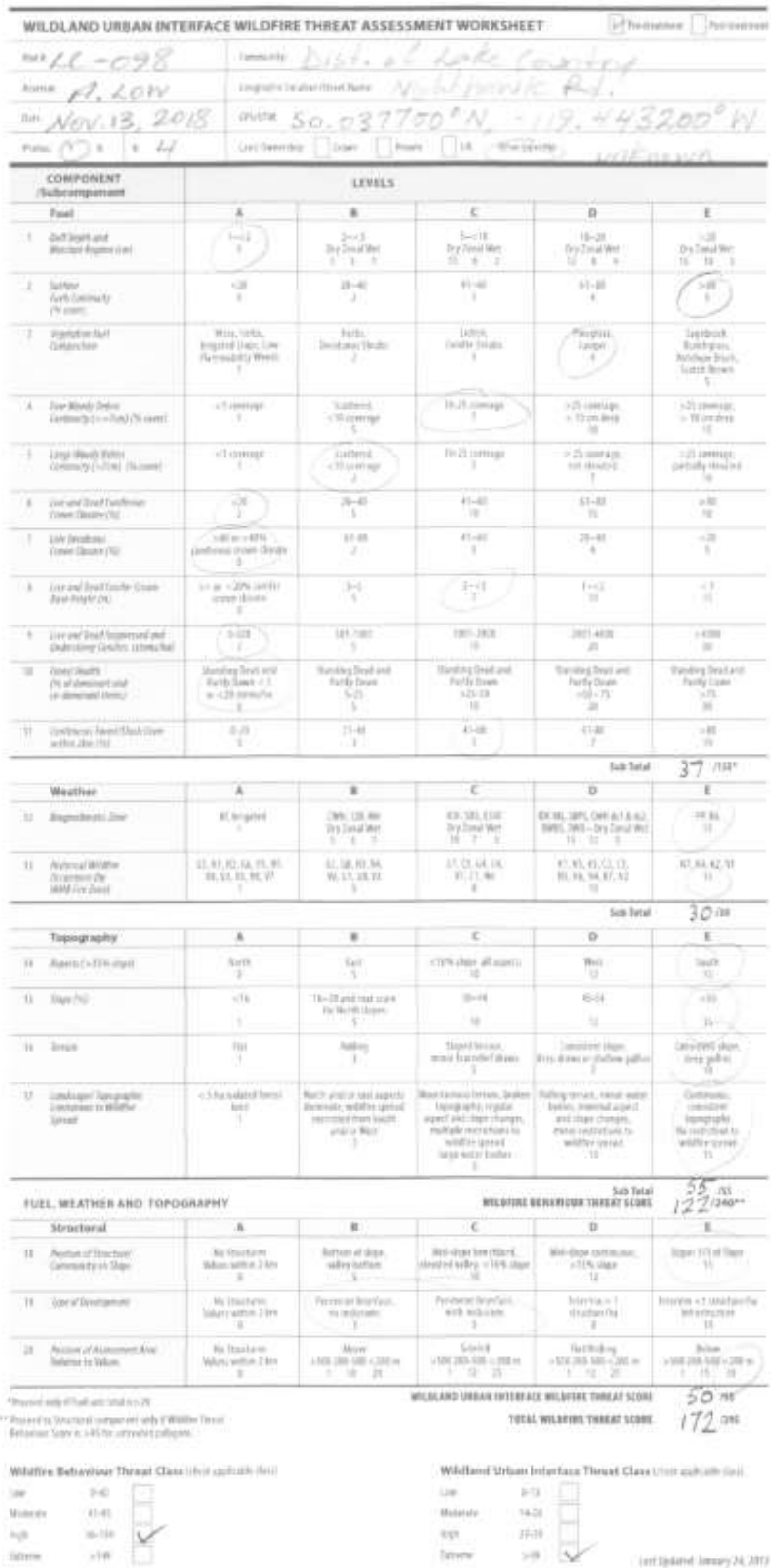


Figure 70 Plot LC_098 threat assessment worksheet.

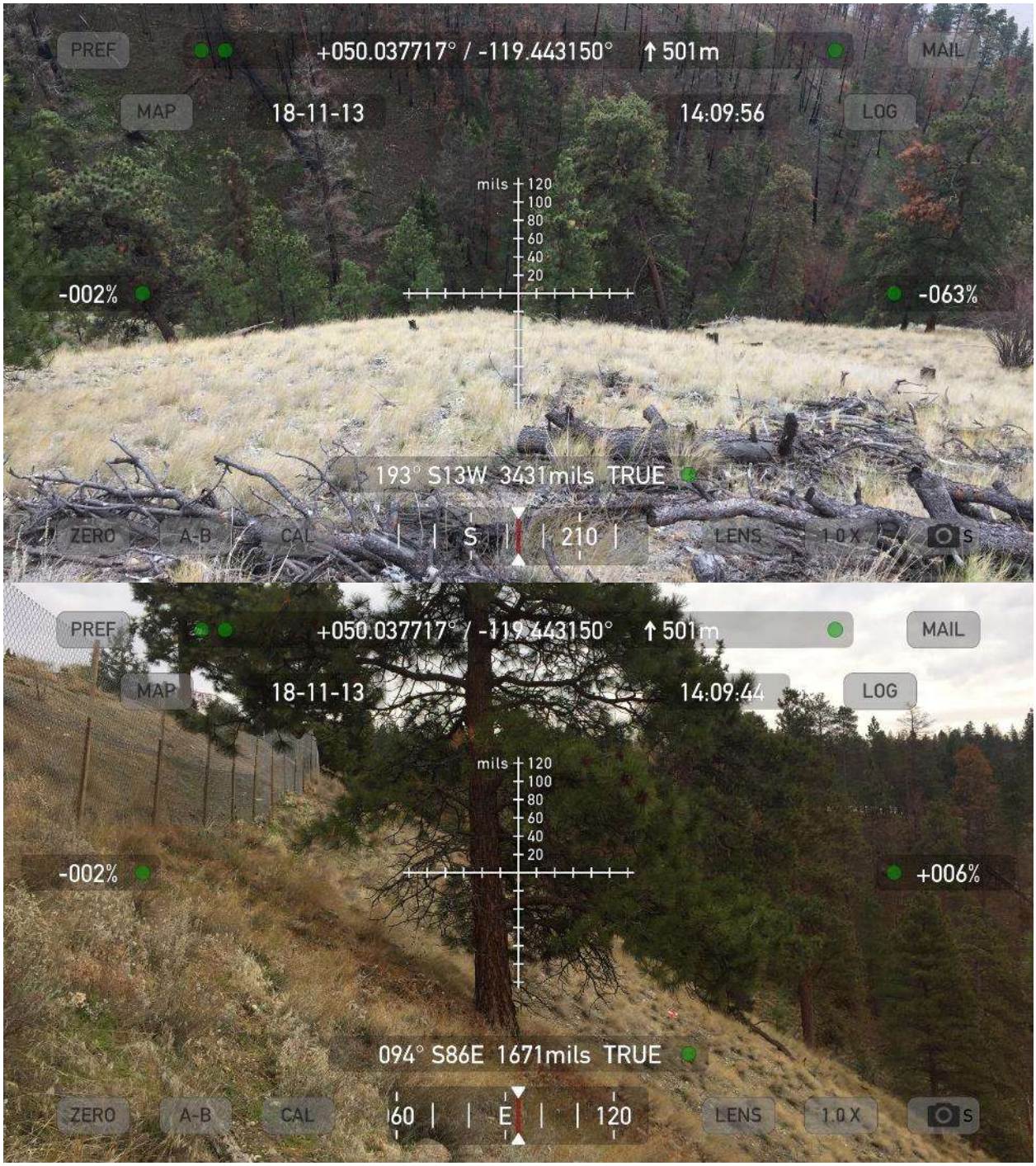
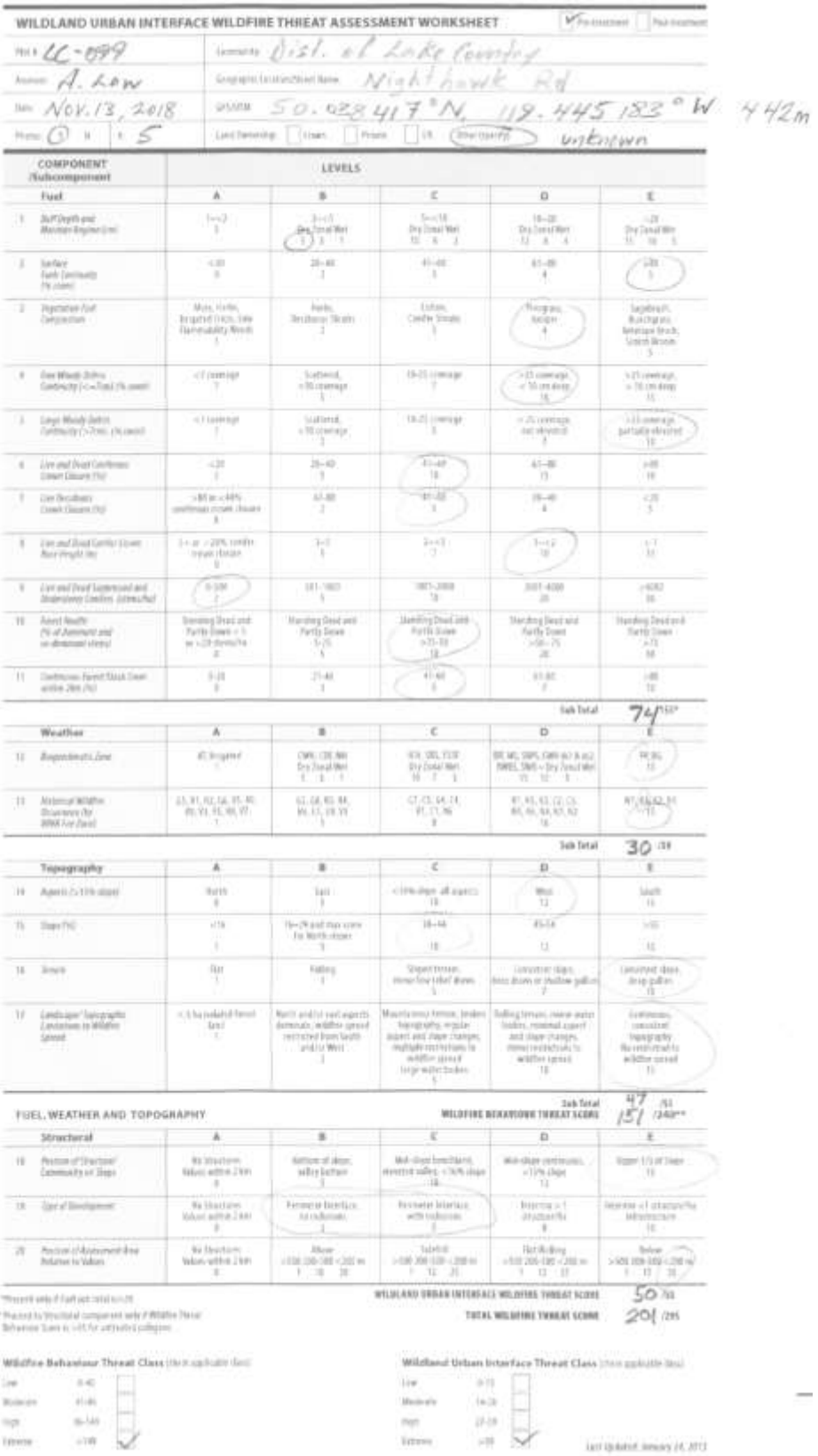


Figure 71 Plot LC_098 photos from plot centre.

Figure 72 Plot LC_098 photos from plot centre.

APPENDIX



WILDLAND URBAN INTERFACE WILDFIRE THREAT ASSESSMENT WORKSHEET

Plot # LC-099 | Community: Dist. of Lake Country
Assessor: A. Low | Geographic Location/Street Name: Nighthawk Rd
Date: NOV. 13, 2018 | UTM/LL: 50.028417°N, 119.445182°W 442m
Photos: 5 | Land Ownership: Crown / Private / LR / Other (specify) unknown

COMPONENT /Subcomponent	LEVELS				
Fuel	A	B	C	D	E
1 Duff Depth and Moisture Regime (cm)	1–<2 1	2–<3 Dry / Dead Wet 1 3 1	3–<5 Dry / Dead Wet 10 4 2	5–20 Dry / Dead Wet 12 8 4	>20 Dry / Dead Wet 15 10 5
2 Surface Fuels Continuity (% cover)	<30 0	30–60 2	61–80 3	61–80 4	>80 5
3 Vegetation Fuel Composition	Moss, Forbs, Irrigated Crops, Low Flammability Weeds 1	Forbs, Deciduous Shrubs 2	Conifer, Conifer Shrubs 3	Pine grass, Sagebrush 4	Sagebrush, Bunchgrass, Ponderosa Shrub, Grass Blowout 5
4 Fine Woody Debris Continuity (<=7mm) (% cover)	<1 coverage 1	Scattered, <50 coverage 3	10–25 coverage 7	>25 coverage or 50 cm deep 10	>25 coverage, >50 cm deep 15
5 Large Woody Debris Continuity (>7mm) (% cover)	<1 coverage 1	Scattered, <50 coverage 3	10–25 coverage 5	>25 coverage not elevated 7	>25 coverage partially elevated 10
6 Live and Dead Coniferous Crown Closure (%)	<20 1	20–40 3	41–60 10	61–80 15	>80 20
7 Live Deciduous Crown Closure (%)	>80 or <40% continuous crown closure 3	61–80 2	41–60 5	20–40 4	<20 5
8 Live and Dead Conifer Crown Base Height (m)	1+ or <20% conifer crown closure 0	3–5 5	2–<3 7	1–<2 10	<1 15
9 Live and Dead Lightwood and Slash/Litter Conifers (stems/ha)	0–500 2	501–1000 5	1001–2000 10	2001–4000 20	>4000 30
10 Forest Health (% of Stems/ha and or Basal Area)	Standing Dead and Partly Down <5 or <20 stems/ha 0	Standing Dead and Partly Down 5–15 5	Standing Dead and Partly Down 15–25 10	Standing Dead and Partly Down >50–75 20	Standing Dead and Partly Down >75 30
11 Continuous Forest Stock Down and/or Slash (%)	0–20 0	21–40 1	41–60 5	61–80 7	>80 10
					Sub Total 74 /80*
Weather	A	B	C	D	E
12 Biogeoclimatic Zone	IDF, Irrigated 1	CWH, CDF, MH Dry / Dead Wet 5 3 1	ICH, SBS, ESSF Dry / Dead Wet 10 7 3	IDF, MS, SBPS, CWH (62 & 62), BWBS, SWB Dry / Dead Wet 15 12 8	PP, BG 15
13 Historical Wildfire Occurrence (for WMA / Fire Zone)	23, 81, 82, 56, 85, 86, 93, 95, 98, 99 1	62, 68, 80, 84, 86, 13, 09, 99 3	67, 75, 04, 74, 81, 17, 96 8	87, 93, 63, 72, 75, 84, 86, 94, 97, 02 10	87, 93, 63, 72, 75, 84, 86, 94, 97, 02 15
					Sub Total 30 /30
Topography	A	B	C	D	E
14 Aspect (>15% slope)	North 0	East 3	<15% slope, all aspects 10	West 12	South 15
15 Slope (%)	<15 1	15–29 and slope runs to North/down 3	30–44 10	45–59 12	>60 15
16 Terrain	Flat 1	Rolling 3	Sloped terrain, moderate relief drains 5	Canyons/ slopes, steep drains or shallow gullies 7	Canyons/ steep, deep gullies 10
17 Landscape/ Topographic Constraints to Wildfire Spread	<5 ha isolated forest fuel 1	North and/or east aspects dominate, wildfire spread restricted from South and/or West 3	Mountainous terrain, broken topography, irregular aspect and slope changes, negligible restrictions to wildfire spread, large water bodies 5	Rolling terrain, narrow water bodies, minimal aspect and slope changes, minor restrictions to wildfire spread 10	Continuous, consistent topography, No restrictions to wildfire spread 15
					Sub Total 47 /55
FUEL, WEATHER AND TOPOGRAPHY				WILDFIRE BEHAVIOUR THREAT SCORE	151 /240**
Structural	A	B	C	D	E
18 Position of Structure/ Community on Slope	No Structures Values within 2 km 0	Bottom of slope, valley bottom 3	Mid-slope benches, moderate valleys, <30% slope 5	Mid-slope continuous, >15% slope 12	Upper 1/3 of Slope 15
19 Type of Development	No Structures Values within 2 km 0	Perimeter Interface, no subdivision 3	Perimeter Interface with subdivision 5	Intermix < 1 structure/ha 8	Intermix >1 structure/ha, Infrastructure 15
20 Position of Assessment Area Relative to Values	No Structures Values within 2 km 0	Above >100, 200–300, <200 m 1 10 20	Same/All >100, 200–300, <200 m 1 12 25	Flat/Rolling >100, 200–300, <200 m 1 12 25	Below >100, 200–300, <200 m 1 17 30
				WILDLAND URBAN INTERFACE WILDFIRE THREAT SCORE	50 /55
				TOTAL WILDFIRE THREAT SCORE	201 /295

*Percent value if fuel not rated in (1)

** Proceed to Structural component only if Wildfire Threat Behaviour Score is >151 for wildland/rural categories

Wildfire Behaviour Threat Class (check applicable box)

Low	0–40	
Moderate	41–86	
High	86–149	
Extreme	>149	✓

Wildland Urban Interface Threat Class (check applicable box)

Low	0–71	
Moderate	74–126	
High	127–177	
Extreme	>177	✓

Last Updated: January 24, 2013

Figure 73 Plot LC_099 threat assessment worksheet.

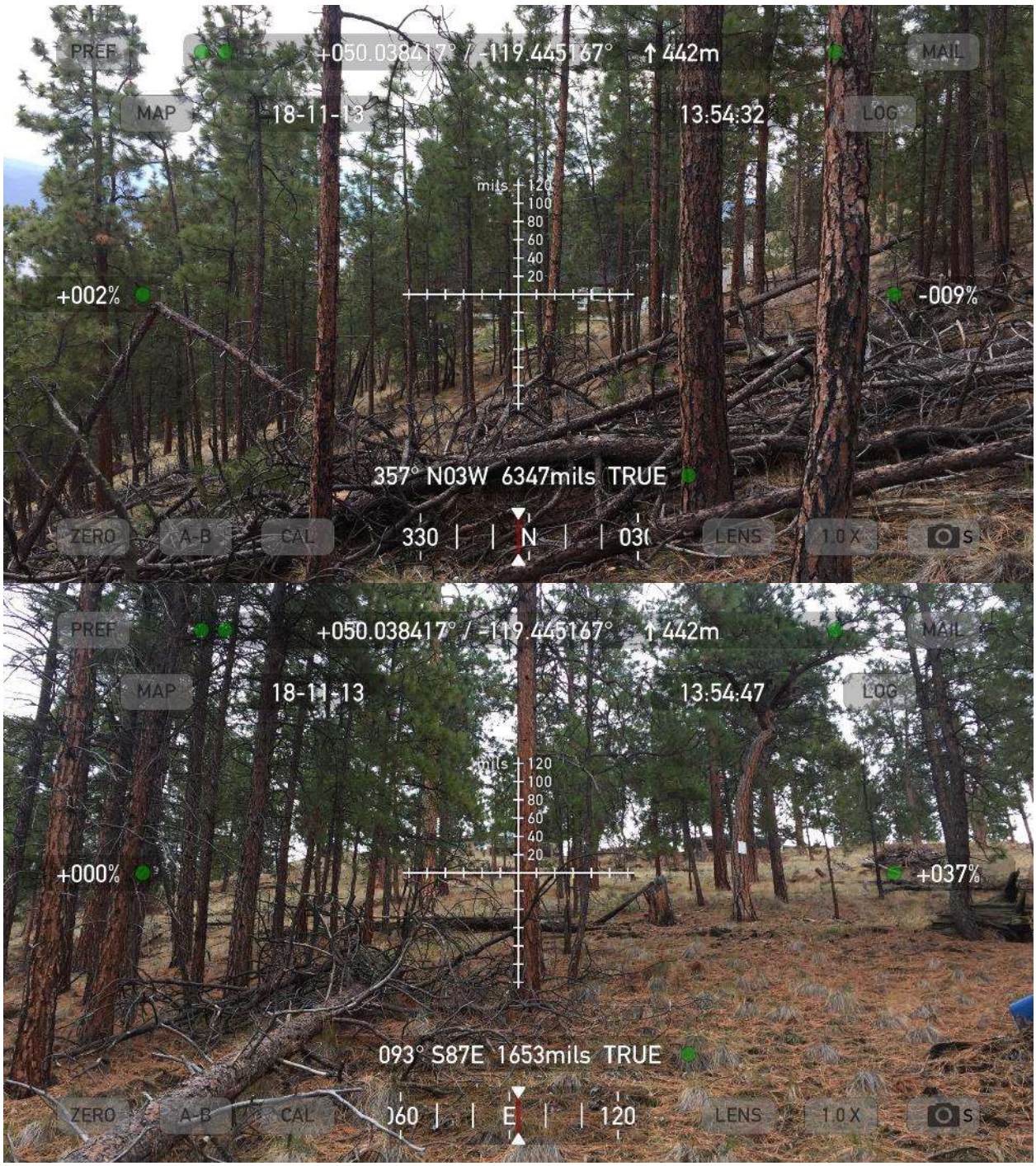


Figure 74 Plot LC_099 photos from plot centre.

Figure 75 Plot LC_099 photos from plot centre.

Figure 76 Plot LC_099 canopy closure.

APPENDIX 3: Maps

Included as a separate document due to file size and dimensions.

APPENDIX 4: GIS Methodology

The Wildfire Risk Analysis (WRA) is a GIS-based model that spatially quantifies and analyzes the relationships that exist between the critical factors affecting wildfire risk. The intent of the analysis is to provide planners with a decision making tool to spatially identify the risk at the landscape level. This information allows planners to analyze and explore the implications of different management activities in relation to wildfire risk.

The overall rating spatially expresses wildfire risk by incorporating four key components, with specific weightings, as follows:

- Fire behaviour characteristics (40% of the weighting);
- Risk of ignition (10% of the weighting);
- Threat to structures, natural features and cultural features of significance (25% of the weighting);
- Suppression constraints (25% of the weighting).

These four components are in turn calculated from contributing factors, or sub components, each of which is represented by a layer in GIS. The layers representing these four components are subsequently overlain to produce the final wildfire risk rating.

Component #1 - Fire Behaviour

The fire behaviour component of the WRA measures how wildfire will behave under extreme weather conditions. The Canadian Fire Behaviour Prediction System (FPB) provides quantitative outputs of selected fire behaviour characteristics for the major Canadian fuel types.

Fuel Types

Sixteen national benchmark fuel types, which are divided into five categories, are used by the Canadian Fire Behaviour Prediction System to forecast how wildfire will react. These fuel types were defined using the forest inventory and guidelines developed by the Ministry of Forests, Lands and Natural Resource Operations. Six fuel types were identified in the study area. It is important to note that these fuel types represent a type of behaviour pattern and their names are generic and do not accurately describe the type of stand itself.

Weather

Weather conditions used to calculate fire behaviour were derived from historic government records for two weather stations within the area.

This weather data was compiled and statistically analyzed to determine the average 80th percentile fire weather indices for the months of May to September.

Topography

Topographical attributes required to predict fire behaviour include slope and aspect. The study area was delineated into polygons based on slope breaks of 10% intervals and aspects of 45 degrees. The cardinal wind direction was calculated from the aspect so that it was blowing upslope and the elapsed time was set at 24 hours.

All of the data pertaining to fuel types, topographical attributes, and fire weather was compiled for the entire study area. This information was then run through the modeling software (Remsoft FPB97) to create the three output fire behaviour layers: fire intensity, rate of spread and crown fraction burned.

Fire Intensity

This layer is a measure of the rate of heat energy released per unit time per unit length of fire front and is based on the rate of spread and the predicted fuel consumption. The units for this layer are kilowatts per meter.

Rate of Spread

This layer is a measure of the speed at which a fire extends its horizontal dimensions. It is based on the hourly Initial Spread Index (ISI) value and is adjusted for the steepness of slope, the interactions between slope and wind direction and increasing fuel availability as accounted for through the Build Up Index (BUI). The units for this layer are meters per minute.

Crown Fraction Burned

This layer is a measure of the proportion of tree crowns involved in the fire. It is based on the rate of spread, the crown base height and the foliar moisture content and is expressed as a percentage value.

The weightings of the fire behaviour layers were designated as follows with a total maximum value of 40 and categorized into risk categories as follows: 6-19 = Low; 20-29 = Medium; 30-40 = High.

Table 5 Fire behaviour units and applied weighting.

Layer	Units	Unit Value	Weight
Fire Intensity	Kilowatts per meter (kW/m)	>0-500 501-1000 1001-2000 2001-4000 4001-10000 10001-30000 >30000	4 – Very Low 8 – Low 10 – Low 12 – Medium 16 – Medium 18 – High 20 – Very High
Rate of Spread	Meters per minute (m/min)	>0-5 6-10 11-20 21-40 >40	2 – Very Low 4 – Low 6 – Medium 8 – High 10 – Very high
Crown Fraction Burned	Percent of canopy crown burned (%)	0 1-9 10-49 50-89 90-100	0 – None 3 – Low 6 – Medium 8 – High 10 – Very high

Component #2 – Risk of Ignition

Fires are ignited by either humans or lightning. The most common source of human caused ignition includes the use of motorized machinery, discarded cigarettes and matches, fires started in houses,

campfires lit within natural areas, sparks from railways and trees falling and striking hydro distribution and transmission lines. These causes are accounted for by buffering all areas where these causes are most likely to occur. A 30-meter buffer has been established around all roads, structures, hydro lines and railways. Where these areas run through fuel types that are likely to sustain a fire ignition, the area has been assigned a high-risk ranking.

It is difficult to predict the risk of lighting striking across a landscape. Therefore, all fuel types that are likely to sustain a fire ignition due to a lighting strike have been identified and assigned a moderate risk ranking. All deciduous fuel types have been assigned a low ranking and non-fuels have been assigned a weighting of 0.

The weightings of the risk of ignition were designated as follows with a total maximum value of 10 and categorized into risk categories as follows: 1 = Low; 5 = Medium; 10 = High.

Table 6 Risk of ignition units and applied weighting.

Layer	Units	Weight
Risk of Human Caused Ignition	Areas within 30 meters of Structures Roads Trails/Camping areas Hydro Transmission lines Railways	10
Risk of Lightning Caused Ignition	All fuel types except deciduous or non-fuels (C2, C3, C4, C7, M2)	5
	All Deciduous fuels (D1/D2)	1
	All non-fuels (W, I, U, N)	0

Component #3 - Values at Risk - Structures

The structural values at risk component of the model identifies human structures which are at risk of being damaged or destroyed by wildfire. All structures within the wildland interface were identified using orthophotos and buffers of 30 m, 100 m and 2 km were then created around these structures. Weightings were assigned to these buffers as per the table below.

The weightings of the structures and natural features at risk were designated as follows with a total maximum value of 25 and categorized into risk categories as follows: 5 = Low; 10-25 = High.

Table 7 Values at risk units and applied weighting.

Layer	Units	Weight
Structures and facilities at risk	Areas within 30 meters of any structures	25
	Areas within 100 meters of any structures	20
	Areas within 2km of any structures	5

Component #4 – Suppression Constraints

The ability to suppress a wildfire depends on a number of factors including terrain characteristics, accessibility and the availability of suppression resources. Four factors were used to determine the overall rating for suppression capability: proximity to roads, proximity to water sources, initial attack time and steepness of terrain.

Proximity to Roads – Access

This layer accounts for the accessibility of suppression resources to fight a wildfire by creating 100 m, 500 m and 1000 m buffers along all roads in and adjacent to the study area. These buffers were assigned threat weightings that decreased with their proximity to roads.

Proximity to Water Sources

This layer is a measure of the availability of water sources for fire suppression. It was derived by creating 100 m buffers around all fire hydrants and perennial rivers, creeks and lakes. Fire hydrants were

designated the lowest weighting of 2, perennial water sources (ponds, reservoirs, lakes, rivers) were designated a weighting of 6 and all other areas were designated a weighting of 10.

Steepness of Terrain

Steepness of terrain influences the timely ability of ground crews to access the fire and construct fire lines Areas were weighted based on their average slope class. Designated weights increase relative to the steepness of the slope.

Weightings of the suppression constraints were designated as follows with a total maximum value of 25 and categorized into risk categories as follows: 0-9 = Low; 10-19 = Medium; 20-25 = High.

Table 8 Suppression constraints units and applied weighting.

Layer	Units	Unit Value	Weight
Proximity to Roads	Distance from roads in meters	0-100 from roads	1
		101-500 from roads	3
		501-1000 from roads	6
		>1000 from roads	10
Proximity to Water sources	Distance from water sources in meters	< 100m from perennial water sources (ponds, reservoirs, lakes, rivers)	5
		>100 meters from perennial water sources (ponds, reservoirs, lakes, rivers)	10
Steepness of terrain	% Slope	0-20	1
		21-40	2
		41-60	3
		60-100	4

		>100	5

*The entire area was weighted based on distance from roads. The risk was reduced by three if the area was accessible by a trail.

Final Wildfire Risk Rating

The final wildfire risk rating has been calculated by adding together the ratings of the four primary components to produce a final weighting out of 100. The final weightings have been categorized as follows:

Table 9 Final wildfire risk weighting and risk class.

Final Weight	Wildfire Risk
0-39	Low
40-59	Moderate
60-79	High
>80	Very high