Fraser Valley Regional District, Zone A Community Wildfire Protection Plan 2019

Submitted by:

B.A. Blackwell & Associates Ltd.
270 – 18 Gostick Place
North Vancouver, BC, V7M 3G3
Ph: 604-986-8346
Email: bablackwell@bablackwell.com

Submitted to:

Reg Dyck, Manager of Electoral Area Emergency Services
Fraser Valley Regional District
45950 Cheam Avenue
Chilliwack, BC, V2P 1N7
Ph: 604-702-5028
E-mail: emergencyinfo@fvrd.ca

B.A. Blackwell & Associates Ltd.

Fraser Valley Regional District

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REGISTERED PROFESSIONAL SIGN AND SEAL

RPF PRINTED NAME	
Leslie Brown	RPF 5117
DATE SIGNED	
June 30, 2020	
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.	
Registered Professional Forester Signature and Seal	
	

EXECUTIVE SUMMARY/ SUMMARY OF CWPP RECOMMENDATIONS

The Community Wildfire Protection Plan (CWPP) process was created in British Columbia (BC) as a response to the devastating 2003 wildfire in Kelowna. As an integral part of the Community Resiliency Investment (CRI) program, managed and funded through the Union of BC Municipalities, CWPPs aim to develop strategic recommendations to assist in improving safety and to reduce the risk of damage to property from wildfires.

This CWPP will provide the Fraser Valley Regional District (FVRD) with a framework that can be used to review and assess areas of identified high fire risk within FVRD Zone A, which encompasses portions of Electoral Areas A and B. Additionally, the information contained in this report should help to guide the improvement and/or development of emergency plans, emergency response, evacuation plans, communication and education programs (including FireSmart), bylaw development in areas of fire risk, and the management of potentially hazardous forest lands adjacent to the community.

Wildfire management requires a multi-faceted approach for greatest efficacy and risk reduction outcomes. A total of **48 strategic recommendations** are found in a tabularized format within this Executive Summary. In addition, these recommendations are more thoroughly discussed in their appropriate sections within the document. Because the area of interest extends outside the FVRD boundary onto private land and therefore outside FVRD jurisdiction, the FVRD's role may be limited to the role of an influencer in some instances, while other recommendations can be directly implemented by the FVRD. The recommendations are displayed in totality in Table 1. Ultimately, the recommendations within this strategy should be considered a toolbox of options to help reduce the wildfire threat to the community. There is not one combination or course of action which is the answer; the FVRD will have to further prioritize based on resources, strengths, constraints, and availability of funding and regularly update the prioritization and course of action as variables change through time.

Table 1. Summary of CWPP Recommendations by Document Section.

Document Section 2: Local Area Description (2.5.3: Local Government/First Nations Policies and Recommendations)				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Review and amend the current regulatory framework to incorporate wildfire mitigation and preparedness considerations				
1	12	High	Review and amend the three OCPs that apply to communities in the AOI to include a growth management policy which considers wildfire risk and other natural hazards during development.	~200 consultant hours and 50-100 in-house hours (local government funding) per individual EA OCP. May be eligible for UBCM CRI Program Funding[1]
2	12	Moderate	Review and amend the three OCPs that apply to the communities in the AOI to include wildfire as a natural hazard which has the potential to impact public health and safety, economics (i.e. through evacuations, loss of tourism, interruption of services, etc.), ecosystems, habitat, and water quality, among other values. Identification of natural hazards can allow for planning and policies to be put in place to increase FVRD resilience, mitigate potential damages, and increase public and official awareness of risk.	Can be done in conjunction with Recommendation #1; effort hours included in Recommendation #1. May be eligible for UBCM CRI Program funding
3	12	High	Revise the three OCPs to include an interface wildfire hazard objective which sets specific policies relating to development in the wildland-urban interface (for example, as included in the OCP for Electoral Areas "E" and "H"[2]). Policies could include: avoiding development in areas that are at higher risk to wildfire hazards (as identified in this CWPP), requiring new tenure applications to provide a detailed wildfire hazard report, and encouraging existing homeowners in WUI areas to practice FireSmart techniques, install sprinklers and well pumps, and utilize rain storage tanks, whenever possible for firefighting on-site.	Can be done in conjunction with Recommendation #1; effort hours included in Recommendation #1. May be eligible for UBCM CRI Program funding

[1] Refer to Section 5.1 and the Union of BC Municipality's website (https://www.ubcm.ca/EN/main/funding/lgps/community-resiliency-investment.html) for further information on the Community Resiliency Investment (CRI) Program.

[2] Fraser Valley Regional District. Official Community Plan for Electoral Areas "E" and "H" Bylaw No. 1115, 2011. Retrieved from: https://www.fvrd.ca/assets/Government/Documents/Bylaws/Planning~and~Land~Use/Area%20E%20and%20H%20-%20OCP%20Bylaw%201115%20-%20Columbia%20Valley,%20Lindell%20Beach%20and%20Chilliwack%20River%20Valley.pdf

Document Section 2: Local Area Description (2.5.3: Local Government/First Nations Policies and Recommendations)				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
4	13	Moderate	Work with the Planning and Development Department (i.e., building inspectors) to ensure house numbering is posted prior to occupancy of new development and to provide instructions on how and where best to affix numbering to facilitate emergency response and evacuation efforts. Consider encouraging home owner participation via a FVRD-wide engagement campaign and providing incentives such as the opportunity to acquire/purchase discounted address signs.	~30-45 in-house hours (local government funding). May be eligible for UBCM CRI Program funding
5	14	Moderate	Review and amend Section 5.1.4 of Bylaw 1386 to specify what constitutes an effective means of extinguishing an open fire (i.e., camp fire). BCWS recommends 8 litres of water and a hand tool (shovel, Pulaski). In accordance with BCWS recommendations,[3,4] this section should also require the clearing of a fuel break around a fire wide enough to stop the spread of the fire and the siting of the fire in a fire pit or rock ring that is at least 3 m from trees, shrubs, structures, and debris.	~30 in-house hours (local government funding). May be eligible for UBCM CRI Program Funding
6	14	Moderate	Complete updates to the FVRD Regional Parks Strategic Plan (2025-2035) to include wildfire threat as a parks acquisition criterion. Access and potential costs of park and trail maintenance to mitigate wildfire risk should be weighed against other acquisition criteria. Amend Bylaw 1190 Campgrounds and Holiday Parks to include the following provisions: 1) require the use of a QP in review, assessment, and siting of parks and park access prior to acceptance; and 2) ensure that OCPs provide the FVRD authority to request modification (either fuels, access, or siting) based upon QP recommendation and prior to acceptance to ensure that the park is received in, and able to be maintained in, an acceptable range of risk.	~30-60 in-house hours (local government funding or UBCM/CRI program funding)

[3] Province of BC. 2019. Fire Bans and Restrictions. https://www2.gov.bc.ca/gov/content/safety/wildfire-status/fire-bans-and-restrictions

[4] Province of BC. 2019. British Columbia Campfire Regulations [poster]. https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/wildfire-status/fire-bans-and-restrictions/bcws_campfireposter.pdf

Document Section 2: Local Area Description (2.5.3: Local Government/First Nations Policies and Recommendations)				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
7	14	Moderate	Develop a trails master plans in collaboration with member municipalities to complement the FVRD Regional Parks Strategic Plan and include considerations for the placement, type, width, and objective of trails. Consideration should also be given to trail building and maintenance as these activities can either increase wildfire risk (through fuels accumulations and unsafe work practices) or decrease wildfire risk (though proper placement, clean-up of combustible fuels trailside and work practices which adhere to *Wildfire Act* and *Regulation*).	~50-80 in-house hours (local government funding)
Document Section 3: Values at Risk Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Protect critical infrastructure and mitigate post-wildfire impacts				
8	20	High	The use of fire-resistant construction materials, building design and landscaping should be considered for all critical infrastructure (CI) when completing upgrades or establishing new infrastructure. Additionally, vegetation setbacks around critical infrastructure should be compliant with FireSmart guidelines.	Negligible in-house cost
9	20	High	Complete formal FireSmart assessments (by a qualified professional) for CI such as the fire halls, emergency operations centres, water infrastructure, and others as identified in this CWPP (Table 3) and by the FVRD.	~$1,500-2,000 per location (consultant cost, local government funding or UBCM/CRI program funding)
10	24	Moderate	The FVRD should consider the option of conducting future assessments to explore the potential hydrologic and geomorphic impacts of wildfire on the watersheds and communities. Alternatively, there may be an option to complete a stand-alone assessment to help identify and quantify the post-fire hazards and levels of risk to communities.	To be determined, cost depends on the scope of the assessment (~$10,000-$40,000)

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Undertake fuel treatments to improve emergency access				
11	48	Moderate	The FVRD should work with the Ministry of Transportation and Infrastructure (MOTI), to assess high hazard fuel types (C-3 and M-1/2) along Hwy 1 and reduce hazardous fuels within 100 m of either side of the road, where possible, with consideration of private land and topographic constraints. This is to increase public safety by improving emergency access in the event of an evacuation or wildfire event.	Appropriate funding stream to be identified. ~10-person hours, however, dependent upon FVRD's role within the project
Objective: Reduce wildfire threat through fuel management				
12	49	Moderate	Proceed with detailed assessment, prescription development and treatment of the unit identified in this CWPP.	UBCM CRI Program funding/local government funding
13	49	Moderate	Develop a rationale for alternative stocking standards applicable to the FVRD, by employing a qualified wildfire management professional, and in consultation with the Wildfire Prevention Officer (Coastal Fire Centre) and MFLNRORD. Engage partners such as woodlot and/or other licensees to apply the MFLNRORD approved reduced fire management stocking standards in the FVRD Zone A wildland urban interface to reduce interface wildfire threat. These standards should take into consideration other values in the interface, such as provision of water, wildlife habitat, etc.	~$3,000, local government funding
14	52	Moderate	If and when operational fuel treatments are conducted within the AOI, treatment monitoring should be completed by a qualified professional in order to schedule the next set of maintenance activities (5 – 10 years out). This can be completed with a CWPP update or as a stand-alone exercise.	UBCM CRI Program funding/local government funding

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Reduce wildfire hazard on private land				
15	58	Moderate	Develop a landscaping standard which lists flammable non-compliant vegetation and landscaping materials, non-flammable drought and pest resistant alternatives, and tips on landscape design to reduce maintenance, watering requirements, avoid wildlife attractants, and reduce wildfire hazard.	$2,000 - $3,000 to outsource. Alternatively, general FireSmart landscaping information is available free of charge, but is not climate/ plant hardiness zone specific
16	58	Moderate	Consider engaging the development/building community (may include developers, builders, landscapers, and architects) in FireSmart planning. This can be accomplished through a series of workshops/informational sessions to: 1) increase awareness of wildfire risk, 2) demonstrate that there are a variety of actions which can be undertaken to immediately and measurable reduce the risk to the homeowner and community, and 3) discuss various strategies and actions which could be implemented to meet wildfire mitigation objectives.	~40 hours, UBCM CRI Program funding/local government funding
17	60	Moderate	Following FireSmart assessments of critical infrastructure, the FVRD should apply for FireSmart demonstration grants through the Community Resiliency Investment (CRI) Program. This type of project can display the practices and principles of FireSmart activities to the public in the form of demonstration treatments.	20-40 in-house administrative hours. Cost varies depending on number of projects and extent of upgrades. Eligible for UBCM CRI Program funding.
18	60	High	Develop and implement a community chipper program with the help of neighbourhood representatives or community groups. As a demonstration, this program can begin twice per year in two separate neighbourhoods. This program can also be implemented in conjunction with community clean-up days.	Time dependent upon program. Eligible for UBCM CRI Program funding. Additional time for advertisement of program availability will be required.

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
19	60	High	Apply for funding from the UBCM CRI Program to develop a local FireSmart rebate program. This will allow homeowners to access partial rebates for FireSmart activities on their properties if rated as moderate, high or extreme risk in a FireSmart home and property assessment. The rebate program must adhere to the goals of FireSmart, as outlined in Section 5.2.1.	40-80 in-house administrative hours. Eligible for UBCM CRI Program funding.
20	61	High	The FVRD should hire a qualified professional (QP) or consider training local fire services staff members as Local FireSmart Representatives to assist the various communities in complying with FireSmart principles at the neighbourhood and individual home-level.	~25 in-house hours (Consultant and/or Fire Department, FVRD Emergency Management staff)
Objective: Increase public wildfire awareness				
21	63	High	This report and associated maps to be made publicly available through webpage, social media, and public FireSmart meetings. In addition, this CWPP should be shared with local industry partners; in particular industrial forest companies who may be interested in collaborating on direct fuel management treatments or with other sections of this CWPP document.	3-6 in-house hours depending on method of distribution
22	63	Moderate	Complete or schedule periodic updates of the CWPP to gauge progress and update the threat assessment (hazard mapping) for changes in fuels, forest health, land planning, stand structure or changes to infrastructure in the interface. The frequency of updates is highly dependent upon major changes which would impact the FVRD's wildfire threat assessment or the rate at which wildfire risk reduction efforts are implemented. An evaluation of major changes (including funding program changes that may lead to new opportunities) and the potential need for a CWPP update should be initiated every 5 - 7 years.	UBCM/CRI Program funding/local government funding

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
23	64	Moderate	Develop a social media strategy and ensure that its full power is leveraged to communicate fire bans, high or extreme Fire Danger days, wildfire prevention initiatives and programs, easily implementable FireSmart activities, updates on current fires and associated air quality, road closures, and other real-time information in an accurate and timely manner.	~40 hours to create strategy. ~20 hours to identify partners, initiate relationship and gain strategy support. Additional daily/weekly hours to implement and update depending on strategy
24	64	High	Promote FireSmart approaches for wildfire risk reduction to FVRD residents through Town Hall meetings, workshops and/or presentations. Aim to conduct the engagement/promotion campaign prior and during the fire season. Consider supplying FireSmart materials to homeowners in the interface during these engagement campaigns.	~10 hours, may be eligible for UBCM CRI Program funding
25	64	High	Promote improved planning and preparedness of agriculture producers in the FVRD and encourage FireSmart practices on private farm land through distribution or sharing of wildfire action planning resources prepared specifically for the agriculture sector by the BC Agriculture & Food Climate Action Initiative (i.e., on FVRD website, mailouts).	~30-40 in-house hours
26	64	Moderate	Work towards FireSmart community recognition, at the neighbourhood level and facilitate uptake into the FireSmart Canada Community Recognition Program (FSCCRP). This will help reduce fire risk and aid in further funding applications.	FireSmart grant (when funding is available)
27	64	Moderate	Facilitate the FSCCRP uptake within the FVRD Zone A and enhance its applications by including the following: 1) inviting BCWS crews to participate in and support the annual FireSmart events set up by participating neighbourhoods. 2) Encourage individual homeowner participants to complete the self-administered FireSmart home assessment tool. 3) Include within the FireSmart Canada Community Assessment Report the standard recommendation that participating neighbourhoods hold a home hazard assessment workshop as one of their FireSmart events.	$5,000/neighbourhood and an additional 40 hours/initiative UBCM/CRI Program grant(s) available

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
28	64	Moderate	Promote the use of the FireSmart Home Partners Program offered by the Partners in Protection Association, which facilitates voluntary FireSmart assessments on private property. Use the opportunity to educate the home or business owner about the hazards which exist on their property and provide easy improvements to reduce their risk.	~1.5 hours/assessment
29	64	Moderate	Encourage schools to adopt and deploy existing school education programs to engage youth in wildfire management and risk reduction. There is emergency preparedness curriculum available provincially, including Master of Disaster and the FireSmart BC Education Package for kindergarten to grade 12 students.	~30-40 in-house hours
30	65	High	Develop and work with all key stakeholders (industrial operators, local First Nations, MFLNRORD, BCWS, recreational groups/representatives, FVRD staff) to formalize an Interface Steering Committee. The purpose of the steering committee would be to identify wildfire related issues in the area and to develop collaborative solutions to minimize wildfire risks.	~40 hours to initiate group; an additional ~50 hours/year to plan, advertise/ communicate, attend, and debrief meetings; additional hours required depending on implementable actions and potential sub-committees developed
31	65	Moderate	Work towards educating homeowners within areas outside of primary fire service areas located around town centres. It is common, especially in the case of second homeowners/vacation owners, for them to be unaware of the lack of fire services or response capabilities in their area (in the event they call 911).	~10-20 hours to prepare materials and disseminate information to landowners
32	65	High	Promote and provide information to private landowners related to external residential sprinklers as a FireSmart prevention measure.	~10-20 hours to prepare materials and disseminate information to landowners

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Promote fuel management and joint initiatives				
33	66	Moderate	Work with industrial operators such as BC Hydro, Canadian National Railway and Canadian Pacific Railway to advocate that high-risk activities, such as grubbing/brushing, right-of-way mowing work, and rail grinding do not occur during high fire danger times to reduce chance of ignitions as per the *Wildfire Act* and *Regulation*.	~4-6 in-house hours
34	66	Moderate	Work with industrial operators (i.e., BC Hydro and railways) to advocate that rights-of-way do not contain fine fuel accumulations (easily cured) or high conifer regeneration prior to and during the fire season and are maintained in a low hazard state (to serve as fuel breaks).	~4-6 in-house hours
Document Section 6: Wildfire Response Resources Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Improve water availability for emergency response				
35	70	High	All new rural development outside existing FVRD water systems should have a water system which meets or exceeds minimum standards of NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*[5]. FVRD fire services and/or Engineering and Community Services should review the water supply to ensure it provides sufficient placement, flow, and reliability for suppression needs and that secondary power is available in the event of power outages.	~5-10 hours per development
36	71	Moderate	Complete a fire flow/water vulnerability assessment to identify where upgrades to systems, flows, hydrant number or location, and water storage, or secondary power is required. Prioritize and rank projects and complete or require upgrades as resources allow.	~$10,000
Objective: Improve access/egress to enhance emergency preparedness				
37	71	High	Complete and participate in regular testing of, and updates to, the evacuation plan for the FVRD.	~30-40 hours to plan and stage; 8 hours to complete testing

[5]National Fire Protection Association (NFPA).2017. Standard on Water Supplies for Suburban and Rural Fire Fighting. Retrieved online at: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1142

Document Section 6: Wildfire Response Resources Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
38	72	Moderate	Conduct a review of the Fire Service Area (FSA) boundaries, fire department capabilities, and demand for services to determine if FSA boundaries should be updated or if additional resources or training is required to meet the demand in each FSA.	~30-40 in-house hours
39	72	High	Complete and participate in regular testing of, and updates to, an evacuation plan for the Sunshine Valley. Collaboration or consultation with the FVRD is recommended in the event that an emergency requires a joint response.	~10-30 hours to plan and stage; 8 hours to complete testing
40	73	Moderate	Include a qualified professional with experience in operational wildland/interface fire suppression in the planning and strategic siting of future trails and parks.	10-20 hours to review current trails/map and provide recommendations
41	73	High	Develop a Total Access Plan for the FVRD to create, map and inventory trail and road network in natural areas for suppression planning, identification of areas with insufficient access and to aid in strategic planning. Georeferenced maps with ground-truthed locations of potential optimal firebreaks should be developed as part of the Total Access Plan and shared with fire suppression personnel and BCWS to support emergency response in the event of a wildfire.	~8,000-$10,000 to build plan, map, populate attributes and update (contractor estimate)
Objective: Increase and continually develop FVRD volunteer fire department staff training				
42	74	High	FVRD Zone A fire departments should continue working with BCWS to initiate and/or maintain an annual structural and interface training program. As part of the training, it is recommended to conduct annual reviews to ensure PPE and wildland equipment resources are complete, in working order, and the crews are well-versed in their set-up and use. It is recommended the FVRD and adjacent municipal fire departments engage in yearly practical wildland fire training with BCWS that covers at a minimum: pump, hose, hydrant, air tanker awareness, and deployment of SPUs. Interface training should include completion of a joint wildfire simulation exercise and safety training specific to wildland fire and risks inherent with natural areas.	Cost and time dependent upon training exercise (scope, number of participating members etc.)
43	74	Moderate	FVRD Zone A fire departments should engage in regular communication with the BCWS Fraser Fire Zone - Cultus/Haig Fire Base to foster a strong relationship and identify potential cooperative wildfire risk reduction opportunities.	~4 hours/ year

Document Section 6: Wildfire Response Resources Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
44	74	High	Ensure that the FVRD Zone A fire departments maintain the capability to effectively suppress wildland fires by training members in SPP-WFF1 (or S-100 and S-185 combined), at a minimum. Consider expanding the training programs to maintain high level of member education and training specific to interface and wildland fires. SPP-115 (formerly S-115) trains structural firefighters on the use of wildfire pumps and hose, and fire service hose and hydrants in the application of structural protection units (SPUs).	Current FVRD training budget and UBCM CRI Program funding
Objective: Structure protection				
45	76	Moderate	Work with local distributors and homeowners within FVRD Zone A and its communities with the objective to improve education of homeowners and remove some barriers to FireSmart action. For additional detail see Section 6.2.	~60 hours
46	76	Moderate	Develop programs which serve to remove barriers to action for homeowners by providing methods for them to cheaply and easily dispose of wood waste removed from their property. Programs may include scheduled community chipping opportunities, yard waste dumpsters available by month in neighbourhoods, waiving of tipping fees, or scheduled burning weekends. Programs should be available during times of greatest resident activity (likely spring and fall).	Time dependent upon program scope. May be eligible for UBCM/CRI Program funding. Additional time for advertisement of program availability will be required.
47	76	High	Complete a vulnerability assessment of all critical infrastructure, secondary power sources, and fuel availability. Review current capability of secondary power sources, identify vulnerabilities, and prioritize needs, in the case of prolonged or extensive power outages. Upgrade or realign resources, as prioritized.	~$1,500-$5,000 per location (consultant cost) or ~80 in-house hours or CRI program funding
48	76	Moderate	Consider acquiring a Type 2 SPU trailer to improve wildfire response (provides protection for 25-30 residences) in Zone A. The SPU could be moved between fire departments within the AOI depending on training and demand for use.	$100,000-$150,000 depending on configuration.

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COMMONLY USED ACRONYMS

BCWS	British Columbia Wildfire Service
BEC	Biogeoclimatic Ecosystem Classification
CDC	Conservation Data Centre
CFFDRS	Canadian Forest Fire Danger Rating System
CRI	Community Resiliency Investment Program
CWPP	Community Wildfire Protection Plan
DP	Development Permit
EA	Electoral Area
FBP	Fire Behaviour Prediction System
FMP	Fire Management Plan
FSCCRP	FireSmart Canada Community Recognition Program
FVRD	Fraser Valley Regional District
GAR	Government Actions Regulation
HIZ	Home Ignition Zone
LRMP	Land and Resource Management Plan
MFLNRORD	Ministry of Forests, Lands, Natural Resource Operations, and Rural Development
MOTI	Ministry of Transportation and Infrastructure
NFPA	National Fire Protection Agency
OFC	Office of the Fire Commissioner
PSTA	Provincial Strategic Threat Analysis
PTU	Proposed Treatment Unit
SAR	Search and Rescue
TSA	Timber Supply Area
UBCM	Union of British Columbian Municipalities
VFD	Volunteer Fire Department
WRR	Wildfire Risk Reduction Program
WUI	Wildland Urban Interface

SECTION 1: INTRODUCTION

In 2019, B.A. Blackwell and Associates Ltd. was retained to assist the Fraser Valley Regional District (FVRD) in developing a Community Wildfire Protection Plan (CWPP) for Zones A, B, and C. FVRD staff have recognized that wildfire mitigation and planning is an important component of emergency planning and preparedness for the community. This CWPP document will focus on integrating the updated Provincial Strategic Threat Analysis (PSTA), updated BC Wildfire Service (BCWS) Fuel Type mapping, and the updated and improved wildfire threat analysis methodology into the document for FVRD Zone A (see Section 2.1 for a description of the area of interest).

Although forest fires are both inevitable and essential to the health of forested ecosystems, the 2003, 2004, 2009, 2010, 2015, 2017 and 2018 wildfire seasons resulted in significant economic, social and environmental losses in BC. The 2018 fire season was the most extensive in terms of area burned, surpassing the 2017 fire season. The total suppression costs for the 2018 season were calculated at $615 million and the 2017 fire season costs were estimated at over $568 million[6]. Recent wildfire disasters like those experienced in Slave Lake, Alberta (2011), Washington State (2014 and 2015), Fort McMurray, Alberta (2016) and BC and California (2017 and 2018) all display the vulnerability of communities and the potential toll of wildfires on families, neighbourhoods and the economy of entire regions. These events, along with critical lessons learned and important advances in knowledge and loss prevention programs, have spurred the need for greater consideration and due diligence with respect to fire risk in the wildland urban interface[7] (WUI).

1.1 PURPOSE

The purpose of this CWPP is to identify the wildfire risks within and surrounding Zone A of the FVRD, to describe the potential consequences if a wildfire was to impact one or more of its communities, and to examine options and strategies to reduce the wildfire risks. This CWPP provides an assessment of the level of risk with respect to changes in the area that have occurred recently and gives the FVRD a current and accurate understanding of the threats to human life, property, and critical infrastructure faced by its communities from wildfires. The goal of this CWPP, in addition to defining these threats, is to identify the necessary measures to mitigate these threats, and outline a plan of action for implementing these measures. Specifically, this CWPP is intended to serve as a framework to inform the implementation of specific actions and strategies that will serve to: 1) reduce the likelihood of wildfire entering or leaving the community, 2) reduce the impacts and losses to property and critical infrastructure if wildfire were to enter, and 3) reduce the negative economic and social impacts of wildfire to the community.

[6] https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-history/wildfire-season-summary

[7] Wildland/urban interface is defined as the presence of structures in locations in which conditions result in the potential for their ignition from flames and firebrands/embers of a wildland fire (National Fire Protection Association). See Appendix E for a more detailed discussion.

1.2 CWPP PLANNING PROCESS

This CWPP is a review and synthesis of the background information and current data related to the Area of Interest (AOI) which represents a two-kilometer spotting buffer around values at risk (structures) within Zone A of the FVRD. The CWPP process consists of four general phases:

1) **Consultation involving key local government representatives, structural and wildfire specialists, and stakeholders**. Information sharing with First Nations at various stages of the CWPP development and review and integration of relevant existing land use plans, legislation, and policy currently in place.
2) **Identification of the values at risk and assessment of the local wildfire threat**. Wildfire threat assessment takes into consideration Natural Fire Regime and Ecology, Provincial Strategic Threat Analysis (2019), and field work, fuel type verification, completion of WUI Threat Forms, and GIS wildfire threat analyses.
3) **Developing a risk mitigation strategy**. A guide for the FVRD to implement mitigation and risk reduction activities. The risk mitigation strategy accounts for prioritization of fuel treatments, FireSmart Activities, and wildfire response recommendations that will reduce wildfire risk locally.
4) **Building a community engagement and education strategy**. Presentation of the CWPP to the Board or Council, the formation of a Wildfire Working Group as well as comprehensive outside consultation with First Nations, government and non-governmental agencies (See Section 1.2.1 for specifics).

1.2.1 Consultation

Engagement with local government, Provincial government landowner representatives, stakeholders and First Nations played a key role in developing this CWPP.

The first step in the consultation process was to assemble the key players in the 'Wildfire Working Group'. This group was composed of key internal FVRD staff, which included: Manager of Electoral Area Emergency Services, Deputy Director of Planning and Development, Director of Engineering and Community Services, Planner, Manager of Park Operations, and GIS Technician. The Fire Chief of the Sunshine Valley Volunteer Fire Department was also included. At the initial meeting of the Wildfire Working Group, the objective was to obtain information on wildfire risk mitigation initiatives currently in place or completed, existing plans and policies, current resources, identify areas of concern and vulnerabilities, and to determine priorities and potential mitigation strategies. Members of the Wildfire Working Group were consulted on an ongoing basis throughout plan development and were essential in providing CWPP review and approval.

BCWS representatives were consulted as follows: 1) at the onset of the project planning phase and 2) throughout the CWPP development process, both via the submission of Fuel Type Change Rationales and questionnaire regarding concerns and priorities of BCWS with respect to wildfire and emergency planning in the FVRD; and 3) revision of draft document upon plan completion.

Information sharing took place with 50 First Nations (including tribal associations and representative groups) with overlapping rights and title, as identified through the Consultative Areas Database and in consultation with MFLNRORD and the FVRD. Consultation efforts involved the review of the draft CWPP document and focused on identifying areas where potential cultural values at risk may require protection and consideration. Information sharing consisted of an initial phone call, and subsequent distribution of a referral letter and information sharing package (maps, explanation of CWPP, and CWPP draft).

Additional stakeholders were consulted to identify synergies, opportunities for collaboration, and ensure linkages with adjacent and overlapping planning. These stakeholders included the MFLNRORD South Coast – Chilliwack Natural Resource District's Stewardship Officer and Senior Authorizations Specialist; MFLNRORD Regional Integrated Investment Specialist, and BC Parks staff. Combined, these various consultation and engagement opportunities have generated a shared understanding of the CWPP objectives and expected outcomes among local government, stakeholders, and land managers.

1.2.2 Identification of Values at Risk and Local Wildfire Threat Assessment

The risks associated with wildfire must be clearly identified and understood before a CWPP can define strategies or actions to mitigate risks. The identified values at risk are described in Section 3 and concepts of wildfire threat and risk are elaborated on in SECTION 4:SECTION 4:. The wildfire threat in Zone A of the FVRD was assessed through a combination of the following approaches:

- Natural fire regime and ecology (Section 4.1);
- Provincial Strategic Threat Analysis (section 4.2); and
- Local wildfire threat analysis (Section 4.3).

1.2.3 Development of a Risk Management Strategy

An effective risk management strategy was developed considering a full range of activities relating to the following:

- Fuel management;
- FireSmart planning and activities;
- Community communication and education;
- Other prevention measures;
- Structure protection and planning (i.e., FireSmart activities);
- Emergency response and preparedness;
- Evacuation and access; and
- Planning and development.

1.2.4 Building Community Engagement and Education Strategy

Engaging the community from local government staff and officials, to key stakeholders and residents in wildfire protection planning activities is key to ensuring successful implementation. A community engagement and education strategy is described in Section 5.3.

A presentation to FVRD Board will aim to ensure high level approval and support for this CWPP.

SECTION 2: LOCAL AREA DESCRIPTION

This section defines the area of interest (AOI) and describes the communities within the AOI. It also summarizes the current community engagement in wildfire prevention and mitigation and identifies linkages to other plans and policies of relevance to wildfire planning.

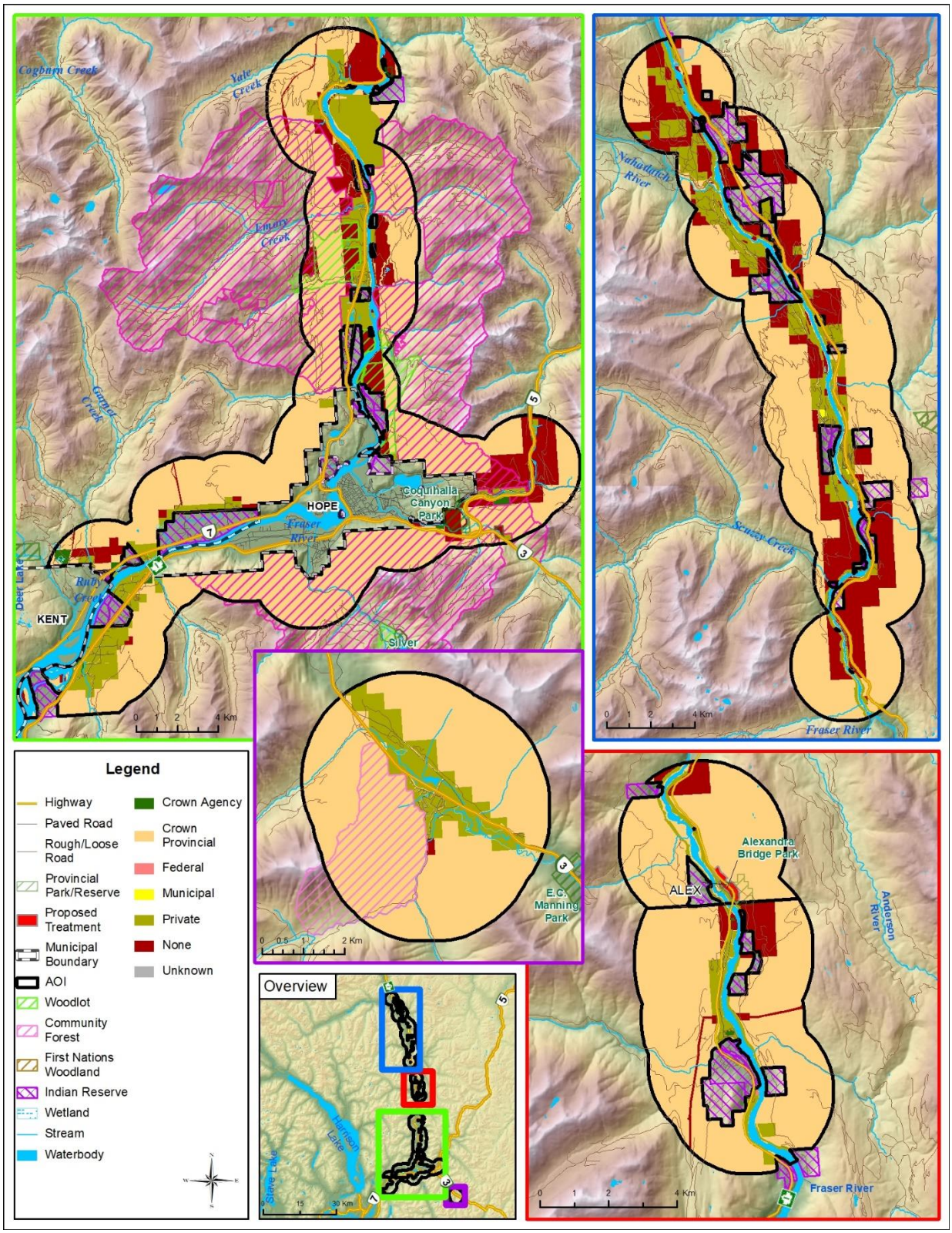
2.1 AREA OF INTEREST

The Fraser Valley Regional District is located in the South Coast region of BC, approximately 100 kilometers (km) east of Vancouver. The AOI represents a two-kilometer (km) spotting buffer around values at risk (structures) within Electoral Areas A and B of the FVRD (as illustrated below in Map 1). There are multiple small, unincorporated communities located within the AOI including Boston Bar, Spuzzum, Yale, and Haig. The AOI does not include any municipalities or First Nations communities. The AOI is characterized by a mix of residential, commercial, rural, and industrial properties. In its entirety, the FVRD has a population of 295,934 within eight Electoral Areas and six municipalities.[28] Electoral Areas (A and B) that overlap the AOI have a combined population of 1,320 residents and the population of the FVRD Zone A AOI is a subset of this total population. The AOI is composed of four polygons and spans approximately 45,589 ha. A breakdown of the AOI's land ownership by area is provided in Table 2.

Table 2. Summary of AOI by land ownership.

Land Ownership*	Hectares
Private	5,461
Municipal	15
Provincial Crown	39,945
Crown Agency	132
Federal Crown	7
Unknown	29
Total	**45,589**

[8] Fraser Valley Regional District. 2017. Retrieved from: https://www.fvrd.ca/assets/About~the~FVRD/Documents/2017%20Annual%20Report.pdf



Map 1. Area of Interest (AOI).

2.2 COMMUNITY DESCRIPTION

The Fraser Valley region has been inhabited by the Stl'atl'imc, Nlakapamux and the Coast Salish Aboriginal Peoples since time immemorial. The Boston Bar, the Shxw'ow'hamel, Skawahlook and Yale First Nations are among the many Stl'atl'imc, Nlakapamux and the Coast Salish First Nations that historically occupied the land, some of whom continue to live within the AOI today. European, American, and Chinese settlers arrived in the area in significant numbers in 1858 with the Fraser River gold rush.[9] After this point, Boston Bar became an important stopping location for miners destined for Barkerville during the Cariboo gold rush.[10] At present, FVRD Zone A is comprised of multiple distinct communities (as listed in Section 2.1 above). Several First Nations reserves are surrounded by or adjacent to the AOI.

Services to residents of the FVRD member jurisdictions are provided both at the regional and the electoral level. The regional government provides emergency planning, economic development and regional parks planning. At the electoral area level, services provided include land use planning, fire protection services, water/waste water services, flood control, waste management, community parks, street lighting, and bylaw development and enforcement.

The AOI is topographically diverse, with low lying agriculturally productive lands, large lakes and rivers, floodplains, and mountainous terrain. Due to this variable topography, the elevation varies significantly within the AOI, from sea level to roughly 1000 m. The Fraser River is the largest freshwater body; however, the AOI also includes a few small lakes including Kawkawa Lake and Lake of the Woods near Hope, and Cedar Lake near the Sunshine Valley. There are several other rivers, and dozens of creeks and streams present in the AOI.

The economy of Zone A was historically driven by railway building and the forest industry, as well as mining, agriculture, and fishing. Although these industries continue to remain important to the communities within the AOI, the economic focus has shifted in recent decades to also include tourism.[11,12]

Fire protection within the AOI is the responsibility of three volunteer fire departments (VFD): Boston Bar/North Bend, Yale, and Sunshine Valley. Mutual aid agreements exist between Boston Bar/North Bend and Yale departments. Additionally, a mutual aid agreement exists between the Yale VFD and the Hope Fire Department (outside the AOI), and between the Popkum VFD (outside the AOI) and the Boston Bar VFD. Each department has a particular Fire Service Area (FSA) that include the First Nations communities within the FSA. The Sunshine Valley Volunteer Fire Department has one fire hall, and is not under the jurisdiction of the FVRD. BCWS is responsible for responding to fires that are beyond the

[9] Fraser Valley Regional District. Official Community Plan for Boston Bar, North Bend, and Canyon Alpine. 1994.

[10] Ibid.

[11] Fraser Valley Regional District. Official Community Plan for Portions of Electoral Area "B": Yale, Emory Creek, Dogwood Valley, and Choate. 1998.

[12] Fraser Valley Regional District. Official Community Plan for Boston Bar, North Bend, and Canyon Alpine. 1994.

boundaries of the department Fire Service Areas and is requested to respond to fires within FSAs if they are beyond of the capabilities of the local VFDs.

In the event of a wildfire, Zone A has limited emergency access and egress routes. The Trans-Canada Highway (Highway 1), which runs north and south through the AOI, is one of four reliable, paved access routes. Other paved highways include the Coquihalla Highway (Highway 5), the Crowsnest Highway (Highway 3), and the Lougheed Highway (Highway 7). Many developments within Zone A of the FVRD are located on single access roads which branch off of the aforementioned highways. This not only presents a challenge for emergency access and egress, but also limits the ability of fire crews to respond to fires and safely evacuate residents.

2.3 PAST WILDFIRES, EVACUATIONS AND IMPACTS

BCWS staff communicated that the majority of past wildfire activity within the AOI was human-caused and ignitions are primarily due to abandoned campfires, poor recreation practices, and suspicious or undetermined causes. Lightning was only cited as a concern in the Nahatlatch and Sunshine Valleys. BCWS staff reported that slash accumulations following industrial logging can be an issue, particularly next to forest service roads.

Based on the BCWS historical wildfire dataset, the two largest fires to burn within and adjacent to the FVRD Zone A AOI occurred in 1933 and 1936, with an area burned of over 2,900 ha and 1,190 ha, respectively. Although smaller in scale, there have been several wildfires within and adjacent to the AOI in recent years. In 2018, a fire was ignited from a discarded cigarette on Highway 7 and spread over an estimated 427 ha on Mt. Hicks in the District of Kent. This fire overlaps a small portion of the Zone A AOI and the stand types are representative of those surrounding Haig and Yale. Also in 2018, an interface fire started along Highway 3 near the Hope Slide and community of Sunshine Valley, which resulted in a temporary closure of the highway, and a lightning-caused fire near Hope caused the closure of Skagit Valley Provincial Park. In August of 2016, an interface wildfire ignited on the east side of the Fraser River, which resulted in property damage near Boston Bar.

Access and evacuation vulnerabilities are present in many locations throughout the AOI. Several communities in the northern portion of the AOI have few residential roads and only one primary evacuation route, Highway 1. Most neighbourhoods in the Sunshine Valley are located on single access roads which branch off of Highway 3. In the event of an emergency which requires evacuation or a wildfire that restricts access on these routes, these communities are vulnerable to delays in evacuation as well as reduced access for suppression crews.

The BC Wildfire Service historical ignition dataset demonstrates that the proportion of human-caused fires within the FVRD Zone A AOI is substantially greater than that of the province as a whole.[13] This ignition data shows that within the FVRD Zone A AOI, approximately 82% of ignitions since 1919 have been human-caused (a conservative estimate not including miscellaneous/undetermined causes),

[13] BC Wildfire Service: Fire Incident Locations - Historical

versus 40% in the province of BC.[14] This statistic may be explained by the prevalence of recreational use, specifically camping, and the prevalence of forestry activities, railways, and other industrial activities within the AOI.

2.4 CURRENT COMMUNITY ENGAGEMENT

There is fairly widespread recognition and awareness, from both FVRD staff and the communities of Zone A, of the threat posed to the community by wildfire; however, there has been somewhat limited community engagement in FireSmart initiatives to this point and no fuel treatments have been planned or carried out within in the AOI. The Wildfire Working Group reported that FireSmart initiatives have been carried out with community interest and uptake in the Sunshine Valley, however no other such initiatives have taken place. Within the AOI there is at least one FVRD staff member who is trained as a FireSmart representative and can provide FireSmart presentations to community members upon request. The FVRD website incorporates links to the Emergency Management BC and BC Wildfire Service websites which in turn provide access to relevant information regarding wildfires, fire bans and wildfire prevention. The FVRD has prepared a "Fraser Valley Regional District Emergency Preparedness Guide"[15] and workbook for residents including guidance on how to prepare in advance of a wildfire. No bylaw amendment or reviews have been undertaken to address issues relating to public safety, such as road and pathway design for access and egress and the integration of FireSmart principles into bylaws. The FVRD does not have an established wildfire hazard development permit area in Electoral Areas A and B to address new development in the wildland-urban interface.

Fire department-initiated education regarding wildfire threat and prevention varies by department and none of the volunteer fire departments have their own website. The Yale VFD has a Facebook page that was not active at the time of writing. Future community engagement initiatives should focus efforts during times of high public uptake (typically during and following an active fire season) in order to maximize the resources available for community engagement. Recommendations for further education and communication initiatives that may be undertaken by the FVRD and its VFDs are provided in Section 5.3.

[14] BCWS, 2018

[15] https://www.fvrd.ca/assets/Services/Documents/Emergency~Services/Emergency%20Preparedness%20Workbook.pdf

2.5 LINKAGES TO OTHER PLANS AND POLICIES

The following is a summary of FVRD and provincial policies and guidelines that relate to strategic wildfire management, wildfire threat reduction, operational fuel treatments and emergency planning.

2.5.1 Local Authority Emergency Plan

Emergency preparedness and response is managed by the FVRD, which has created a comprehensive Emergency Management Response and Recovery Plan[16] to serve the regional district. This emergency management plan was developed to optimize the response, resources and planning for major emergencies that may occur within the FVRD. The plan outlines the overall emergency management structure; Emergency Operations Centre (EOC) organization, functions and activation; guidelines for emergency response (internal and external communications, personnel identification, documentation, etc.); and hazard-specific roles and procedures (response objectives) for priority risk hazards. The response objectives (guidance) for wildland-urban interface fires include the roles and responsibilities of the FVRD EOC, as well as the respective roles and jurisdiction of the BC Wildfire Service and the Chief of the responding fire department. Emergency response is coordinated using the BC Emergency Management System (BCEMS) Site and Site Support Standard, with designated EOC locations and Incident Command (IC) for site level response. A Provincial Emergency Operations Centre (PREOC) and a Provincial Emergency Coordination Centre (PECC) may also be established if the emergency is large in scale. The FVRD emergency management plan also establishes priorities for training and periodic reviews and revisions of the plan.

The FVRD's Emergency Management Response and Recovery Plan is complemented by an all-hazard Evacuation Planning & Implementation Guide[17] intended to be used as a tool for emergency personnel and managers to support planning and implementation of an evacuation (an evacuation planning template is in development). The FVRD is in the process of developing, in a staged process, a comprehensive emergency management plan that would eventually repeal and replace all previous emergency management documents.

2.5.2 Affiliated CWPPs

CWPPs have been developed for the District of Kent (2017), Chawathil First Nation (2013), Shxw'owhamel First Nation (2012), Skawahlook First Nation (2014), Spuzzum First Nation (2015), and Yale First Nation (2014). These documents, when available, were reviewed for relevance (i.e., synergistic project opportunities, as well as to confirm that there are no contradicting recommendations). Furthermore, CWPPs for FVRD Zone B and Zone C were developed concurrently with this CWPP by the same consultant, ensuring consistency in recommendations.

[16] FVRD. 2013. Emergency Management Response and Recovery Plan – A Strategic Guide for Support to Major Emergencies and Disasters. Last reviewed May 2019.
[17] FVRD. 2011. Fraser Valley Regional District Evacuation Planning & Implementation Guide.

2.5.3 Local Government/First Nation Policies and Recommendations

The intent of this section is to review all relevant local government plans, policies and bylaws and identify sections within that are relevant to the CWPP. The following municipal bylaws, strategies and policies are relevant to wildfire planning in the FVRD.

Electoral Areas A and B Official Community Plans

The three Official Community Plans (OCPs) for Electoral Areas A and B provide guidance for general policies, land-use area designations, development permit areas, environmental protection, infrastructure and services in these FVRD Electoral Areas. The OCP for Electoral Area A, Bylaw No. 804, 1994[18], includes the communities of Boston Bar, North Bend, and Canyon Alpine. The two OCPs for Electoral Area B are Bylaw No. 150, 1998[19], for the communities of Yale, Emory Creek, Dogwood Valley, and Choate and Bylaw No. 800, 1986[20] for unincorporated areas near Hope, including Laidlaw, Flood, Silver Creek, Kawkawa Lake, Othello, Landstrom Road, Ross Road, and Lake of the Woods. The following sections of the three OCPs contain objectives and policies which are directly relevant to wildfire risk reduction, emergency response, and community resilience post-disaster in the AOI.

1994 Electoral Area "A" OCP, Subsection 7.1: Water Supply

This subsection of the OCP describes the deficient water systems within the plan area, and the possible improvements that may be implemented to mitigate concerns. The objectives of this section are to define and implement a community water system that unifies the surrounding communities and develops an adequate community water supply.

1994 Electoral Area "A" OCP, Subsection 7.3: Fire Protection

This subsection of the OCP describes the policies which support continued improvements to fire protection plans and services. The regional board policy defines such fire protection measures as: the use of a volunteer fire department, support of ongoing water systems improvements, multilateral fire protection service agreements, upholding specific fire hall tenures, and hazardous goods and emergency plan for all railway companies.

1994 Electoral Area "A" OCP, Subsection 10.1: Natural Hazards

This subsection of the OCP describes the natural hazards that occur within the area, including slope instability, erosion, rockfall, flooding, debris flows, and other geotechnical problems. It outlines the Regional Board's policy in relation to development of lands that may be subject to these hazards and defines building restrictions in areas that are or may be deemed potentially hazardous.

[18] Official Community Plan for Boston Bar – North Bend – Canyon Alpine, Bylaw No. 804, 1994.

[19] Official Community Plan for Portions of Electoral Area "B" Yale, Emory Creek, Dogwood Valley, and Choate, Bylaw No. 150, 1998.

[20] Official Community Plan for Portions of Electoral Areas "B" and "C", Regional District of Fraser-Cheam Bylaw No. 800, 1986.

1998 Electoral Area "B" OCP, Part 1, Subsection 4.4: Land Use and Services – Community Water Supply

This subsection describes the history, the current breadth of service, and the future services and jurisdiction of the community water supply. The community water supply is fairly limited in its capacity and is mainly comprised of individual or shared water wells through the use of water lines and or surface water sources.

1998 Electoral Area "B" OCP, Subsection 4.5: Land Use and Services – Fire Protection

This subsection describes the infrastructure and services that are provided by the community fire protection plan. It also describes the history of fire protection within the area and the current services, such as the volunteer fire departments located in Yale and Dogwood Valley. It outlines the structural state of the community water system within Yale, which includes fire hydrants, adequate water pressure and volume, and a reservoir tank. It also addresses certain logistical limitations such as the railway line which can impose an access barrier to other developed areas.

1998 Electoral Area "B" OCP, Subsection 5.2: Development Services – Water Systems

This subsection describes the challenges and opportunities facing the current community water system, which include increasing density and insufficient community water supply.

1998 Electoral Area "B" OCP, Subsection 5.3: Development Services – Fire Protection

This subsection outlines the objectives and the appropriate policies of the community fire protection plan which are intended to support the volunteer fire department in responding to fires. It outlines policies which are created to support the maintenance of the volunteer fire department. These include the installation of new sprinkler systems, the implementation of new water storage tanks, engaging in forest fire protection service agreements, and acknowledging that new developments shall not impose on the volunteer fire department.

1986 Electoral Area "B" and "C" OCP, Schedule A

Table 1 in Schedule A describes the objectives for the OCP sub-plan areas. This includes the risk management objective to direct development away from areas that are susceptible to natural hazards such as erosion, flooding, geological hazards, and avalanches and to reduce risks where possible. Furthermore, the objective to expand and provide adequate water, sewer, fire protection and other public services is also noted.

1986 Electoral Area "B" and "C" OCP, Section 7

Section 7 outlines the Environmental Protection objectives and policies in these portions of Electoral Areas "B" and "C". This includes the regulation of tree cutting on private land so that may not result in an increase in natural hazards, the recommendation for streamside tree retention, and preservation and replanting of trees within the "Tree Conservation Area" (Policy 7.06).

RECOMMENDATION #1: Review and amend the three OCPs that apply to communities in the AOI to include a growth management policy which considers wildfire risk and other natural hazards during development. By containing development within a specified area, the overall fire risk is less than when compared to areas of intermixed development, i.e. rural sprawl. In intermixed or rural areas there is often the potential to have inadequate or unreliable water supply for suppression, as well as longer emergency response times. By constraining development, the FVRD can ensure that future development occurs where urban services, such as water for fire suppression, is available, reliable, and accessible. Overall intermix and rural areas are generally more vulnerable (at higher risk) for interface fires.

RECOMMENDATION #2: Review and amend the three OCPs that apply to the communities in the AOI to include wildfire as a natural hazard which has the potential to impact public health and safety, economics (i.e. through evacuations, loss of tourism, interruption of services, etc.), ecosystems, habitat, and water quality, among other values. Identification of natural hazards can allow for planning and policies to be put in place to increase FVRD resilience, mitigate potential damages, and increase public and official awareness of risk.

RECOMMENDATION #3: Revise the three OCPs to include an interface wildfire hazard objective which sets specific policies relating to development in the wildland-urban interface (for example, as included in the OCP for Electoral Areas "E" and "H"[21]). Policies could include: avoiding development in areas that are at higher risk to wildfire hazards (as identified in this CWPP), requiring new tenure applications to provide a detailed wildfire hazard report, and encouraging existing homeowners in WUI areas to practice FireSmart techniques, install sprinklers and well pumps, and utilize rain storage tanks, whenever possible for firefighting on-site.

Fraser Valley Regional District Bylaws

Bylaw No. 0037, 1996: Unsightly Premises and Unwholesome Matter Regulations

The bylaw prohibits the accumulation of litter, debris, and any material which poses a fire, health, or environmental hazard on a site, including solid fuels but excluding firewood. It also regulates the storage of building materials. The bylaw provides the FVRD the authority to impose the removal/clean-up of materials and recoup costs from the owner in the case of failure to comply.

Bylaw No. 0384, 1984: Campground Bylaw

This bylaw states regulates the establishment, extension, design and servicing of campgrounds, holiday parks and natural campgrounds. It states that every campground shall comply with regulations made pursuant to the Forest Services Act, specifically those relating to fire protection and other matters. It notes that campground owners shall provide a sufficient and constant water supply system to the

[21] Fraser Valley Regional District. Official Community Plan for Electoral Areas "E" and "H" Bylaw No. 1115, 2011. Retrieved from: https://www.fvrd.ca/assets/Government/Documents/Bylaws/Planning~and~Land~Use/Area%20E%20and%20H%20-%20OCP%20Bylaw%201115%20-%20Columbia%20Valley,%20Lindell%20Beach%20and%20Chilliwack%20River%20Valley.pdf

campground. The bylaw also states that roadways to and from the campground are to have a minimum roadway hard surfaced width of 13 m or gravel width of 6.7 m for safe access and egress.

Bylaw No. 569, 2003: Regional Growth Management Strategy

This bylaw is a framework to guide growth in all areas of the FVRD and an assessment of current and future challenges. Many of the goals and related actions are applicable to wildfire risk planning, including goals to limit rural sprawl and non-contiguous (i.e. intermix) development; establish partnerships with First Nations, the provincial government, and stakeholders; and implement Regional Transportation Improvement Priorities.

Bylaw No. 0823, 1990: Zoning Bylaw for the Rural Portions of Electoral Area "A"

This bylaw divides the FVRD into zones and establishes permitted and prohibited uses for each. how land can be used and what types of buildings and structures are allowed within the area. Regulations pertaining to the use of land, home industry uses, and commercial uses, as well as regulations regarding extraction and transportation uses, are also included.

Bylaw No. 1188, 2013: Building Bylaw

This bylaw is intended to regulate construction; which includes reconstruction, installation, repair and much more, within the Fraser Valley Regional District. This bylaw also aims to provide a framework to follow in terms of health, safety and the protection of persons and property while on the job site. This bylaw also outlines that applications for standard buildings should have structural, mechanical or fire suppression drawings prepared before building.

RECOMMENDATION #4: Work with the Planning and Development Department (i.e., building inspectors) to ensure house numbering is posted prior to occupancy of new development and to provide instructions on how and where best to affix numbering to facilitate emergency response and evacuation efforts. Consider encouraging home owner participation via a FVRD-wide engagement campaign and providing incentives such as the opportunity to acquire/purchase discounted address signs. Additional specifications to be communicated to residents could be made in consultation with fire departments, such as reflective signs with a minimum number height to ensure visibility from the road at night, and instructions on how and where best to affix numbering to facilitate emergency response and evacuation efforts.

Bylaw No. 1190, 1979: Campground and Holiday Park Bylaw

This bylaw regulates the establishment, extension, design and servicing of campgrounds, holiday parks and natural campgrounds. Under services (section 7.08) it defines the specific violations and exemptions that relate to fire protection, including the provision of standpipes, fire hydrants, stoves, outdoor barbeques, fire extinguishers on site and other required firefighting equipment such as; axes, shovels, pulaskis or hand pumps.

Bylaw No. 1386, 2016: Open Fire Bylaw

This bylaw regulates open fires within the Fraser Valley Regional District in order to protect public health and safety and property. It does so by imposing open burning regulations and restrictions in areas during

extreme fire conditions. It also stipulates in the regulations that all open fires must be under control and supervised, by a person at least 16 years old, at all times until they are extinguished. It also declares the authority of the Fire Chief and appointed officers in restricting and prohibiting open burning in designated fire protection service areas. The document covers exemptions, offences and penalties relating to the bylaw. Note that the Fire Chief can allow open burning if the Board determines that extreme fire conditions no longer exist, despite a provincial fire ban.

RECOMMENDATION #5: Review and amend Section 5.1.4 of Bylaw 1386 to specify what constitutes an effective means of extinguishing an open fire (i.e., camp fire). BCWS recommends 8 litres of water and a hand tool (shovel, Pulaski). In accordance with BCWS recommendations,[22,23] this section should also require the clearing of a fuel break around a fire wide enough to stop the spread of the fire and the siting of the fire in a fire pit or rock ring that is at least 3 m from trees, shrubs, structures, and debris.

FVRD Regional Parks Strategic Plan 2014-2024

This plan identifies priorities for FVRD regional park management, improvement, and acquisition over a ten- year period. The AOI overlaps two regional parks and one interregional park.

RECOMMENDATION #6: Complete updates to the FVRD Regional Parks Strategic Plan (2025-2035) to include wildfire threat as a parks acquisition criterion. Access and potential costs of park and trail maintenance to mitigate wildfire risk should be weighed against other acquisition criteria. Amend Bylaw 1190 Campgrounds and Holiday Parks to include the following provisions: 1) require the use of a QP in review, assessment, and siting of parks and park access prior to acceptance; and 2) ensure that OCPs provide the FVRD authority to request modification (either fuels, access, or siting) based upon QP recommendation and prior to acceptance to ensure that the park is received in, and able to be maintained in, an acceptable range of risk. (See Section 6.1.3 for related recommendations specific to access).

RECOMMENDATION #7: Develop a trails master plans in collaboration with member municipalities to complement the FVRD Regional Parks Strategic Plan and include considerations for the placement, type, width, and objective of trails. Consideration should also be given to trail building and maintenance as these activities can either increase wildfire risk (through fuels accumulations and unsafe work practices) or decrease wildfire risk (though proper placement, clean-up of combustible fuels trailside and work practices which adhere to *Wildfire Act* and *Regulation*).

[22] Province of BC. 2019. Fire Bans and Restrictions. https://www2.gov.bc.ca/gov/content/safety/wildfire-status/fire-bans-and-restrictions

[23] Province of BC. 2019. British Columbia Campfire Regulations [poster]. https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/wildfire-status/fire-bans-and-restrictions/bcws_campfireposter.pdf

2.5.4 Higher Level Plans and Relevant Legislation

The section will review provincial legislation and regulations, as well as other higher-level resource management plans and associated legal objectives, whose boundaries overlap the AOI of this CWPP. The intent of this review is to ensure consistency, compatibility, and synergy exists between this CWPP and existing landscape-level strategic planning.

Landscape Unit Plans

There are 11 overlapping landscape units (LUs) in the AOI: Fraser Valley South, East Harrison, Silverhope, Yale, Coquihalla, Manning, Nahatlatch, Spuzzum, Anderson, Ainslie, and Kwoiek. The Cascades Landscape Units Plan Background Report[24] and Fraser Canyon Landscape Units Background Report[25] apply to these LUs. These plans describe the resource tenure holders in the LU, the resource values and associated objectives, existing higher-level plans, and a description of the Old Growth Management Areas (OGMAs) and Wildlife Tree Retention specifications within the LU. For these landscape units, two legal objectives are established, 1) recruit and maintain OGMAs according to spatially explicit land use restrictions; and 2) retain wildlife tree patches (WTPs).

Sustainable Resource Management Plan

Within the AOI there is one overlapping LU with a Sustainable Resource Management Plan (SRMP), which is a higher-level planning document which guides resource planning and provides management direction in the LU. The plan describes the resource tenure holders in the LU, the resource values and associated objectives, existing higher-level plans, and specifics regarding OGMAs and Wildlife Tree Retention.

Relevant Legislation

Multiple spatially explicit ministerial orders pertaining to OGMAs were identified within the AOI. These orders must be reviewed, considered, and addressed during the fuel management prescription-level phase. Fuel management within these areas should aim to enhance these values within the AOI, whenever possible, and the land manager and/or Stewardship Forester (Chilliwack and Cascades Natural Resource Districts) must be consulted regarding any overlapping values at risk, spatially explicit ministerial orders, or other notable values on the land base, during prescription development.

Spotted Owl Management Plan[26]

Numerous Wildlife Habitat Area (WHA) for spotted owls (established by government area regulation order) were identified in the AOI. The Spotted Owl Management Plan is a guidance document for spotted owl management within the Chilliwack and Squamish Forest Districts. The goal of this plan is to stabilize, and ideally increase, spotted owl populations in the two districts over time while avoiding substantial impacts to forestry employment and timber supply. It includes a strategic management plan with

[24] Cascades Landscape Units Plan Background Report for: Silverhope, Manning and Yale Landscape Units. 2004.

[25] Fraser Canyon Landscape Units Plan Background Report for: Spuzzum Landscape Unit, Ainslie Landscape Unit, Anderson Landscape Unit, Mehatl Landscape Unit, Nahatlatch Landscape Unit. 2003.

[26] The Province of BC, 1997.

objectives and policies and operational guidelines for forest practices and creating operational plans in spotted owl management areas. Best management practices to manage forests within spotted owl habitat were subsequently updated as a component of the Spotted Owl Management Plan[27]. This document should be reviewed and integrated into any fuel management activities that are proposed within spotted owl management areas, WHAs, or in areas of suitable spotted owl habitat such as late seral stage forests.

2.5.5 Ministry or Industry Plans

Reviewing and incorporating other important forest management planning initiatives into the CWPP planning process is a critical step in ensuring a proactive and effective wildfire mitigation approach.

Forest Stewardship Plans

There are ten approved Forest Development Units (FDUs) associated with licensees operating within the AOI. All tenure holders and forest agreement holders must provide a government approved Forest Stewardship Plan (FSP) before any harvesting or road building activities occur. FSPs integrate government objectives and legislation to set forest practices obligations applicable to specific forest licensees. These plans are area-based, landscape level plans that outline potential forest development activities within the area. The following FSPs are approved within the AOI: Northwest Hardwoods, BCTS Chinook Chilliwack District, Ts'elxwéyeqw Forestry Limited Partnership, and the Probyn Log Ltd FSPs. These plans are critical at the prescription level phase and must be consulted before any implementation occurs.

South Coast Response Fire Management Plan

The South Coast Response Fire Management Plan (FMP)[28] was developed for the Chilliwack Natural Resource District (NRD), the Sea to Sky NRD, and the Sunshine Coast NRD. The FMP was reviewed to identify any regional fire management planning objectives and their interpretation in the context of management considerations for the AOI. The 2018 South Coast FMP identifies values at risk and prioritizes broad categories of values as 'themes' for response planning through the Resource Strategic Wildfire Allocation Protocol (RSWAP). The South Coast FMP briefly speaks to the concept of wildfire prevention engineering within the region, which includes fuel management such as locally identified fuel breaks, proposed treatment areas, or demonstration and operational treatment areas. In order to reduce local fire threat and to build defensible space around critical infrastructure and/or residential neighbourhoods, this CWPP identifies various fuel treatment opportunities (Section 5.1.1).

[27] Spotted Owl Best Management Practices Working Group, 2009. Retrieved online from: https://www.for.gov.bc.ca/ftp/DCK/external/!publish/LOCAL_DATA/Spotted_Owl_Management_Plan/DOCUMENTS/SPOWBestManagementPractiesJul2009.pdf

[28] South Coast Fire Management Plan. 2018. (Internal government document)

2019/20 Coast Area Integrated Investment Plan

The 2019/20 Coast Area Integrated Investment Plan[29] is a Provincial initiative that identifies and coordinates landbase investments for the south coast and the west coast regions and targets multiple objectives such as carbon sequestration, timber supply, forest rehabilitation, habitat and population enhancement and fuel management. The Integrated Investment Plan provides information to funders and stakeholders within the Coast Area regarding categories for potential investment, provincial and regional priorities, eligible and supported potential activities and funding opportunities. This Plan should be reviewed to ensure that fuel treatment opportunities proposed in this CWPP document align with Land Manager investment objectives and regional priorities.

Other Relevant Plans

Five provincial parks are also located within the AOI: Alexandra Bridge, Emory Creek, Coquihalla Canyon, Nicolum River and F.H. Barber Provincial Parks. Management plans for these parks consist of zoning plans and management policies. No management plans exist for Nicolum River and F.H. Barber Provincial Parks. No fire management plans exist for any of these provincial parks.

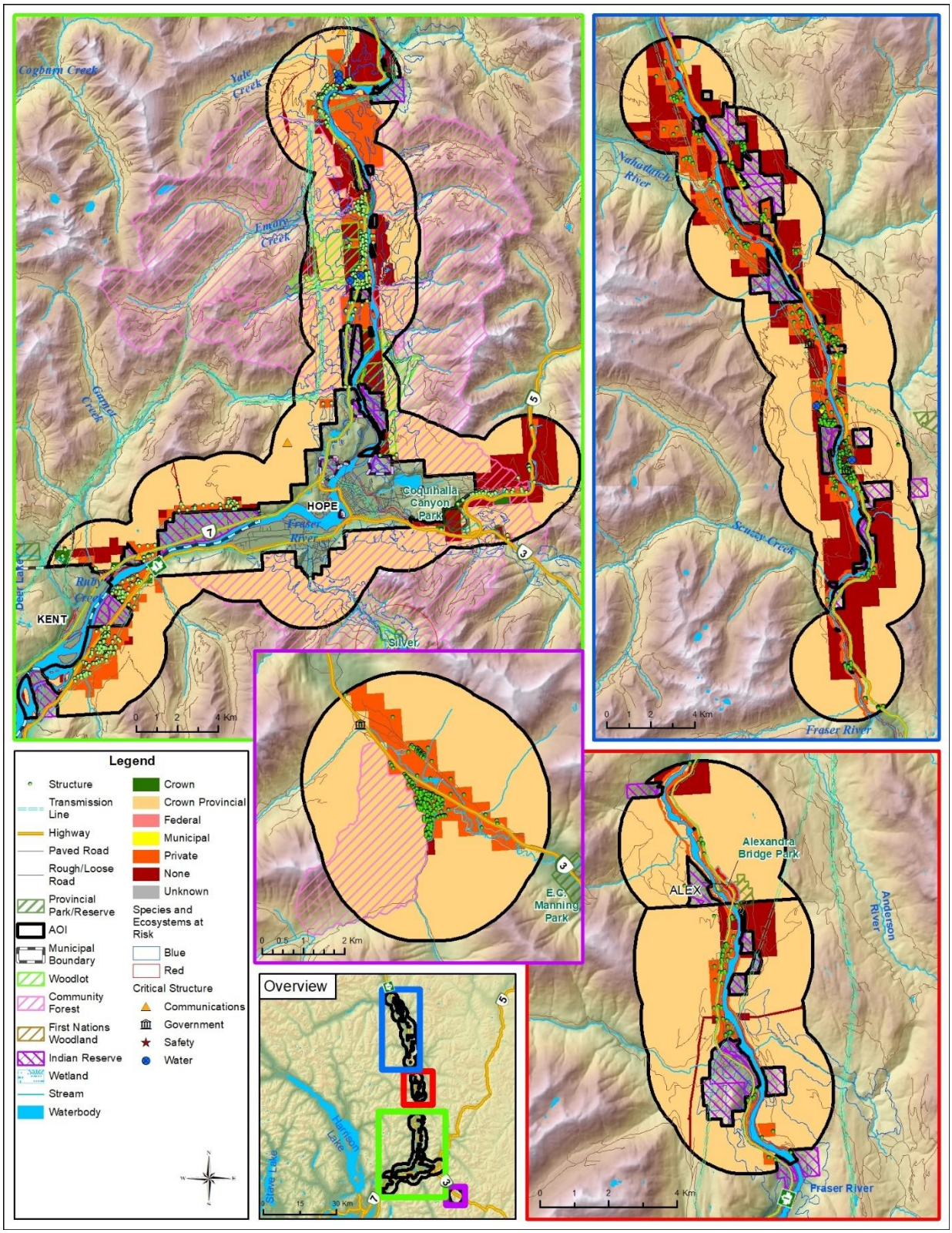
Forest health management and associated initiatives within the Fraser Timber Supply Area (TSA) are guided by the Coast Area 2015-17 Coastal Timber Supply Areas Forest Health Overview[30].This plan must be reviewed, considered, and addressed during the prescription-level phase. Fuel management and prescriptions aimed at reducing wildfire hazard within the AOI should aim to incorporate the guiding principles and best management practices (BMPs) presented within this aforementioned plan.

SECTION 3: VALUES AT RISK

Following is a description of the extent to which wildfire has the potential to impact the values at risk (VAR) within FVRD Zone A AOI. VAR or the human and natural resources that may be impacted by wildfire include human life and property, critical infrastructure, high environmental and cultural values, and other resource values. VAR also include hazardous values that pose a safety hazard. Key identified VAR are illustrated below in Map 2.

[29] 2019/20 Coast Area Integrated Investment Plan. Retrieved online at: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/land-based-investment/coast_area_iip.pdf

[30] Ministry of Forests, Lands and Natural Resource Operations. 2015.



Map 2. Values at Risk within the AOI.

3.1 HUMAN LIFE AND SAFETY

One of the primary goals of the BCWS is to support emergency response and provide efficient wildfire management on behalf of the BC government. BCWS aims to protect life and values at risk, while ensuring the maintenance and enhancing the sustainability, health and resilience of BC ecosystems.[31]

Human life and safety are the first priority in the event of a wildfire. A key consideration is the evacuation of at-risk areas and safe egress. Evacuation can be complicated by the unpredictable and dynamic nature of wildfire, which can move quickly. Evacuation takes time and safe egress routes can be compromised by wildfire causing limited visibility, or by traffic congestion and/or accidents.

The population distribution (both people and structures) within the AOI is important in determining the wildfire risk and identifying mitigation activities. The population of the FVRD has increased significantly in recent years. The FVRD has a growth rate of 6.6%; higher than both Metro Vancouver and BC as a whole. It was last recorded at approximately 295,934 residents.

As of 2016, the combined population of Electoral Areas A and B is 1,320 residents.[32] The 2016 census found Electoral Area B to have the highest growth rate of all EAs since 2011. Within the FVRD there are approximately 288,760 dwellings, 7% of which are occupied on a part-time basis. Electoral area B has one of the highest percentages of unoccupied dwellings. Electoral Area B also has the higher population, with approximately 915 residents compared to 405 residents in Electoral Area A.[33] Both Electoral Areas also attract visitors for camping, hiking, canoeing, summer camps, and other recreational endeavors, particularly during the fire season (May – October). Several parks and recreation sites throughout the AOI are highly used during the summer months, including Alexandra Bridge Provincial Park, Emory Creek Provincial Park and Coquihalla Canyon Provincial Park. Furthermore, the Trans-Canada Highway (Highway 1), the Coquihalla Highway (Highway 5), and the Crowsnest Highway (Highway 3) are very frequently used for travelling to and from the Lower Mainland, increasing the number of people to evacuate in the event of a wildfire.

Knowledge of and access to updated structure locations is a critical step in efficient and successful emergency response planning and the development of mitigation strategies and recommendations. Field visits to Electoral Areas A and B and access to recent orthophotography and spatial data from the FVRD has enabled the development a spatial layer with structure locations that accounts for the most recent development in the AOI.

[31] BC Provincial Coordination Plan for Wildland Urban Interface Fires. 2016. Retrieved online at: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/bc-provincial-coord-plan-for-wuifire_revised_july_2016.pdf

[32] Statistics Canada. 2016 Census

[33] Fraser Valley Regional District Census 2016 Release Report. 2017. Retrieved online at: https://www.fvrd.ca/assets/Services/Documents/Strategic~Planning~and~Initiatives/Census%20Release%20Report%20FINAL%2014%20July.pdf

3.2 CRITICAL INFRASTRUCTURE

Protection of critical infrastructure (CI) during a wildfire event is an important consideration for emergency response effectiveness, ensuring that coordinated evacuation can occur if necessary, and that essential services can be maintained and/or restored quickly in the case of an emergency. Critical infrastructure includes emergency and medical services, electrical and gas services, transportation, water, social services, and communications infrastructure. Table 3 provides an inventory of critical infrastructure identified by the FVRD and during field visits, while Map 2 provides a visual depiction of the critical infrastructure within the AOI.

Protection of critical infrastructure is essential for wildfire preparedness. Survival and continued functionality of these facilities not only support the community during an emergency but also determine, to a great degree, the extent and cost of wildfire recovery and economic and public disruption during post wildfire reconstruction. Critical infrastructure provides important services that may be required during a wildfire event or may require additional considerations or protection. As outlined in Section 5.2, FireSmart principles are important when reducing wildfire risk to both classes of structure and are reflected in the outlined recommendations. During field visits, it was observed that the FVRD's critical infrastructure (i.e., fire halls, community centers, etc.) is in various levels of compliance with FireSmart principles.

RECOMMENDATION #8: The use of fire-resistant construction materials, building design and landscaping should be considered for all CI when completing upgrades or establishing new infrastructure. Additionally, vegetation setbacks around critical infrastructure should be compliant with FireSmart guidelines.

RECOMMENDATION #9: Complete formal FireSmart assessments (by a qualified professional) for CI such as the fire halls, emergency operations centres, water infrastructure, and others as identified in this CWPP (Table 3) and by the FVRD.

3.2.1 Electrical Power

Electrical service for most of Zone A is received through a network of wood pole transmission and underground distribution infrastructure supplied by BC Hydro. Neighbourhoods with small, street-side wooden poles to connect homes are particularly vulnerable to fire. It is recommended that utility right-of-way BMPs such as, regular brushing and clearing of woody debris and shrubs be employed to help reduce fire risk, utility pole damage and subsequent outages.

Three major radial transmission lines bisect the FVRD within Zone A, connecting the Wahleach substation to the Boston Bar substation; the Kelly Lake substation to the Clayburn substation; and the Nicola substation with the Abbotsford and the Meridian substations. This system is well-mapped and BC

Hydro states that staff will work with local fire departments and BCWS to mitigate impacts to this infrastructure in the event of a wildfire.[34]

A large fire has the potential to impact electrical service by causing disruption in network distribution through direct or indirect means. For example, heat from flames or fallen trees associated with a fire event may cause power outages. Consideration must be given to protecting this critical service and providing power back up at key facilities to ensure that the emergency response functions are reliable.

Secondary power sources are important to reduce critical infrastructure vulnerability in the event of an emergency which cuts power for days, or even weeks. Secondary power is available for some critical infrastructure such as the fire halls and RCMP, and all water systems, including lift stations, via backup generators. Vulnerabilities for secondary power sources include mechanical failure, potentially insufficient power sources should a wide-scale outage occur, and fuel shortage in the event of long outages (longer than 3-4 days of continuous usage). Refer to Section 6.1.2 for discussion and recommendations related to backup power and water availability for fire suppression.

3.2.2 Communications, Pipelines and Publicly Owned Buildings

There is one airport and one major hospital in Zone A. The Fraser Canyon Hospital in Hope services all residents. The FVRD Regional Airpark is a turf runway airport, primarily used recreationally, with an aviation fuel cardlock.[35] Additionally, Enbridge's BC Pipeline, which transports natural gas south to the Lower Mainland runs through the FVRD. This pipeline is not associated with a distribution network through the communities in the FVRD. A publicly available service map[36] indicates the pipeline runs north-south, through the AOI for this CWPP. There are no publicly available wildfire policies associated with this infrastructure. A full inventory of critical infrastructure for communications, pipelines and Regional District buildings with updated locations is presented in Table 3, below.

Table 3. Critical Infrastructure identified in CWPP field visits.

Critical Infrastructure Type	Location
Yale Fire Hall #1	31246 Douglas St
Yale Fire Hall #2	28555 Trans Canada Highway
Boston Bar Fire Hall #1	48165 Trans Canada Highway
Boston Bar Fire Hall #2	48904 North Bend Cres
Boston Bar RCMP	47864 Old Boston Bar Rd
Rogers Communications Tower	Highway 7 west of Moore Kostiuk Rd (30 m)
BC Hydro Communications Tower	West of Mary Ann Creek and Saddle Rock Tunnel (660 m)

[34]BC Hydro. Earthquakes, wildfires and floods. Retrieved from: https://www.bchydro.com/safety-outages/emergency-preparation/natural-disasters.html

[35] FVRD Regional Airpark. Retrieved from: https://www.fvrd.ca/EN/main/services/fvrd-regional-airpark.html

[36] Enbridge. Project Map. Retrieved from: https://www.enbridge.com/Map#map:infrastructure

Critical Infrastructure Type	Location
BC Ministry of Health Communications Tower	North of Stockholm Creek near Haig (1280 m)
Boston Bar Elementary	47632 Old Boston Bar Rd
Emergency Support Services (ESS) – Primary Reception Centre	Media announcements and evacuation orders will direct evacuating public to a place of safety.

3.2.3 Water and Sewage

There are three communities that connect to drinking water systems administered by the FVRD in Zone A: Boston Bar, Dogwood Valley, and Yale. Boston Bar utilizes a surface water source for its drinking water supply, while drinking water for Dogwood Valley and Yale is supplied by deep wells. The FVRD Regional Airpark in Hope, Yale and District Volunteer Fire Department, and area of North Bend also have water systems administered by the FVRD.

A new water system and treatment facility was completed in Boston Bar in 2012, integrating seven separate drinking water systems into one. A boil-water advisory had been in since 1997 previous to these infrastructure upgrades.[37] Old water systems were privately or corporately owned and maintained, and failed to provide adequate flow, pressure, or storage capacity.[38,37] The new water system flows by gravity from an intake and One and One Quarter Mile Creek to the new treatment facility which both filters and disinfects the water supply. The new reservoir stores up to 465 cubic metres[39] and provides adequate fire suppression capacity. In 2017, water infrastructure servicing the Boston Bar Fire Hall received further upgrades.[40] Although these projects established the majority of the waterworks infrastructure in Boston Bar, significant portions of the remaining system, built by the CN Railway in the 1960s, are still remaining.

The Yale community water system was constructed in 1980 and is supplied by a deep well source.[41] It services properties west of Yale Creek and east of All Hallowes Recreational Park. In the last reporting year, it met all water quality standards. In other parts of the Electoral Area B, near Yale, Emory Creek, Dogwood Valley, and Choate, residents use individual or shared wells, and/or surface waters sources for water supply. There is also water system that services Dogwood Valley and Yale First Nation, around Stulkawhits Rd and BC Nickel Mine Rd. It is supplied by a deep well source, with a reservoir on BC Nickel

[37] EBA Engineering Consultants Ltd. Watershed Assessment (CWAP) for Stoyoma Creek, Boston Bar, BC. 2001. Retrieved online at: http://a100.gov.bc.ca/appsdata/acat/documents/r8610/stoyama_cwap_2001_1166743114649_b99f8155e2214f509e67dbbe4832afed.pdf

[38] The Valley Voice. 2012. Retrieved online at: https://www.thevalleyvoice.ca/Voice%20Stories/July%202012/Chilliwack%20News%20-%20Boston%20Bar%20Water%20Treatment%20Plant%20Opens%20-%20July%2012%202012.htm

[39] Schoenit, Kerrie-Ann. Hope Standard. 2012. Retrieved online at: https://www.hopestandard.com/news/new-water-system-in-boston-bar/

[40] Fraser Valley Regional District website. Boston Bar Water System Upgrade. 2017. Retrieved online at: https://www.fvrd.ca/EN/meta/news/news-archives/2017-archives/boston-bar-water-system-upgrade.html

[41] Fraser Valley Regional District. Drinking Water System Annual Report 2018. Retrieved online at: https://www.fvrd.ca/assets/Services/Documents/Water~Systems/2018%20yale%20system%20water%20quality.pdf

Mine Rd. Upgrades to this system were completed in 2018. In Huckleberry Village, one of the several small communities in the larger Sunshine Valley area, lack of adequate water treatment for surface source water has resulted in a boil-water advisory since 2000.[42]

Points of diversion are present throughout the AOI where residents outside these communities may source drinking water from. At the time of writing, the Canyon Alpine community is in the process of organizing funding to develop new drinking water service infrastructure.

The FVRD operates one sewage system in Zone A, in the community of North Bend. The area of coverage extends to both the east and west side of the CP Railway tracks, from North Bend Post Office Rd at the southern extent, to mid-way up Highline Rd at the northern extent. Other communities in Zone A, including Boston Bar, Dogwood Valley, and Yale, rely on resident-owned private septic systems to treat wastewater and sewage.[43] An exception to this is in the Sunshine Valley, where a sewage system is owned and operated by Sunshine Valley Development Ltd.[44]

Water availability for firefighting in the FVRD Zone A is, in most areas, adequate; however, vulnerabilities are present. Hydrant service is limited to Yale, part of Dogwood Valley, and most of North Bend and Boston Bar. There are no hydrants in the Sunshine Valley. All VFDs in the FVRD have the capability and training to draw water from natural sources; however, in the Sunshine Valley, especially in drought conditions, there is not a sufficient water supply for large structural or wildland firefighting. North Bend and Boston Bar are reliant on surface sources for all water services but have not noted shortages thus far. There is no water or sewage system in Laidlaw.

Locations for water and sewage infrastructure (current as of 2019) within the FVRD Zone A AOI are detailed below in Table 4.

Table 4. Critical Water and Sewage Infrastructure Identified in CWPP field visits.

Critical Infrastructure Type	Location
Water supply	Communities within the FVRD Zone A are served by the Electoral Area A and B Integrated Water System, with associated infrastructure, including: • Dogwood Valley water well – Reynolds Road and Highway 1, Dogwood Valley • Yale water well - Albert Street, Yale • Yale pumphouse – Albert Street, Yale • Yale water reservoir – Albert Street, Yale • North Bend water reservoir – west of Chaumox Road, North Bend • Dogwood Valley water reservoir – BC Nickel Mine Road, Dogwood Valley

[42] Health Space. Current Boil Advisories. Retrieved online at: https://www.healthspace.ca/Clients/FHA/FHA_Website.nsf/Water-Drinking-Closures

[43] Fraser Valley Regional District website. Sewer & Septic. Retrieved online at: https://www.fvrd.ca/EN/main/services/sewer-septic.html

[44] Sunshine Valley Rate Payers. Retrieved online at: http://www.sunshinevalleyratepayers.org/pdf/Report050708.pdf

Critical Infrastructure Type	Location
	• Boston Bar water reservoir – Ash Road, Boston Bar
Sanitary sewer system	Sewage is transported, treated, stored and discharged through FVRD operated and through other municipal and privately-operated independent systems. There is one FVRD operated sewage system within the AOI, located in North Bend. This is a lagoon sewage system.

3.3 HIGH ENVIRONMENTAL AND CULTURAL VALUES

The following section identifies high environmental and cultural values and where they are located. Environmental, cultural and recreational values are high throughout the AOI. A more detailed account of environmental and biodiversity aspects of this region is presented in Section 3.3.3.

3.3.1 Drinking Water Supply Area and Community Watersheds

Domestic water in the AOI is drawn from various surface and groundwater sources. Drinking water availability is a concern in the FVRD due to the dry spells that typically occur during the summer and is exacerbated by growing domestic and agricultural demand and climate change impacts.[45, 46]

There are 15 Community Watersheds which overlap the AOI, predominantly clustered around the communities of North Bend and Boston Bar, and the municipality of Hope; however, some also exist adjacent to smaller communities along Highway 1. Special management considerations are required within and adjacent to the perimeter of Community Watersheds to maintain timing of flow and the volume and quality of the water source. The potential impacts of wildfire extend past the time a fire is extinguished. Depending on fire size and severity, there is the potential for significant hydrological impacts, extending for years post-burn.[47] Some areas may have a lower threshold for precipitation triggered events and would be particularly vulnerable to post-wildfire debris flows, mass wasting, landslides, or flooding. This may directly impact the community (i.e., structure loss, risk to public safety) or indirectly, through loss or damage of critical infrastructure, roads, or impacts on the watershed affecting water quality.

RECOMMENDATION #10: The FVRD should consider the option of conducting future assessments to explore the potential hydrologic and geomorphic impacts of wildfire on watersheds and communities. Alternatively, there may be an option to complete a stand-alone assessment to help identify and quantify the post-fire hazards and levels of risk to the community.

[45] BC Agriculture and Climate Change Regional Adaptation Strategies Series: Fraser Valley Region. 2015. Retrieved online at: https://www.bcagclimateaction.ca/wp/wp-content/media/RegionalStrategies-FraserValley.pdf

[46] BC Agriculture and Climate Change Regional Adaptation Strategies Series: Fraser Valley Adaptation Strategies Update. Retrieved online at: https://www.bcagclimateaction.ca/wp/wp-content/media/RegionalStrategies-FraserValley-2018-update-report.pdf

[47] Jordan, P., K. Turner, D. Nicol, D. Boyer. 2006. Developing a Risk Analysis Procedure for Post-Wildfire Mass Movement and Flooding in British Columbia. Part of the 1st Specialty Conference on Disaster Mitigation. Calgary, AB May 23 -26, 2006.

3.3.2 Cultural Values

According to information from the BC Consultative Areas database, there are 50 First Nations groups with territories that overlap the FVRD AOI. These First Nations, their representative agency, or alliances or councils representing multiple First Nations communities are as follows: Ashcroft Indian Band, Boston Bar First Nation, Coldwater Indian Band, Cook's Ferry Indian Band, Cowichan Tribes, Halalt First Nation, Lake Cowichan First Nation, Lower Nicola Indian Band, Lower Similkameen Indian Band, Lyackson First Nation, Nicola Tribal Association, Nlaka'pamux Nation Tribal Council, Esh-kn-am Cultural Resources Management, Nooaitch Indian Band, Okanagan Indian Band, Okanagan Nation Alliance, Penelakut Tribe, Penticton Indian Band, People of the River Referrals Office, Peters Band, Popkum Indian Band, Seabird Island First Nation, Shackan Indian Band, Shxw'ow'hamel First Nation, Siska Indian Band, Sto:lo Nation, Sto:lo Tribal Council, Stz'uminus First Nation, Union Bar First Nation, Upper Nicola Indian Band, Yale First Nation, Boothroyd Indian Band, Lytton First Nation, Oregon Jack Creek Band, Skuppah Indian Band, Spuzzum First Nation, Ts'elxwéyeqw Tribe, Aitchelitz First Nation, Chawathil First Nation, Cheam First Nation, Leq'a:mel First Nation, Scowlitz First Nation, Shxwha:y First nation, Skawahlook First Nation, Skowkale First Nation, Soowahlie First Nation, Squiala First Nation, Sumas First Nation, Tzeachten First Nation, and Yakweakwioose First Nation.

Archaeological sites in BC that pre-date 1846 are protected by the *Heritage Conservation Act* (HCA), which applies on both private and public lands. Archaeological remains in the Province of British Columbia are protected from disturbance, intentional and inadvertent, by the Heritage Conservation Act (HCA). Archaeological sites that pre-date 1846 are automatically protected under the Heritage Conservation Act whether on public or private land[48]. Sites that are of an unknown age that have a likely probability of dating prior to 1846 (e.g., lithic scatters) as well as Aboriginal pictographs, petroglyphs, and burials (which are likely not as old but are still considered to have historical or archaeological value) are also protected. Under the HCA, protected sites may not be damaged, altered or moved in any way without a permit. It is a Best Practice that cultural heritage resources such as culturally modified tree (CMT) sites be inventoried and considered in both operational and strategic planning.

Due to site sensitivity, the locations of archaeological sites may not be made publicly available, however, data provided by the MFLNRORD Archaeology Branch confirms that multiple sites do exist. The FVRD should ensure that they have direct access to Remote Access to Archaeological Data (RAAD), which allows the FVRD to look up or track any archeological sites in the area.[49] Prior to stand modification for fire hazard reduction, and depending on treatment location, preliminary reconnaissance surveys may be undertaken to ensure that cultural heritage features are not inadvertently damaged or destroyed. Pile burning and the use of machinery have the potential to damage artifacts that may be buried in the upper soil horizons. Above ground archaeological resources may include features such as CMTs, which could be damaged or accidentally harvested during fire hazard reduction activities. Fuel treatment

[48] Snetsinger, 2010.

[49] Government of BC website. Request Archaeological Information. Retrieved online at: https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/archaeology/request-arch-info

activities should include consultation with all identified First Nations at the site level and with sufficient time for review and input regarding their rights and interests prior to prescription finalization or implementation.

3.3.3 High Environmental Values

The AOI overlaps with multiple legal orders for Old Growth Management Areas (OGMAs). Any proposed fuel treatment that may overlap these areas requires MNFLRORD oversight at the prescription development phase, and works can only occur following MNFLRORD consultation and approval.

Multiple Ungulate Winter Range (UWR) polygons intersect the AOI. Some of these polygons correspond to conditional harvest zones for mule or blacktail deer as per Government Actions Regulation (GAR) Order U-2-006; some correspond to no harvest zones for mountain goat, as per GAR Order U-2-001. This GAR Order is intended to protect critical winter foraging habitats for black-tailed deer, mule deer, and mountain goat populations and has specific management requirements associated with it.

The Conservation Data Centre (CDC), which is part of the Environmental Stewardship Division of the Ministry of Environment, is the repository for information related to plants, animals and ecosystems at risk in BC. To identify species and ecosystems at risk within the study area, the CDC database was referenced. Two classes of data are kept by the CDC: non-sensitive occurrences for which all information is available (species or ecosystems at risk and location); and masked, or sensitive, occurrences where only generalized location information is available.

There are eight occurrences of red-listed species and five occurrences blue-listed species within the AOI (Table 5). Much of the AOI overlaps masked occurrences. Through consultation with the CDC and a biologist or qualified professional, all site level operational plans must determine if these occurrences will be impacted by fuel management or other wildfire mitigation activities. All future fuel treatment activities or those associated with recommendations made in this plan should consider the presence of, and impact upon, potentially affected species. Additionally, all site level operational plans should consult the most recent data available to ensure that any new occurrences or relevant masked occurrences are known and considered in the operational plan to mitigate any potential impacts on species at risk. The BC Species & Ecosystems Explorer, which allows combined searches for species and ecological communities, should also be consulted at the prescription phase. Due to potential limitations of existing databases, consultation with a QP with local knowledge may also be recommended at the prescription phase.

Table 5. Publicly available occurrences of Red and Blue-listed species recorded within the AOI.

Common Name	Scientific Name	Category	BC List	Habitat Type
Bearded Sedge	*Carex comosa*	Vascular Plant	Yellow	Riverine; Riparian

Common Name	Scientific Name	Category	BC List	Habitat Type
Dun Skipper	*Euphyes vestris*	Invertebrate Animal	Red	Terrestrial
Dun Skipper	*Euphyes vestris*	Invertebrate Animal	Red	Terrestrial: Forest Needleleaf, Grassland/Herbaceous, Roadside
Garry Oak - Bigleaf Maple - Cherries	*Quercus garryana - Acer macrophyllum - Prunus spp.*	Ecological Community	Red	Terrestrial; Woodland Mixed
Heterocodon	*Heterocodon rariflorus*	Vascular Plant	Blue	Terrestrial: Rock Outcrop
Mountain Beaver	*Aplodontia rufa*	Vertebrate Animal	Yellow	Forest Needleleaf
Oregon Forestsnail	*Allogona townsendiana*	Invertebrate Animal	Red	Terrestrial
Oregon Forestsnail	*Allogona townsendiana*	Invertebrate Animal	Red	Terrestrial: Coarse Woody Debris
Oregon Forestsnail	*Allogona townsendiana*	Invertebrate Animal	Red	Terrestrial: Forest Mixed, Coarse Woody Debris
Peacock vinyl	*Leptogium polycarpum*	Fungus	Yellow	Terrestrial: Forest Mixed, Scree/Fine Talus
Shinleaf Wintergreen	*Pyrola elliptica*	Vascular Plant	Blue	Terrestrial; Woodland Needleleaf
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Vertebrate Animal	Blue	Terrestrial; Woodland Needleleaf
Vivid Dancer	*Argia vivida*	Invertebrate Animal	Blue	Riverine: Creek
Western Hemlock - Douglas-fir/ Electrified Cat's-tail Moss Dry Submaritime 1	*Tsuga heterophylla - Pseudotsuga menziesii/ Rhytidiadelphus triquetrus* Dry Submaritime 1	Ecological Community	Blue	N/A
White Sturgeon (Lower Fraser River Population)	*Acipenser transmontanus pop. 4*	Vertebrate Animal	Red	Riverine: Big River; High Gradient; Low Gradient; Moderate Gradient; Estuarine: River Mouth; Tidal Flat
White Sturgeon (Upper Fraser River Population)	*Acipenser transmontanus pop. 5*	Vertebrate Animal	Red	Riverine: Big River: High Gradient; Moderate Gradient; Pool
Bearded Sedge	*Carex comosa*	Vascular Plant	Yellow	Riverine; Riparian

3.4 OTHER RESOURCE VALUES

There are multiple resources values associated with the land base, including recreation and tourism, wildlife habitat, drinking water supplies, timber supply, and many others.

The AOI is located in the Fraser Timber Supply Area (TSA), which encompasses approximately 1.4 million hectares of land and is administered by the Chilliwack Natural Resource District.[50] The last Timber Supply Review (TSR) was completed in 2015[51] and the Allowable Annual Cut (AAC) determination was completed in February of 2016,[52] however, effective August, 2016 the current AAC is 1,241,602 cubic metres (as a result of the surrender of a Tree Farm License).[50] The AAC is not applicable to private managed forest land. The effective timber harvesting land base in the TSA, based on the last TSR, is 250,405 ha or approximately 17.6% of the total land area.[51]

Fuel reduction treatments are not anticipated to have a measurable effect on the timber harvesting land base. Typically, forest stands identified for fuels treatments are highly constrained for conventional logging and are often in undesirable or uneconomic stand types. Several forest tenures exist on crown land in the AOI including the Cascade Lower Canyon Community Forest, and two woodlot licenses (see Map 1). The Cascade Lower Canyon Community forest is managed by a three-way partnership between Yale First Nation, the District of Hope, and the FVRD. These lands are managed for long-term community economic development and employment; local-level decision making; and protection of drinking watersheds and viewscapes.[53] Several Forest Development Units with associated licensees are also present within the AOI. The opportunity may exist to work with local licensees on commercial thinning projects that meet fuels management objectives.

3.5 HAZARDOUS VALUES

Hazardous values are defined as values that pose a safety hazard to emergency responders. The FVRD Zone A has multiple industrial sites and facilities that can be considered hazardous. There are several landfills and transfer stations operated by the FVRD within the AOI, including the District of Hope Transfer Station; the Chaumox Landfill, in Boston Bar; and the Sunshine Valley Transfer Station. There is also railway infrastructure throughout the AOI, including railyards at Boston Bar and North Bend.

The management and treatment of fuels in proximity to hazardous infrastructure is critical in order to reduce the risks associated with both structural fire and wildfire. Specifically, best management practices recommended for management of hazardous values include: 1) incorporating FireSmart

[50] Government of BC, Fraser Timber Supply Area. Retrieved online at: https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut/allowable-annual-cut-timber-supply-areas/fraser-tsa

[51] Ministry of Forests, Lands and Natural Resource Operations, Fraser TSA Timber Supply Analysis Discussion Paper. Retrieved online at: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/fraser_tsa_discussion_paper.pdf

[52] Fraser Timber Supply Area Rationale for AAC Determination. Retrieved online at: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/fraser_tsa_rationale.pdf

[53] Cascade Lower Canyon Community Forest. Retrieved online at: http://www.clccf.ca/what-we-do/

planning and setback requirements for all infrastructure in this category; and 2) maintaining emergency fuel/propane emergency shut off procedures to be enacted immediately and efficiently in the event of an approaching wildfire or ember shower. The FVRD did not identify any other hazardous values.

Table 6. Hazardous Infrastructure Identified in CWPP field visits.

Critical/Hazardous Infrastructure Name	Location
District of Hope Transfer Station	1L3 Ross Rd, Hope
Chaumox Landfill	50390 Chaumox Rd, North Bend
Sunshine Valley Transfer Station	70860 Hwy 3, Cawston
CN Boston Bar Railyard	East of Riverside Rd, Boston Bar
CP North Bend Railyard	North Bend Post Office Rd

SECTION 4: WILDFIRE THREAT AND RISK

This section summarizes the factors that contribute to and were assessed in the determination of wildfire threat around the community. These factors include the natural fire regime and ecology, the Provincial Strategic Threat Analysis, and the local wildfire threat analysis completed for the AOI.

The relationship between wildfire hazard, threat and risk is defined as follows:

$$Wildfire\ risk\ =\ Probability\ x\ Consequence$$

Where:

- Wildfire risk is defined as the potential losses incurred to human life, property and critical infrastructure within a community in the event of a wildfire;
- Probability is the likelihood of fire occurring in an area and is related to the susceptibility of an area to fire (fuel type, climate, probability of ignition etc.); and
- Consequences refer to the repercussions associated with fire occurrence in a given area (higher consequences are associated with densely populated areas, or areas of high biodiversity etc.).

4.1 FIRE REGIME, FIRE DANGER DAYS AND CLIMATE CHANGE

The ecological context of wildfire and the role of fire in the local ecosystem under historical conditions is an important basis for understanding the current conditions and the potential implications of future conditions on wildfire threat to the community. Historical conditions may be altered by the interruption of the natural fire cycle (i.e., due to fire exclusion, forest health issues, human development) and/or climate change.

4.1.1 Fire Regime and Fire Weather

Historic Fire Regime

The Biogeoclimatic Ecosystem Classification (BEC) system describes zones by vegetation, soils, and climate. Regional subzones are derived from relative precipitation and temperature. Subzones may be further divided into variants based upon climatic variation and the resulting changes in the vegetative communities; variants are generally slightly drier, wetter, snowier, warmer, or colder than the climate of the regional subzone.[54] BEC zones have been used to classify the province into five Natural Disturbance Types (NDTs). NDTs have influenced the vegetation dynamics and ecological functions and pathways that determine many of the characteristics of our natural systems. The NDT classification is based on the frequency and severity of pre-European disturbance events (including but limited to wildfires) and provides an indication of historical fire regime. The physical and temporal patterns, structural complexity, vegetation communities, and other resultant attributes should be used to help design fuel treatments, and where possible, to help ensure that treatments are ecologically and socially acceptable[55]. The AOI is characterized by the BEC subzones and associated NDTs as outlined in Table 7 and illustrated in Map 3.

Table 7. BEC zones and natural disturbance types found within the AOI[56].

Biogeoclimatic Zone	Natural Disturbance Type	Area (ha)	Percent (%)
CMAunp: Coastal Mountain-heather Alpine, Undifferentiated and Parkland	NDT5	159	<1%
CWHdm: Coastal Western Hemlock, Dry Maritime	NDT2	495	1%
CWHds1: Coastal Western Hemlock, Dry Submaritime, Southern variant	NDT2	17,689	39%
CWHms1: Coastal Western Hemlock, Moist Submaritime, Southern variant	NDT2	9,502	21%
CWHvm2: Coastal Western Hemlock, Very Wet Maritime, Montane variant	NDT1	74	<1%
ESSFmw: Engelmann Spruce – Subalpine Fir, Moist Warm	NDT2	203	<1%
IDFww:: Interior Douglas-fir, Wet Warm	NDT4	15,505	34%
IDFww1: Interior Douglas-fir, Wet Warm, Stein variant	NDT4	427	1%
MHmm1: Mountain Hemlock, Moist Maritime, Windward variant	NDT1	10	<1%
MHmm2: Mountain Hemlock, Moist Maritime, Leeward variant	NDT1	1,521	3%
MSmw2: Montane Spruce, Moist Warm, Stein variant	NDT3	3	<1%
TOTAL		45,589	100%

[54]BECWeb: https://www.for.gov.bc.ca/HRE/becweb/resources/classificationreports/subzones/index.html

[55] Province of British Columbia, 1995. Biodiversity Guidebook, s.l.: s.n.

[56]Source: MFLNRORD BEC Map (DataBC)

The AOI is primarily NDT 2 (61%), which comprises forest ecosystems (CWHdm, CWHds1, CWHms1 and ESSFmw) with infrequent stand initiating events. Historically, fires have been of moderate size (20 to 1,000 ha) with a mean return interval of approximately 200 years. Many of these fires have occurred after periods of extended drought and have produced a forested landscape characterized by extensive areas of mature forest with intermixed patches of younger forests.[57] Although the historical fire frequency is not high and fires are generally not large, pre-planning and preparation are essential to reduce the negative impacts of a potential wildfire.

NDT 4 also encompasses a significant component of the AOI (35%). It comprises forest ecosystems (IDFww, IDFww1) that experience frequent stand-maintaining fires. Less arid sites are characterized by forests of large, old trees, with thick fire-resistant bark. Fires have ranged in intensity and frequency, creating a natural mosaic of mostly uneven aged forests interspersed with grassy and shrubby openings. Surface fire return intervals have historically ranged between 4-50 years; stand-initiating crown fire return intervals have historically ranged between 150 and 250 years.[58]

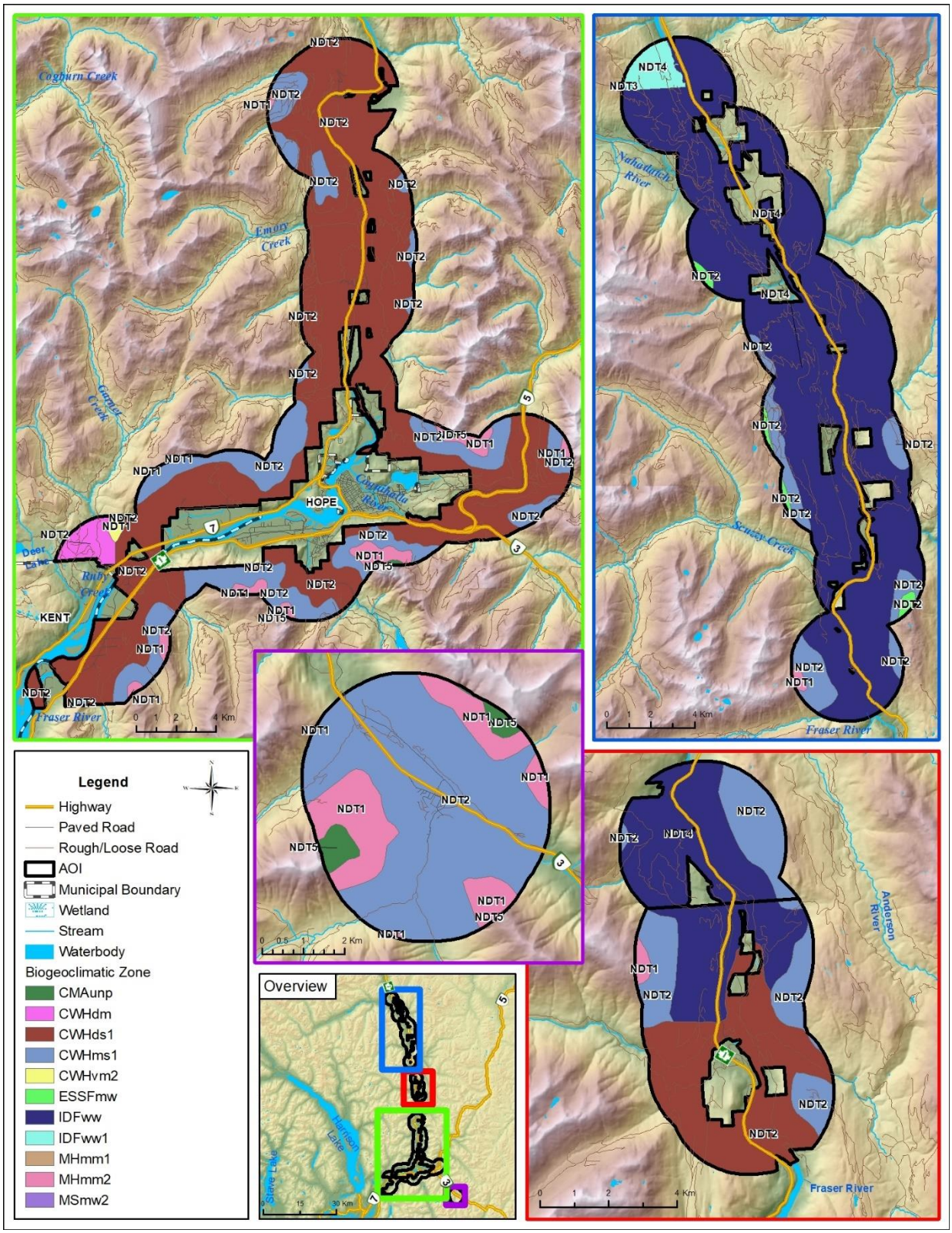
NDT 1 comprises ecosystems (CWHvm2, MHmm1, and MHmm2) with rare stand-initiating events. These are forest ecosystems that experience relatively small disturbances in terms of spatial extent. They have historically resulted in uneven-aged, heterogeneous stand structures from rare and small disturbances caused by fire, wind and/or landslides. This NDT represents a minor component of the AOI (about 4%).

While natural disturbance regimes are useful for describing the historical disturbance pattern typical for an area, fire history is complex and highly variable across space and time for many ecosystems.[59] Furthermore, forest health issues, human development and natural events contribute to changes in the fire regime, forest attributes and fuel hazard around the community.

[57] Province of British Columbia, 1995. Biodiversity Guidebook, s.l.: s.n.

[58] Ibid.

[59] Hall, E. 2010. Maintaining Fire in British Columbia's Ecosystems: An Ecological Perspective. Report submitted to the Wildfire Management Branch, Ministry of Forests and Range.



Map 3. Biogeoclimatic Zones within the AOI.

Forest Health Issues

The Coast Forest Health Overview outlines forest health issues present within the Fraser TSA.[60] This overview and forest health strategy (2015-2017) outlines several forest health issues that are most prevalent within this timber supply area. Of particular concern, due to the severity or extent of outbreaks, are the Douglas-fir beetle, drought, root diseases (primarily laminated root disease and Armillaria spp.), forest tent caterpillar, and windthrow. Outbreaks of western hemlock looper and western spruce budworm were a concern in the past, however, occurrences of these pests have declined in recent years. These forest health factors may have implications for the level of surface fuel accumulation in affected stands, as well as access and working conditions for firefighters in the event of wildfire. Both laminated and armillaria root rot can result in high levels of windthrow due to the destabilization of infected trees' root systems.

Human Development and Natural Events

Most land cover change in the AOI can be described as rural residential and commercial/industrial development. This process entails land clearing and road building. Forest harvesting is also common on provincial Crown land as well as on private land within the AOI. Abiotic and biotic natural events tend to occur at small geographic scales. The overall implication of human development is an increase in human ignition potential with a decrease in hazardous fuels cover as land clearing for human development generally increases the non-fuel and O-1a/b fuel types.

Since the establishment of communities within the FVRD Zone A, there have been numerous anthropogenic and natural changes that have occurred on the landscape. The following is a list of notable changes observed within the AOI and a description of associated implications regarding wildfire behaviour.

- Agricultural development – approximately 1,400 ha of the AOI is characterized as Agricultural Land Reserve (ALR). This area is dominated by farmland, cattle rearing, and agricultural production where the potential wildfire behaviour is greatly reduced due to the year-round irrigation, resulting in lower potential for curing during the wildfire season. It should be noted, however, that not all ALR land is developed for agricultural purposes and there is agricultural land outside of the ALR.
- Residential land development has occurred across the AOI since the mid-19th century following wide-spread settlement by early pioneers engaging in resource-based activities. This has generally resulted in an increased wildland-urban interface in particular areas and an increase in fire suppression in ecosystems that have a historic fire interval of 150-200 years. Population growth is expected to continue and the area's favourable climate and high recreational and landscape values make it a desirable place to live and work.

[60] 2015-17 Coastal Timber Supply Areas Forest Health Overview. 2015.

- Forest industry activities – forest harvesting is common on provincial Crown land as well as on private land within the AOI. Poor slash hazard abatement practices have been attributed to some operations which can lead to high fuel loading along roadsides.
- There are numerous satellite intermix neighbourhoods in the AOI, such as Sunshine Valley, Canyon Alpine, and Blue Lake Resort. These satellite neighbourhoods are highly intermixed, some with conifer leading stands, and are in many situations neighbourhoods with one access/egress route.

Fire Weather Rating

Fire Weather refers to weather conditions that are conducive to fire. These conditions determine the fire season, which is the annual period(s) of the year during which fires are likely to start, spread, and cause sufficient damage to warrant organized fire suppression.

The Canadian Forestry Service developed the Canadian Forest Fire Danger Rating System (CFFDRS) to assess fire danger and potential fire behaviour. Fire Danger Classes provide a relative index of the ease of ignition and the difficulty of suppression. A network of fire weather stations is maintained during the fire season by MFLNRORD and the recorded data are used to determine fire danger, represented by Fire Danger Classes, on forestlands within a community. The information can be obtained from the BCWS and is most commonly utilized by municipalities, regional districts, and industry to monitor fire weather, restrict high risk activities when appropriate, and to determine hazard ratings associated with bans and closures.

The BC *Wildfire Act* [BC 2004] and *Wildfire Regulation* [BC Reg. 38/2005], which specify responsibilities and obligations with respect to fire use, prevention, control and rehabilitation, and restrict high risk activities based on these classes. Fire Danger Classes are defined as follows:

- **Class 1 (Very Low)**: Fires are likely to be self-extinguishing and new ignitions are unlikely. Any existing fires are limited to smoldering in deep, drier layers.
- **Class 2 (Low)**: Creeping or gentle surface fires. Ground crews easily contain fires with pumps and hand tools.
- **Class 3 (Moderate)**: Moderate to vigorous surface fires with intermittent crown involvement. They are challenging for ground crews to handle; heavy equipment (bulldozers, tanker trucks, and aircraft) are often required to contain these fires.
- **Class 4 (High)**: High-intensity fires with partial to full crown involvement. Head fire conditions are beyond the ability of ground crews; air attack with retardant is required to effectively attack the fire's head.
- **Class 5 (Extreme)**: Fires with fast spreading, high-intensity crown fire. These fires are very difficult to control. Suppression actions are limited to flanks, with only indirect actions possible against the fire's head.

It is important for the development of appropriate prevention programs that the average exposure to periods of high fire danger is determined. 'High fire danger' is considered as Danger Class ratings of 4 (High) and 5 (Extreme). Danger class days were summarized to provide an indication of the fire weather in the AOI. Considering fire danger varies from year to year, historical weather data can provide information on the number and distribution of days when the AOI is typically subject to high fire danger conditions, which is useful information in assessing fire risk.

Figure 1 displays the average frequency of Fire Danger Class days between the months of April and October. The data summarized comes from the Anderson Creek weather station (years 2010-2019).

According to Figure 1, the months with the highest average number of 'high' fire danger class days are July, August and September. July and September are comparable while August historically has the highest overall average number of 'high' fire danger class days. Although highest fire danger is within these three months, it should be noted that there are 'high' danger class days which extend into June and October (Figure 1). Historically, there is an average of only one 'extreme' fire danger class day in July.

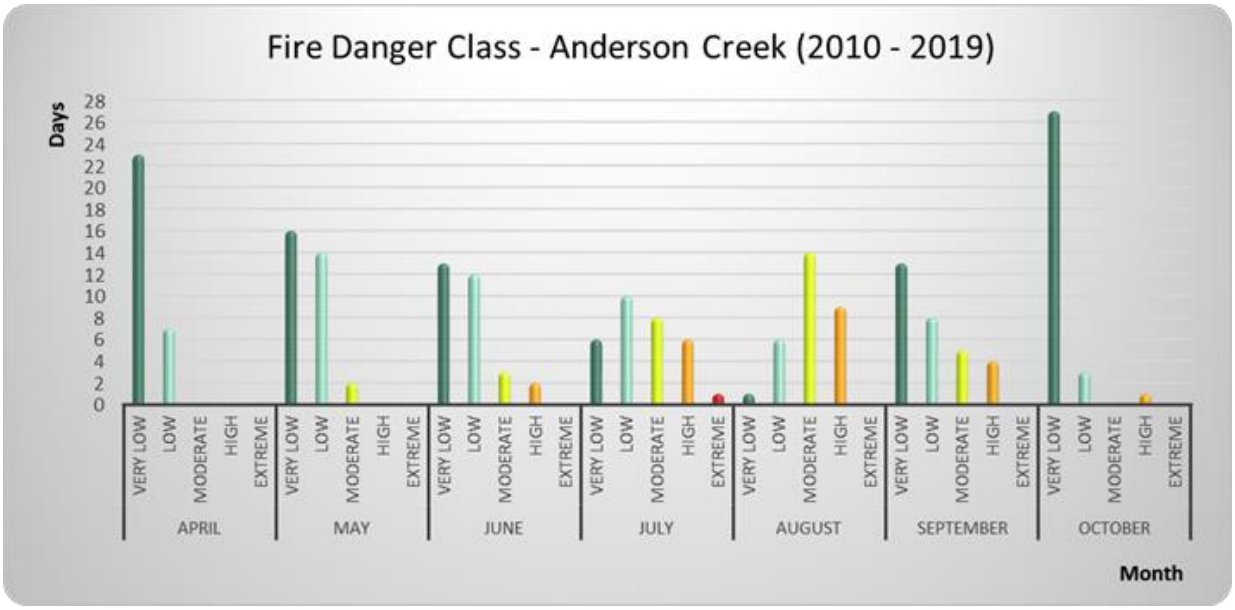


Figure 1. Average number of danger class days for the Anderson Creek weather station. Summary of fire weather data for the years 2010-2019.

4.1.2 Climate Change

Climate change is a serious and complex aspect to consider in wildfire management planning. "Climate change projections point to a warmer and drier environment and shifts in vegetation with the following implications in some areas of the province:

- Increased disturbances due to insects and disease
- Shifts in vegetation. Potential ranges of species will move northward and upward in elevation

- Increased forest fire frequency
- Longer and more intense wildfire seasons

Increased number of high and extreme fire danger days for an average year. Numerous studies outline the nature of these impacts on wildland fire across Canada, and globally. Although there are uncertainties regarding the extent of the impacts of climate change on wildfire, it is clear that the frequency, intensity, severity, duration and timing of wildfire and other natural disturbances is expected to be altered significantly with the changing climate.[61] Despite the uncertainties, trends within the data are notable.

As outlined by *BC Agriculture Climate Change Adaptation Risk & Opportunity Assessment Series Fraser Valley and Metro Vancouver Snapshot Report*[62], the following climate projections for the Fraser Valley are made:

- Increases in average annual temperature consistent with temperature increases for the province of BC (approximately 1.8^{o}C increase from 1961-1990 baseline by 2050);
- Decline in summer precipitation (up to 14% decrease by 2050) leading to drier fuels and soils (increasing fire behaviour potential);
- Increase in winter precipitation (6% by 2050) in the form of rain and significant decreases in snowfall (-25% in the winter and -56% in the spring);
- Annual runoff from the Fraser River is expected to increase by approximately 14%, with increasing spring flow and decreasing summer flow;
- In the province as a whole, as average winter temperatures increase, more intense winter precipitation is expected to fall as rain during extreme events, and less falling as snow; potentially influencing watershed and groundwater storage ability, timing and amount of run-off, and soil and fuel moisture during early fire season.

An increased frequency of natural disturbance events is expected to occur as a result of climate change with coincident impacts to ecosystems. These include: storm events, including catastrophic blowdown and damage to trees from snow and ice; wildfire events; and drought. Furthermore, an increase in winter precipitation may result in slope instability, mass wasting, increased peak flows (loss of forest cover from fire or other disturbance may increase the chance of mass wasting).

Insects and disease occurrence of spruce beetle and Swiss needle cast may increase; outbreaks of western hemlock looper may increase.[63] Other research regarding the intricacies of climate change and potential impacts on wildfire threats to Canadian forests has found that:

[61] Dale, V., L. Joyce. S. McNulty, R. Neilson, M. Ayres, M. Flannigan, P. Hanson, L. Irland, A. Lugo. C. Peterson, D. Simberloff, F. Swanson, B. Stocks, B. Wotton. *Climate Change and Forest Disturbances*. BioScience 2001 51 (9), 723-734.
[62] British Columbia Agriculture & Food Climate Action Initiative, 2010. https://pics.uvic.ca/sites/default/files/uploads/publications/Adapt-FraserMetroVan%20Crawford.pdf
[63] MFLNRO, 2016. BC Provincial Government extension note '*Adapting natural resource management to climate change in the West and South Coast Regions*'. Accessed online at: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/regional-extension-notes/coasten160222.pdf

- Fuel moisture is highly sensitive to temperature change and projected precipitation increases will be insufficient to counteract the impacts of the projected increase in temperature. Results conclude that future conditions will include drier fuels and a higher frequency of extreme fire weather days.[64]
- The future daily fire severity rating (a seasonally cumulative value) is expected to have higher peak levels and head fire intensity is expected to increase significantly in Western Canada. A bi-modal (spring-late summer) pattern of peak values may evolve to replace the historical late summer peak which is the current norm.[65] The length of fire seasons is expected to increase and the increase will be most pronounced in the northern hemisphere, specifically at higher latitude northern regions. Fire season severity seems to be sensitive to increasing global temperatures; larger and more intense fires are expected and fire management will become more challenging.[66, 67]
- More extreme precipitation events (increased intensity and magnitude of extreme rainfall) along with more extreme heat events, that along with drier summers, will contribute to increased wildfire risk in the FVRD.[68]
- Future climatic conditions may be more suitable for, or give competitive advantage to, new species of plants, including invasive species.[69]

In summary, climate scientists expect that the warming global climate will trend towards wildfires that are increasingly larger, more intense and difficult to control. Furthermore, it is likely that these fires will be more threatening to WUI communities due to increased potential fire behaviour, fire season length, and fire severity.

4.2 PROVINCIAL STRATEGIC THREAT ANALYSIS

The Provincial Strategic Threat Analysis (PSTA) evaluates multiple data sets to provide a coarse (high-level) spatial representation of wildfire threats across BC. The information in this section is a synthesis of the BCWS' Provincial Strategic Threat Analysis 2017 Wildfire Threat Analysis Component.[70] Three inputs are combined to create the PSTA Wildfire Threat Analysis (WTA) Component:

[64] Flannigan, M.D., B.M. Wotton, G.A. Marshall, W.J. deGroot, J. Johnston, N. Jurko, A.S. Cantin. 2016. *Fuel moisture sensitivity to temperature and precipitation: climate change implications*. Climatic Change (2016) 134: 59 -71. Accessed online at https://link.springer.com/content/pdf/10.1007%2Fs10584-015-1521-0.pdf.

[65] deGroot, W. J., M. D. Flannigan, A.S. Cantin. 2013. *Climate change impacts on future boreal fire regimes*. Forest Ecology and Management. 294: 35 -44.

[66] Flannigan, M.D., A.S. Cantin, W.J. de Groot, M. Wotton, A. Newbery, L.M. Gowman. 2013. *Global wildland fire season severity in the 21st century*. Forest Ecology and Management (2013) 294: 54 - 61.

[67] Jandt, R. 2013. Alaska Fire Science Consortium Research Brief 2013-3.

[68] British Columbia Agriculture & Food Climate Action Initiative, 2013. Available online at: https://www.bcagclimateaction.ca/wp/wp-content/media/RegionalStrategies-Cowichan.pdf

[69] Pacific Climate Impacts Consortium, 2017. Climate Extremes in the Georgia Basin Summary Report, Available online at: https://www.pacificclimate.org/sites/default/files/publications/Summary-Climate_Extremes_in_the_Georgia_Basin-Final.pdf

[70] BC Wildfire Service. 2015. *Provincial Strategic Threat Analysis 2015 Wildfire Threat Analysis Component*. Retrieved from: https://www.for.gov.bc.ca/ftp/!Project/WildfireNews/PSTA/Provincial_Strategic_Threat_Analysis_PSTA_2015_REPORT.pdf. Accessed January 9, 2018.

1) **Historic fire density**: represents the ignition and fire spread potential based upon historic patterns and fire density weighted by fire size (larger fire perimeters were given a higher weight in order to reflect the greater cost and damage usually associated with larger fires)(see Map 4 below).
2) **Spotting impact**: represents the ability of embers or firebrands from a burning fire to be sent aloft and start new fires in advance of the firefront, or outside of the fire perimeter. Spotting is most associated with high intensity crown fires in coniferous fuels and structure losses. For the wildfire threat analysis, the spotting analysis is based on estimating the threat to a given point on the landscape from the fuels surrounding it, up to a distance of 2 km. Spotting distances greater than 2 km are rare and unpredictable.
3) **Head fire intensity (HFI)**: represents the intensity (kW/m) of the fire front, a measure of the energy output of the flaming front. HFI is correlated with flame length and fire behaviour. The greater the fire intensity (kW/m), or HFI and fire intensity class, the more extreme the fire behaviour is likely to be and the more difficult the fire will likely be to suppress. The HFI used in the wildfire threat analysis was developed using the 90th percentile fire weather index value.

The final wildfire threat analysis value was developed through an average weighting process of the aforementioned three layers.[71] The values were then separated into 10 classes (1 – 10) which represent increasing levels of overall fire threat (the higher the number, the greater the fire threat); threat class 7 is considered the threshold. Threat classes of 7 and higher are locations where the threat is severe enough to potentially cause catastrophic losses in any given fire season, when overlapping with values at risk. Classes were grouped into the following general threat class descriptions: low (1 – 3); moderate (4 – 6); high (7 – 8); and extreme (9 – 10).

There are considerable limitations associated with the PSTA wildfire threat analysis component based upon the accuracy of the source data and the modelling tools, the most notable being:

- Limited accuracy and variability of the fire history point data;
- Sensitivity to fuel type and the associated limitations of using fuel type approximations for fire behaviour modelling; and,
- 90th percentile rating for HFI, which represents a near worst-case scenario which may be artificial in some circumstances.

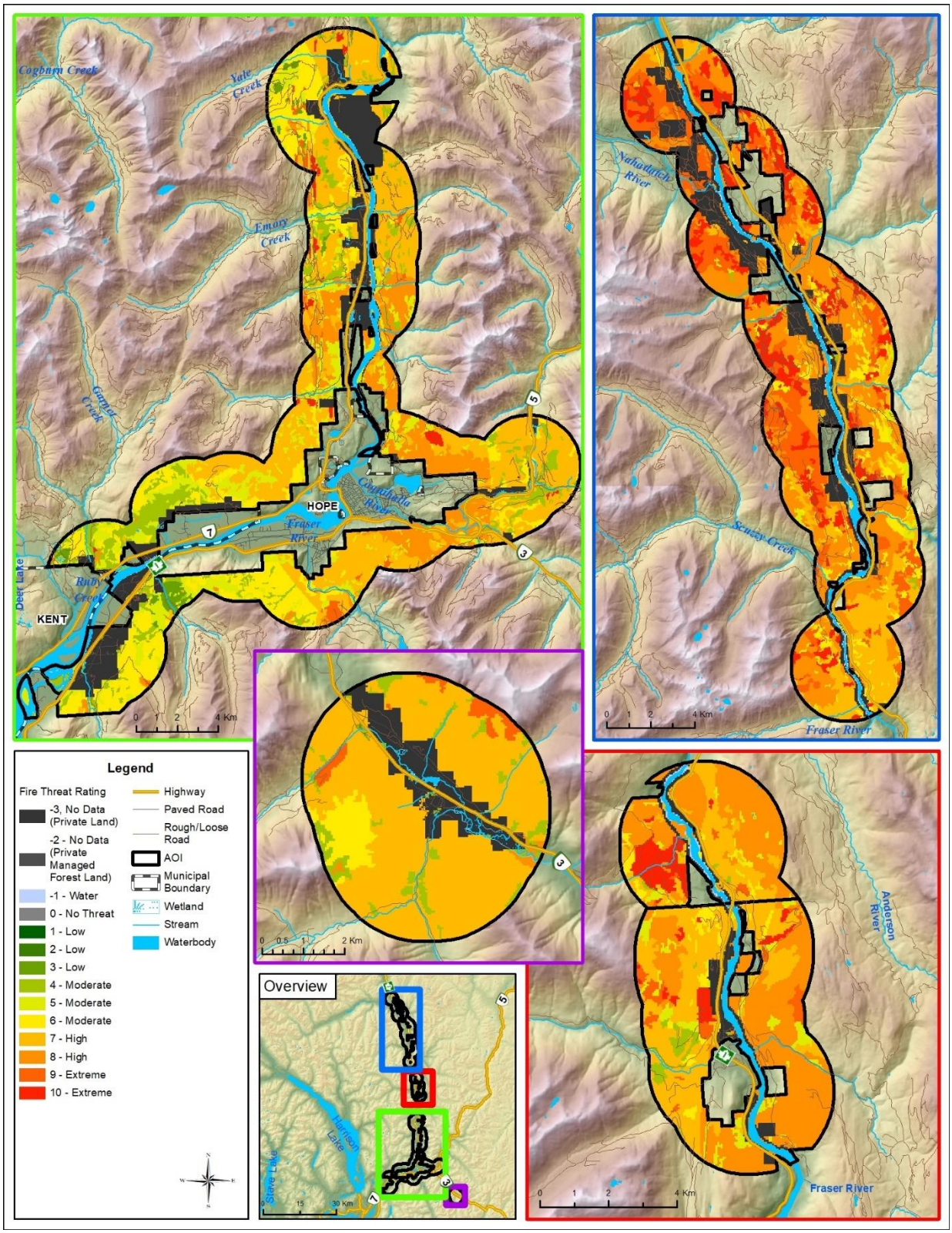
Consequently, the PSTA is complemented by a finer scale local wildfire threat analysis considering local factors to improve the wildfire threat assessment. The key steps to completing the local wildfire threat analysis and a detailed assessment of the local wildfire threat are described in Section 4.3 and Appendix A – Local Wildfire Threat Process.

[71]Weighting of the three PSTA wildfire threat analysis components: Fire density 30%; HFI 60%; spotting impact 10% (water bodies were automatically given a value of 'no threat' [-1]).

The fire threat ratings from the 2019 PSTA are summarized for the AOI in Table 8 and spatially illustrated in Map 4. Approximately 12% of the AOI is categorized as either private land or private managed forest land and has no data for wildfire threat in the PSTA dataset. Low threat areas cover less than 2% of the AOI and water covers 4%. Approximately 23% of the AOI is categorized as having a moderate wildfire threat rating in the provincial Wildfire Threat Analysis (Table 8). High and extreme threat rating covers 60% of the AOI, with the most notable high-threat areas concentrated at the north end of the AOI near Yale, Boston Bar, North Bend, and Canyon Alpine. Higher threat ratings are also present at the eastern edge of Hope's municipal boundaries.

Table 8. Overall PSTA Wildfire Threat Analysis for the study area (rounded to the nearest hectare).

Threat Class	Area (ha)	Threat Class Description	Percent of AOI
-3	5614	No Data (Private Land)	12%
-2	0	No Data (Private Managed Forest Land)	0%
-1	1738	Water	4%
0	0	No Threat	0%
1	0	Low	1%
2	61		
3	383		
4	2516	Moderate	23%
5	2985		
6	4934		
7	12694	High	49%
8	9557		
9	2894	Extreme	11%
10	2212		
Total	**45,589**	**-**	**100%**



Map 4. Provincial Strategic Threat Rating

4.2.1 Fire History

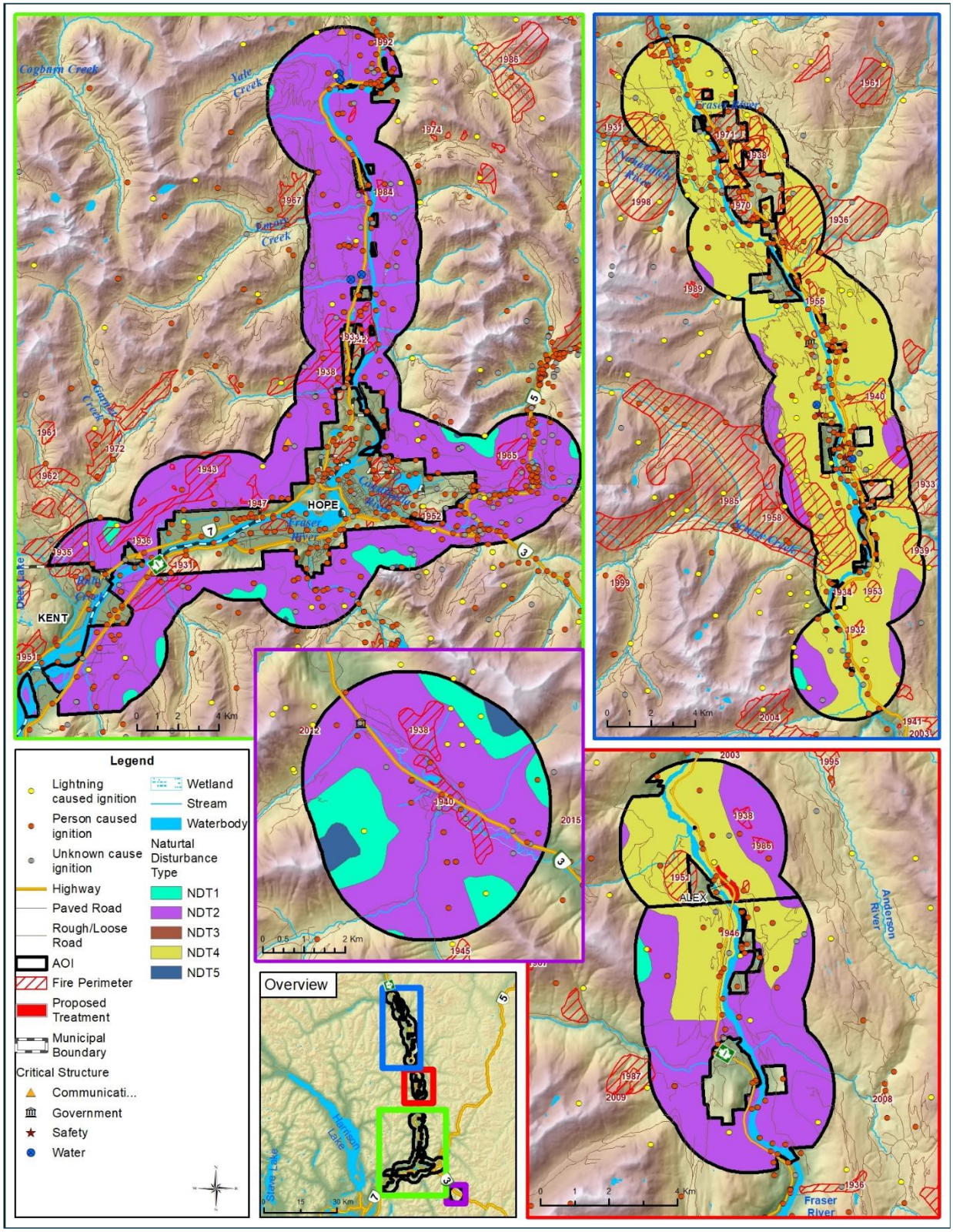
Fire ignition and perimeter data are depicted in Map 5. Locally, BCWS suppression activities have focused primarily on ignitions resulting from residential and recreational burning escapes. Recreational shooting and warming fires have also produced ignitions. Industrial operations, including pile-burning associated with logging, and railway activities, have also produced ignitions. Lighting ignitions are not of significant concern in most of the AOI, except in the Nahatlatch and Sunshine Valleys.

The BCWS provided the following summary of fire weather conditions and fuels within the AOI:

- From Boston Bar northwards, there are transitional C-7 fuel types present, with thick, often matted grasses can support spring fires.
- In the Fraser Canyon, terrain and topography create localized wind patterns that can have distinct effects on fire behaviour.
- Wind can be funneled through the steep slopes in the canyon. Wind switches direction diurnally, blowing southwesterly in the morning, and northerly in the afternoon. Northerly winds, which blow from the interior plateau often decrease relative humidity; this combination of factors can result in fires burning actively overnight. The speed and timing of this diurnal change can be unpredictable.[72]
- In parts of the AOI, slash accumulations can produce volatile fuel types.[73]

As shown in Map 5, small to large historical wildfires have burned within the AOI. PSTA fire ignition data is available from 1950-2019 and fire perimeter data is available from 1918-2019 for the area. Based on the fire ignition data, there have been 943 fire incidents within the AOI, approximately 82% of which were human-caused (a conservative estimate not including miscellaneous/undetermined causes). Ignitions are generally concentrated along highway corridors and around communities. The largest ten fires to occur in the AOI throughout the 20th and early 21st century occurred adjacent to Hope and at the northern end of the AOI, near the communities of Boston Bar, North Bend, Chaumox and Boothroyd. Overall, the majority of the fires (66%) that either overlapped or occurred exclusively within the AOI were over 20 ha in size; a significant proportion of fires (36%) were over 100 ha in size.

[72] Personal communication. BCWS. December 19, 2019.
[73] Personal communication. BCWS, Jordan Struthers. December 17, 2019.



Map 5. Fire Regime, Ecology and Climate Change.

4.3 LOCAL WILDFIRE THREAT ASSESSMENT

The local wildfire threat assessment process includes several key steps as outlined in Appendix A – Local Wildfire Threat Process and summarized as follows:

- Fuel type attribute assessment, ground truthing/verification and updating as required to develop a local fuel type map (Appendix A-1).
- Consideration of the proximity of fuel to the community, recognizing that fuel closest to the community usually represents the highest hazard (Appendix A-2).
- Analysis of predominant summer fire spread patterns using wind speed and wind direction during the peak burning period using ISI Rose(s) from BCWS weather station(s) (Appendix A-3). Wind speed, wind direction, and fine fuel moisture condition influence wildfire trajectory and rate of spread.
- Consideration of topography in relation to values (Appendix A-4). Slope percentage and slope position of the value are considered, where slope percentage influences the fire's trajectory and rate of spread and slope position relates to the ability of a fire to gain momentum uphill.
- Stratification of the WUI according to relative wildfire threat based on the above considerations, other local factors and field assessment of priority wildfire risk areas.

WUI Threat Assessments were completed over five field days in July of 2019, in conjunction with verification of fuel types (see Appendix C for WUI Threat Assessment worksheets and photos). WUI Threat Assessments were completed across the AOI to support development of priority treatment areas, and in order to confidently ascribe threat to polygons which may not have been visited or plotted, but which have similar fuel, topographic, and proximity to structure characteristics to those that were.

Field assessment locations were prioritized based upon:

- PSTA WTA class - Field assessments were clustered in those areas with WTA classes of ≥ 6.
- Proximity to values at risk – Field assessments were clustered in the intermix and interface, as well as around critical infrastructure.
- Prevailing fire season winds – More field time was spent assessing areas upwind of values.
- Slope position of value – More field time was spent assessing areas downslope of values at risk. Similarly, values at top of slope or upper third of the slope were identified as particularly vulnerable.
- Land ownership – Crown and municipal land was the main focus of field assessments.
- Previous mitigation efforts – Those areas which had previously had fuel reduction or modification were field assessed.
- Local knowledge – Areas identified as hazardous, potentially hazardous, with limited access/egress, or otherwise of particular concern as vulnerable to wildfire, as communicated by local fire officials and BCWS zone staff.
- Observations – Additional areas potentially not recognized prior to field work were visually identified as hazardous and assessed during the week.

A total of 35 WUI threat plots were completed and over 900 other field notes and stops (e.g., qualitative notes, fuel type verification, and/or photograph documentation) were made across the AOI (see Appendix F for WUI threat plot locations).

Using the verified and updated fuel types (Appendix A-1, Map 8) combined with field wildfire threat assessments and office-based analysis (Appendix A-1 to A-4), local wildfire threat for the study area was updated. Using the Wildfire Threat Assessment methodology[74], there are two main components of the threat rating system: the wildfire behaviour threat class (fuels, weather and topography sub-components) and the WUI threat class (structural sub-component).

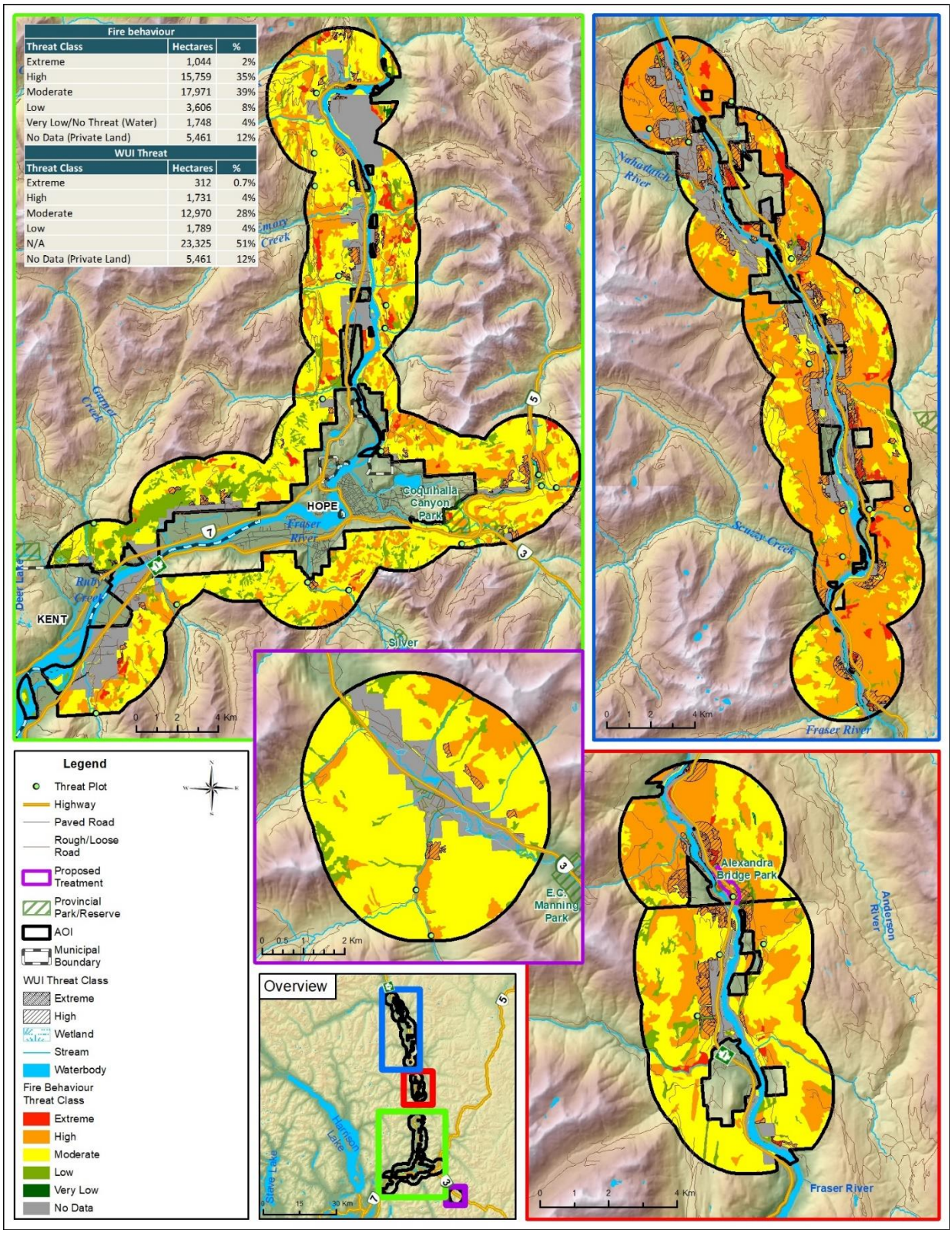
The result of the analysis shows that the study area is composed of a mosaic of very low, low, moderate, high and extreme threat class stands; the variability in wildfire threat is dictated primarily by the level of natural and anthropogenic disturbances that have historically occurred and persist on the landbase. A portion of the AOI is classified as private land and private managed forest land and as such has not been allocated fire threat data. Assessment of fire threat on private land is not funded by the CRI Program and is therefore outside the scope of this CWPP. Table 9 also indicates the differences between the original PSTA threat rating and this CWPP's corrected fire behaviour threat.

The areas that represent the highest wildfire behavior potential within the AOI are in the northernmost polygon of the AOI, surrounding the communities of Boston Bar, North Bend, and Canyon Alpine, and Spuzzum. For detailed field data collection and spatial analysis methodology for the local threat assessment and classification, see Appendix H – WUI Threat Assessment Methodology.

Table 9. Fire behaviour threat summary for the study area.

Wildfire Behaviour Threat Class	2019 PSTA Data	2019 CWPP
	Percent of AOI	Percent of AOI
Extreme	11%	2%
High	49%	35%
Moderate	23%	39%
Low	1%	8%
Very Low/ No Threat (Water)	4%	4%
No Data (Private Land and Private Managed Forest Land)	12%	12%

[74] Using the 2012 WUI Wildfire Threat Assessments in B.C. Guide. Accessed online from: https://www.ubcm.ca/assets/Funding~Programs/LGPS/SWPI/Resources/swpi-WUI-WTA-Guide-2012-Update.pdf



Map 6. Local Fire Behaviour Threat Rating and WUI Threat Rating.

SECTION 5: RISK MANAGEMENT AND MITIGATION FACTORS

This section outlines a wildfire risk management and mitigation strategy that accounts for fuel types present within the community, local ecology, hazard, terrain factors, land ownership, and capacity of Local Government and First Nations. Wildfire risk mitigation is a complex approach that requires cooperation from applicable land managers/owners, which includes all level of governments (local, provincial, federal and First Nations), and private landowners. The cooperative effort of the aforementioned parties is crucial in order to develop and proactively implement a wildfire risk mitigation program. Development of a successful wildfire risk mitigation strategy is dependent on hazard identification within the community, which accounts for forest fuels, high risk activities, frequency and type of human use, and other important environmental factors. The resulting wildfire risk management and mitigation strategy aims to build more resilient communities and produces strategic recommendations or actionable items that can be categorized as follows:

1. Fuel management opportunities to reduce fire behaviour potential in the WUI;
2. Applications of FireSmart approaches to reduce fire risk and impacts within the community; and,
3. Implementation of communication and education programs to inform and remind the public of the important role it plays in reducing fire occurrence and impacts within its community.

5.1 FUEL MANAGEMENT

Fuel management, also referred to as vegetation management or fuel treatment, is a key element of wildfire risk reduction. For the purpose of this discussion, fuel management generally refers to native vegetation/fuel modifications in forested areas greater than 30 m from homes and structures (Priority Zone 3 and beyond).

The objectives for fuel management are to:

- Reduce wildfire threat on private and public lands nearest to values at risk; and,
- Reduce fire intensity, rate of spread, and ember/spot fire activity such that the probability of fire containment increases and the impacts on the forested landscape and the watershed are reduced (create more fire resilient landscapes).

Ideally, these objectives will enhance protection to homes and critical infrastructure. Caveats associated with the statement include: 1) wildfire behaviour will only be reduced if the fire burns in the same location as treatments occurred, and 2) protection of homes and critical infrastructure is highly dependent upon the vulnerability to ignition by embers (ignition potential) directly around the value at risk. In summary, fuel treatments alone should not be expected to protect a community from the effects of wildfire, namely structure loss.

Fuel treatments are designed to reduce the possibility of uncontrollable crown fire through the reduction of surface fuels, ladder fuels and crown fuels. However, the degree of fire behaviour reduction achieved by fuel management varies by ecosystem type, current fuel type, fire weather, slope and other variables and it is important to note that it does not stop wildfire.

Fuel management on local government Crown land and provincial Crown land within local government administrative boundaries or within logical treatment units extending onto provincial Crown land may be funded by the Union of BC Municipalities (UBCM) through the Community Resiliency Investment (CRI) Program (subject to current program requirements). Fuel management on provincial Crown land only, may be funded by the new Crown Land Wildfire Risk Reduction (WRR) funding category[75] under the CRI Program (subject to program requirements). The CRI Program (formerly the Strategic Wildfire Prevention Initiative or SWPI) also provides funding for selected FireSmart activities and planning on private land (subject to program requirements and limits).[76] The best approach to mitigate fuels on private lands is to urge private landowners to comply with FireSmart guidelines (as described below in Section 5.2) and to conduct appropriate fuel modifications using their own resources (CRI program funding may be available). In general, when considering fuel management to reduce fire risk, the following steps should be followed:

- Carefully anticipate the likely wildfire scenarios to properly locate fuel modification areas;
- Acquire an understanding of local ecological, archaeological, and societal values of the site;
- Prescriptions should be developed by a registered professional forester working within their field of competence;
- Public consultation should be conducted during the process to ensure community support;
- Potential treatment areas and draft prescriptions should be referred to First Nations with sufficient time for meaningful review and input;
- Treatment implementation should weigh the most financially and ecologically beneficial methods of fulfilling the prescription's goals;
- Pre- and post-treatment plots should be established to monitor treatment effectiveness; and
- A long-term maintenance program should be in place or developed to ensure that the fuel treatment is maintained in a functional state.
- The fuel treatment opportunities identified in this document include the use of an interface fuel treatment as defined in Section 5.1.1, to reduce the wildfire potential around the AOI. Potential treatment activities include fuel removal, thinning, stand conversion, pruning, and chipping, or a combination of two or more of these activities. Stand conversion has been shown to be effective at reducing wildfire potential in mixed-wood or conifer dominated stands and is recommended as a BMP to encourage a higher deciduous component. This approach generally involves a thin-from-below to reduce ladder fuels and crown fuels continuity, targeting the removal of conifer species and the retention of broadleaf species.

[75] Crown Land WRR is a recently introduced category of CRI Program funding for risk reduction activities on provincial Crown Land effective 2020 that will be led by MFLNRORD (in partnership with local government and others) for wildfire risk reduction activities targeting provincially identified critical infrastructure, and treatment activities on provincial Crown land around communities.

[76] CRI FireSmart Community Funding & Supports – Program & Application Guide. 2020. Retrieved from: https://www.ubcm.ca/assets/Funding~Programs/LGPS/CRI/cri-2020-program-guide.pdf

- In addition to the treatment unit proposed in the following section, it is recommended that the FVRD recognize important fuel treatment opportunities to improve emergency access and public safety along Highway 1 in the event of evacuation, through reduction of hazardous fuels.

RECOMMENDATION #11: The FVRD should work with the Ministry of Transportation and Infrastructure (MOTI), to assess high hazard fuel types (C-3 and M-1/2) along Hwy 1 and reduce hazardous fuels within 100 m of either side of the road, where possible, with consideration of private land and topographic constraints. This is to increase public safety by improving emergency access in the event of an evacuation or wildfire event.

5.1.1 Proposed Treatment Units

Funding opportunities from UBCM under the CRI Program will consider fire prevention activities on provincial Crown land, local government and reserve land[77]. Fire prevention activities on private land that may be funded under this program are related to FireSmart activities (including FireSmart planning and assessments, local rebate programs for completion of eligible FireSmart activities, and provision of off-site disposal of vegetation management debris), subject to program requirements. This does not preclude other current and future funding opportunities or potential industrial partnerships and changes to existing programs.

The potential treatment area represents moderate, high or extreme fire hazard areas which are close to values at risk (structures, infrastructure, or areas of high use during the fire season) and are located on provincial Crown land. It should be noted that the location of the proposed treatment unit on these land ownership types does not imply that high and extreme hazard areas do not exist on private land within the AOI. As stated in Section 5.1, mitigation approaches should also be pursued on private land where hazard exists, bearing in mind the different funding resources and objectives on these land types. Although the potential treatment area has been ground-truthed during field work, additional refinement of the polygon will be required at the time of prescription development. It will require detailed site-level assessment to stratify treatment areas (and areas of no treatment), identify values and constraints, and identify and engage all appropriate Provincial agencies, First Nations, and stakeholders. The recommended potential treatment area within the AOI is outlined in Table 10 and displayed in Map 7.

Fuel Treatment Types

The intent of establishing a fuel treatment is to modify fire behaviour and create a fire suppression option that is part of a multi-barrier approach to reduce the risk to values (e.g., structures). A fuel break in and of itself is unlikely to stop a fire under most conditions. The application of appropriate suppression tactics in a timely manner with sufficient resources, is essential for a fuel break to be effective. Lofting of embers (i.e., "spotting") over and across a fuel break is a possibility (increasing with more volatile fuel

[77]This new funding program (up to $50 million over three years) was initiated in 2018 as per recommendations from the 2017 BC Flood and Wildfire Review Report by Abbott and Chapman (https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/bc-flood-and-wildfire-review-addressing-the-new-normal-21st-century-disaster-management-in-bc-web.pdf). Program details are available on the UBCM's website: https://www.ubcm.ca/EN/main/funding/lgps/community-resiliency-investment.html

types and fire weather) and has the potential to create spot fires beyond the fuel break that can expand in size and threaten values at risk, or land directly on or near structures and ignite them. To address spotting, fuels between the fuel break and the values at risk should be evaluated and treated to create conditions where extinguishment of spot fires is possible and FireSmart Standards should be applied to structures and associated vegetation and other fuel to reduce the risk of structures igniting. Fuel treatments require periodic maintenance to retain their effectiveness.

Primary Fuel Break

Primary fuel breaks are located on Crown land in strategic locations beyond the interface fuel treatments. They are designed to modify fire behaviour and create fire suppression options that reduce the risk of a crown fire reaching a community and/or adjacent private lands. 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 have sufficient width and appropriate fuel reduction measures to break the crown fire threshold and reduce fire intensity such that overstory fire moves to the ground surface and spread rates are reduced. Fuel breaks should be designed to take advantage of natural and man-made fire resilient features and topography to enhance effectiveness. Surface fire spread across, and spotting over the fuel break are both concerns, and depend on the application of suppression resources to be effective. No primary fuel breaks have been recommended due to the lack of opportunities within the AOI, which primarily relate to the orientation of valleys, the location of roads, the position of communities within the AOI (valley bottom), and the predominant wind direction during the fire season.

Interface Fuel Breaks/Treatments

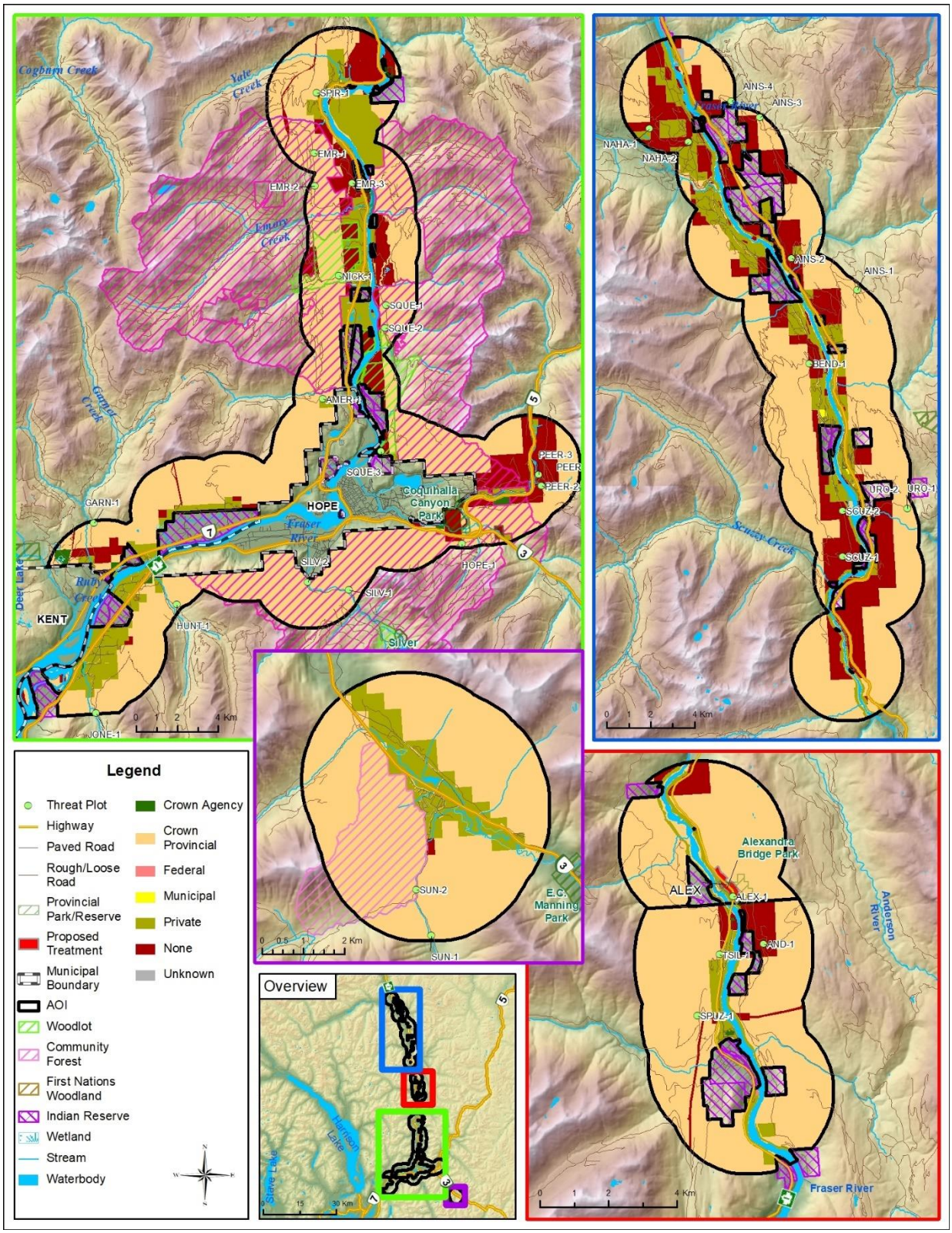
Fuel breaks on Crown Land immediately adjacent to values are termed 'interface fuel treatments'. These are designed to modify fire behaviour, create fire suppression options, and improve suppression outcomes. Interface fuel treatments are relatively small and when treated with appropriate fuel reduction measures, can break the crown fire threshold and reduce the risk of a crown fire reaching values at risk. Treatment widths can be varied to allow for alignment and to take advantage of natural and man-made fire resilient features that enhance effectiveness. Surface fire spread across the fuel treatment and spotting across the fuel treatment, are both concerns and rely on suppression actions to be effective.

RECOMMENDATION #12: Proceed with detailed assessment, prescription development and treatment of the unit identified in this CWPP.

RECOMMENDATION #13: Develop a rationale for alternative stocking standards applicable to the FVRD, by employing a qualified wildfire management professional, and in consultation with the Wildfire Prevention Officer (Coastal Fire Centre) and MFLNRORD. Engage partners such as woodlot and/or other licensees to apply the MFLNRORD approved reduced fire management stocking standards in the FVRD Zone A wildland urban interface to reduce interface wildfire threat. These standards should take into consideration other values in the interface, such as provision of water, wildlife habitat, etc.

Table 10. Proposed Treatment Area Summary Table.

FTU # and Name	Geographic Area	Priority	Total Area (ha)	Treatment Unit Type/ Objective	Local Fire Threat (ha)			Overlapping Values/Treatment Constraints*	Treatment Rationale
					Extreme/ High	Mod	Low		
1 ALEX	Alexandra Bridge Provincial Park	Moderate	27.7	Interface Fuel Break	19.1	2.7	5.9	This fuel treatment unit (FTU) lies partially within Alexandra Bridge Provincial Park. BC Parks should be consulted at the beginning of the prescription development process to ensure that the fuel management can be approved within the park. This FTU also overlaps a Reserve/Notation Tenure (Section 16 Reserve) for quarrying and a utility right-of-way. Furthermore, a portion of the FTU also overlaps a conditional harvest zone ungulate winter range polygon for mule deer, a guide outfitter area, and a trapline boundary. MFLNRORD, relevant tenure holders, and a habitat biologist should be consulted during the prescription development phase and prior to implementation to ensure all concerns are addressed.	Treatment area is located on an important access/egress route (Highway 1) and is highly used area during the fire season due to the popularity of Alexandra Bridge Provincial Park. This area has been recommended for treatment due to its high recreational use and the presence of hazardous fuels. The stands characteristic of this area are primarily typed as C-3, C-5, and C-7 fuel types with moderate to high stand densities, high fine and medium woody fuel levels present throughout, and scattered ladder fuels. The combination of these factors lends to potential for crown fire behavior and high potential surface fire intensity.



Map 7. Proposed and Past Fuel Treatments.

5.1.2 Maintenance of Previously Treated Areas

As no fuel treatments have occurred within the FVRD Zone A AOI, maintenance activities of previously treated areas are not applicable. However, if fuel treatments occur in the FVRD in the future, maintenance activities such as removing standing dead, reducing surface fuels, or additional thinning (overstorey reduction and thinning suppressed conifers or conifer regeneration) should occur as needed to maintain the effectiveness of these treatments. The return interval for maintenance activities depends upon site productivity and the type and intensity of treatment. Less productive areas can likely withstand a longer frequency between maintenance activities, while more productive areas would require treatments more often.

RECOMMENDATION #14: If and when operational fuel treatments are conducted within the AOI, treatment monitoring should be completed by a qualified professional in order to schedule the next set of maintenance activities (5 – 10 years out). This can be completed with a CWPP update or as a stand-alone exercise.

5.2 FIRESMART PLANNING AND ACTIVITIES

This section provides detail on: 1) the current level of FireSmart implementation and uptake within the community; 2) identified FireSmart subdivisions and/or acceptance into the FireSmart Canada Community Recognition Program (FSCCRP); and 3) recommended potential FireSmart activities that can be applied within the AOI at a future date.

5.2.1 FireSmart Goals and Objectives

FireSmart® is the comprehensive nationally accepted set of principles, practices and programs for reducing losses from wildfire.[78] FireSmart spans the disciplines of hazard/threat assessment; regional planning and collaboration; policy and regulations; public communication and education; vegetation/fuel management; training and equipment; and, emergency preparedness and response. FireSmart concepts provide a sound framework for advancing the goal of wildfire loss reduction, as it is a common goal shared with CWPPs.

The FireSmart approach and concepts, including recommended FireSmart guidelines[79], have been formally adopted by almost all Canadian provinces and territories, including British Columbia in 2000; FireSmart has become the de facto Canadian standard. FireSmart is founded in standards published by the National Fire Protection Association (NFPA). The objective of FireSmart is to help homeowners, neighbourhoods, whole communities and agencies with fire protection and public safety mandates to work together to prepare for the threat of wildfire in the WUI. Coordinated efforts between all levels of planning and action are integral to effectively and efficiently reducing the risk to communities. Solutions

[78] FireSmart is the registered trademark held by the Partners in Protection Association.

[79] FireSmart guidelines first published in the 1999 manual "*FireSmart: Protecting Your Community from Wildfire*", with a second edition published in 2003. The most recent "*FireSmart Begins at Home Manual*" is available at https://firesmartcanada.ca/resources/. The "*British Columbia FireSmart Begins at Home Manual*" provides detailed guidance and is available at BC FireSmart: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/firesmart

are required at all scales from individual backyards, to communities and the wider landscape. In order to succeed, these efforts must be integrated across the mosaic of land ownership (Figure 5). The highest level of planning within the FireSmart program is strategic direction, such as that provided in CWPPs.

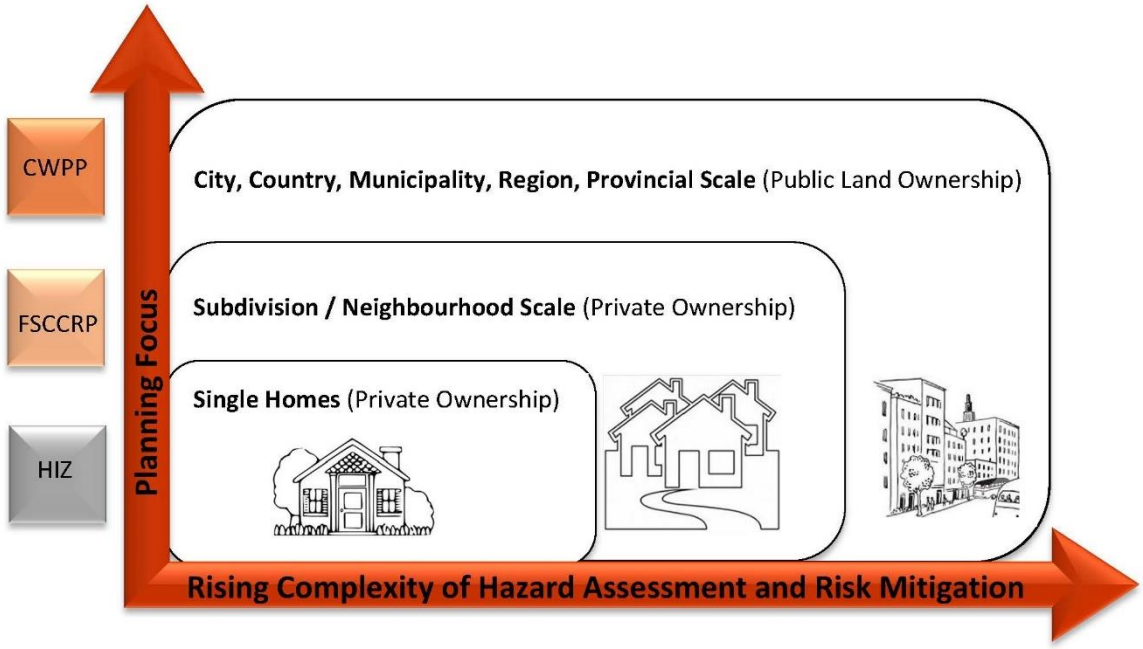


Figure 2. Diagram of the various, coordinated levels of the FireSmart program.[80] FSCCRP: FireSmart Canada Community Recognition Program, HIZ: Home Ignition Zone.

The overarching goal of FireSmart is to encourage communities and citizens to adopt and conduct FireSmart practices to mitigate the negative impacts of wildfire to assets on public and private property. While responsibility for effectively mitigating hazards must be shared between many entities including homeowners, industry, businesses and governments;[81] the ultimate root of the WUI interface problem is the vulnerability of structures and homes to ignition during wildfire events, in particular vulnerability to embers. This leads to an emphasis on risk mitigations on private properties. Findings from an investigation of how homes survived and ignited during the Fort McMurray 2016 Horse River wildfire, indicate that the vast majority of initial home ignitions in the WUI were caused by embers rather than direct contact by flames or radiant heat.[82] Surviving homes in both urban and rural areas exhibited many attributes of FireSmart principles, regardless of the broader wildfire threat surrounding them.[82]

[80]Figure and content developed by A. Westhaver. Adapted by A. Duszynska, 2017.

[81]https://www.firesmartcanada.ca

[82]Westhaver, A. 2017. Why some homes survived: Learning from the Fort McMurray wildland/urban interface fire disaster. Institute for Catastrophic Loss Reduction (ICLR) research paper series – number 56.

The goal of FireSmart with respect to private properties is to encourage homeowners to implement FireSmart practices to reduce damages to their property and minimize the hazards associated with wildfire. These FireSmart practices should aim to accomplish the following:

- "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 fuel adjacent and nearby to structures to reduce the probability of ignition from radiant heat, direct flame contact and ember transport
- Implement measures to structures and assets that reduce the probability of ignition and loss"[83]

Home Ignition Zone

Multiple studies (including the previously referenced recent Fort McMurray WUI fire investigation) have shown that the principal factors regarding home loss to wildfire are the structure's characteristics and immediate surroundings; the area that determines the ignition potential is referred to as the Home Ignition Zone (HIZ).[84,85]The HIZ includes the structure itself and four concentric, progressively wider Priority Zones. HIZ Priority Zones are based upon distance from structure: 0 to 1.5 m (Priority Zone 1a - fuel free zone), 0 – 10 m (Priority Zone 1), 10 – 30 m (Priority Zone 2), and 30 – 100 m (Priority Zone 3). These zones help to guide risk reduction activities, with Recommended FireSmart Guidelines being most stringent closest to the structure. The likelihood of home ignition is mostly determined by the area within 30 m of the structure (Priority Zones 1a, 1 and 2). Recommended FireSmart guidelines address a multitude of hazard factors within the HIZ: building materials and design; vegetation (native or landscaped materials); and the presence of flammable objects, debris, and vulnerable ignition sites. More detail on priority zones can be found in the FireSmart Manual[86].

It has been found that, during extreme wildfire events, most home destruction has been a result of low-intensity surface fire flame exposures, usually ignited by embers. Firebrands can be transported long distances ahead of the wildfire, across fire guards and fuel breaks, and accumulate within the HIZ in densities that can exceed 600 embers per square meter. Combustible materials found within the HIZ combine to provide fire pathways allowing spot surface fires ignited by embers to spread and carry flames or smoldering fire into contact with structures.

Because ignitability of the HIZ is the main factor driving structure loss, the intensity and rate of spread of wildland fires beyond the community has not been found to necessarily correspond to loss potential. For example, FireSmart homes with low ignitability may survive high-intensity fires, whereas highly

[83]Community Resiliency Investment Program. 2018. Community Wildfire Protection Plan Template.

[84] Reinhardt, E., R. Keane, D. Calkin, J. Cohen. 2008. Objectives and considerations for wildland fuel treatment in forested ecosystems of the interior western United States. Forest Ecology and Management 256:1997 - 2006.

[85] Cohen, J. Preventing Disaster Home Ignitability in the Wildland-urban Interface. Journal of Forestry. p 15 - 21.

[86]https://firesmartcanada.ca/ and https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/firesmart

ignitable homes may be destroyed during lower intensity surface fire events.[85] Increasing ignition resistance would reduce the number of homes simultaneously on fire; extreme wildfire conditions do not necessarily result in WUI fire disasters.[87] It is for this reason that the key to reducing WUI fire structure loss is to reduce home ignitability; mitigation responsibility must be centered on homeowners. Risk communication, education on the range of available activities, and prioritization of activities should help homeowners to feel empowered to complete simple risk reduction activities on their property.

FireSmart Canada Community Recognition Program

In the case of adjacent homes with overlapping HIZs, a neighbourhood (or subdivision) approach can be an effective method of reducing ignition potential for all homes within the neighbourhood. The FireSmart Canada Community Recognition Program (FSCCR Program) is an 8-step resident-led program facilitated by trained Local FireSmart Representatives designed for this purpose. It provides groups of residents with critical information and a means of organizing themselves to progressively alter hazardous conditions within their neighbourhood. The program also facilitates FireSmart knowledge and practices to quickly filter downwards onto the property of individual residents to further mitigate wildfire hazards at the single-home scale within the HIZ.

WUI Disaster Sequence

Calkin et.al. (2014) coined the 'WUI disaster sequence', a six-step sequence which has been used to describe the situation in which the firefighting capacity of a community is overwhelmed by wildland/interface fires in highly ignitable communities: 1) extreme wildfire behaviour weather combined with, 2) a fire start, which 3) exposes numerous homes with high ignition potential, and results in numerous structures burning, 4) overwhelms suppression efforts and capabilities, and 5) leads to unprotected homes, and therefore 6) considerable structure loss (Figure 3).

Once multiple homes are ignited in an urban area, there is increasing potential for fire to spread from structure to structure, independently of the wildland vegetation. This is known as an urban conflagration. Effective fire protection depends on ignition resistant homes and properties during extreme wildfire events.[88] Figure 3 illustrates that it is possible to break up the disaster sequence by decreasing the number of highly ignitable homes exposed to embers, therefore reducing the number of homes ignited and removing the consequences of multiple structures lost.

Overall, FireSmart leads to communities that are better adapted to wildfire, more resilient and able to recover following wildfires by sustaining fewer losses and disruption, and safer places to live and recreate. Action by homeowners is the number one priority for reducing structure loss in the event of a WUI fire, but the overall adaptation of the community to wildfire is multi-pronged and the landscape should not be ignored.[88]

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[87]Calkin, D., J. Cohen, M. Finney, M. Thompson. 2014. *How risk management can prevent future wildfire disasters in the wildland-urban interface*. Proc Natl Acad Sci U.S.A. Jan 14; 111(2): 746-751. Accessed online 1 June, 2016 at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3896199/.

[88]Calkin, D., J. Cohen, M. Finney, M. Thompson. "*How risk management can prevent future wildfire"*

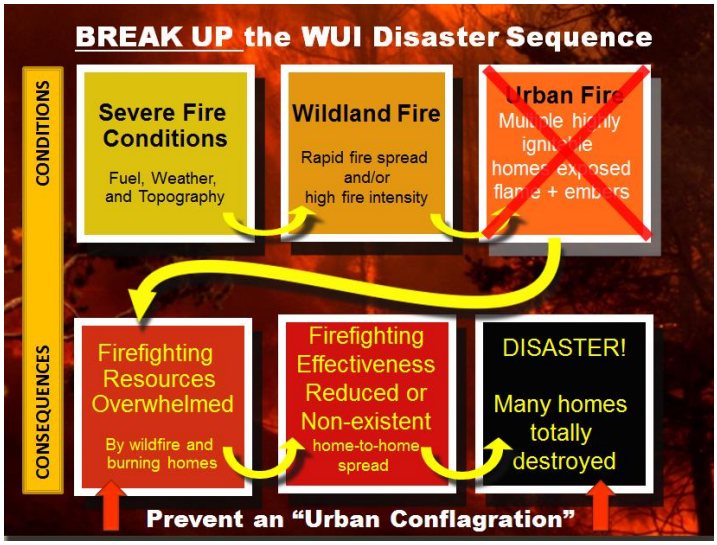


Figure 3. Wildland/urban interface disaster sequence.[89] It is possible to break up the disaster sequence by decreasing the number of highly ignitable homes exposed to embers, therefore reducing the number of homes ignited and removing the consequences of multiple structures lost.

5.2.2 Key Aspects of FireSmart for Local Governments

Reducing the fire risk profile of a community through FireSmart implementation requires coordinated action from elected officials, local government planners, developers, private land owners and industrial managers. This section presents various options of FireSmart practices, which when enacted, provide avenues for reducing fire risk within the community. An evaluation of the current level of FireSmart implementation within the FVRD Zone A is also presented in this section.

Education

Communicating effectively is a key aspect of any education strategy. Communication materials must be audience specific and delivered in a format and through mediums that reach the target audience. Audiences should include home and landowners, students, local businesses, elected officials, FVRD staff, and local utilities providers. Education and communication messages should be simple yet comprehensive. A basic level of background information is required to enable a solid understanding of fire risk issues and the level of complexity and detail of the message should be specific to the target audience.

FireSmart information material is readily available and simple for municipalities to disseminate. It provides concise and easy-to-use guidance that allows homeowners to evaluate their homes and take measures to reduce fire risk. However, the information needs to be supported by locally relevant information that illustrates the vulnerability of individual houses to wildfire.

The FVRD has undertaken some public education outreach in the community and online. These can be expanded upon and/or adapted to further enhance wildfire preparedness and education. The FVRD should consider developing a school fire education program to include an element of wildfire

[89]Graphic adapted from Calkin et. al, by A. Westhaver.

preparedness education to be presented annually in elementary or high schools. Programming could include volunteer/advocacy work from professional foresters, wildland firefighters or prevention officers, and FVRD staff. FireSmart BC has created an education package,[90] developed for four age groups from kindergarten to grade 12, which can be used to guide education programs in the community. The FVRD should consider holding a wildland specific Fire Prevention Day or Week, or similarly formatted event, in the spring prior to the wildfire season. Timely educational materials to increase preparedness would be most effective immediately prior to the fire season.

A full list of recommendations pertaining to the Communication and Education strategy is presented in Section 5.3.

Planning and Development Considerations

Municipal policies and bylaws are tools available to mitigate wildfire risk to a community. It is recognized that, to be successful, all levels of government (municipal, provincial, and federal) and individual landowners need to work together to successfully reduce their risk. To that end, local government can use a range of policy tools and practices to help the community to incrementally increase FireSmart compliance over the mid-term (5 – 20 years) and therefore play a role in reducing the chance of structure loss from wildfire.

The planning objectives/considerations for FVRD Zone A are:

- To include wildfire considerations in the planning and acquisition strategy for parks and recreational areas.
- To develop policies and practices for FireSmart design and maintenance of publicly owned land such as community parks and open spaces and publicly owned buildings.
- To conduct FireSmart and/or risk assessments of publicly owned lands and buildings to inform planning for prevention and mitigation activities, as required.

FireSmart policies and practices can be incorporated in various aspects of development design, zoning and permitting to reduce wildfire hazard on private land and in the communities at large. The development objectives/considerations for the FVRD Zone Aare:

- To utilize regulatory and administrative tools to reduce wildfire hazard on private land and increase number of homes compliant with FireSmart guidelines (with low ignition potential).
- To ensure higher level planning and regulation (i.e., OCP and/or land use, engineering and public works bylaws) incorporate FireSmart policies, as applicable, to reduce wildfire hazard in vulnerable WUI neighbourhoods, and include measures that address wildfire prevention and suppression in subdivision design.

[90] British Columbia Fire Smart. Education Box Resource Manual. Available from https://firesmartbc.ca/wp-content/uploads/2019/04/FireSmart-BC-Education-Package-KinderSmart.pdf

- To ensure multiple departments (including fire departments and/or emergency management staff) are included in the referral process for new developments.

FireSmart Vegetation Management

Some examples of actionable items for the FVRD Zone A with regards to vegetation or fuel management and the FireSmart approach include: 1) policy development and implementation of FireSmart maintenance for community parks and open spaces (as per planning considerations discussed above); and 2) provision of incentives (i.e., a local rebate program) and/or collection services for private landowners with a focus on pruning, yard and thinning debris (as per FireSmart activities for private land discussed below).

The FVRD has not yet engaged in a proactive vegetation management strategy, targeting high-use areas near values at risk, within and immediately adjacent to developed areas. The FVRD does not currently enforce FireSmart landscaping requirements or constrain development based on wildfire hazard. Considerations for vegetation management and maintenance scheduling are provided in section 5.1.2.

RECOMMENDATION #15: Develop a landscaping standard which lists flammable non-compliant vegetation and landscaping materials, non-flammable drought and pest resistant alternatives, and tips on landscape design to reduce maintenance, watering requirements, avoid wildlife attractants, and reduce wildfire hazard.

RECOMMENDATION #16: Consider engaging the development/building community (may include developers, builders, landscapers, and architects) in FireSmart planning. This can be accomplished through a series of workshops/informational sessions to: 1) increase awareness of wildfire risk, 2) demonstrate that there are a variety of actions which can be undertaken to immediately and measurable reduce the risk to the homeowner and community, and 3) discuss various strategies and actions which could be implemented to meet wildfire mitigation objectives.

Additional recommendations for amendments to policies and bylaws were discussed fully in Section 2.5.3.

Subdivision Design or New Development

Subdivision design should include consideration to decrease the overall threat of wildfire. Aspects of subdivision design that influence wildfire risk are access, water pressure and hydrant locations. The number of access points and the width of streets and cul-de-sacs determine the safety and efficiency of evacuation and emergency response. In the communities and/or developed areas within the FVRD Zone A, on-street parking can contribute hazards on narrow or dead-end roads, which are already unlikely to have a high capacity under heavy smoke conditions.[91] When the time for evacuation is limited, poor

[91] Cova, T. J. 2005. Public safety in the wildland-urban interface: Should fire-prone communities have a maximum occupancy? Natural Hazards Review. 6:99-109.

access has contributed to deaths associated with entrapments and vehicle collisions during wildfires.[92] Methodologies for access design at the subdivision level can provide tools that help manage the volume of cars that need to egress an area within a given period of time.[91]

For new development in rural settings where hydrants are limited or unavailable (or it is otherwise determined by the FVRD that adequate or reliable water supply systems may not exist), the NFPA 1142 can be used to help determine minimum requirements for alternative water supply (natural or artificial). Alternative water sources, such as dry hydrant systems, water usage agreements for accessing water on private land, cisterns or other underground storage, etc., should be reviewed by the FVRD and the fire departments prior to development approval.

Increasing Local Capacity – Interagency Cooperation, Emergency Planning and Cross Training

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

- Development and/or maintenance of Structural Protection Units (SPUs) which can be deployed in the event of a WUI fire;
- Conducting a comprehensive review of Emergency Management BC SPU deployment procedures for the purpose of fighting interface fires;
- Provision of sprinkler kits to community residents (at a cost);
- Engagement in annual cross-training exercises with adjacent fire departments and/or BCWS in order to increase both local and regional emergency preparedness with regards to structural fire and wildfire training;
- Participation in cross-jurisdictional tabletop exercises and seasonal readiness meetings;
- Development and/or participation in regional or multi-agency fire or fuel management tables (i.e., interface steering committee or wildfire working group) to facilitate communication and co-operation between groups and agencies responsible for wildfire preparation and response;
- Provision of training and/or professional development for Local FireSmart Representatives, community champions to increase capacity for FireSmart activities.

A detailed account of current local capacity for the FVRD Zone A and recommendations to address gaps is provided in Section 5.3.

FireSmart Demonstration Projects

FireSmart demonstration projects for publicly owned buildings or public and provincially owned critical infrastructure (as identified in Section 3.2) can display the practices and principles of FireSmart to the public. This may be in the form of replacing building materials with fire resistant materials, replacing landscaping with fire-resistant plants, and demonstrating HIZ fuel treatments. Ideally, these projects would include elements of public education (signage, public tours, active demonstrations of operations, etc.). Appropriate/candidate FireSmart demonstration projects may be identified by the FVRD in

[92] De Ronde, C. 2002. Wildland fire-related fatalities in South Africa – A 1994 case study and looking back at the year 2001. Forest Fire Research & Wildland Fire Safety, Viegas (ed.), http://www.fire.uni-freiburg.de/GlobalNetworks/Africa/Wildland.cdr.pdf

consultation with local government and based on assessment by internal trained Local FireSmart Representatives or external Local FireSmart Representative consultant.

RECOMMENDATION #17: Following FireSmart assessments of critical infrastructure, the FVRD should apply for FireSmart demonstration grants through the Community Resiliency Investment (CRI) Program. This type of project can display the practices and principles of FireSmart activities to the public in the form of demonstration treatments. FireSmart demonstration projects are beneficial in that they meet the dual objectives of enhancing public education of wildfire mitigation and FireSmart principles (through signage, community work days, public tours, active demonstrations of operations, etc.) and improving the resilience of a structure to wildfire.

FireSmart Activities for Private Land

The best approach to mitigate fuels on private lands is to urge private landowners to comply with FireSmart guidelines and to conduct appropriate fuel modifications using their own resources (CRI program funding may be available subject to current funding requirements). The FVRD can facilitate uptake within communities by: 1) supporting and/or facilitating planning for private land (with property owners' consent); 2) offering local rebate programs to homeowners on private land and First Nations land who complete eligible FireSmart activities on their properties; and as previously indicated (FireSmart vegetation management), 3) providing off-site debris disposal for private landowners who undertake their own vegetation management (with a focus on pruning, yard and thinning debris). Off-site debris disposal options include providing a dumpster, chipper or other collection method; providing curbside debris pick-up; and waiving tipping fees). Planning for private land may include developing FireSmart Community Plans for identified areas (i.e., a WUI neighbourhood, community, subdivision) and conducting FireSmart home and property assessments.

RECOMMENDATION #18: Develop and implement a community chipper program with the help of neighbourhood representatives and community groups. As a demonstration, this program can begin twice per year in two separate neighbourhoods. This program can also be implemented in conjunction with community clean-up days.

RECOMMENDATION #19: Apply for funding from the UBCM CRI Program to develop a local FireSmart rebate program. This will allow homeowners to access partial rebates for FireSmart activities on their properties if rated as moderate, high or extreme risk in a FireSmart home and property assessment. The rebate program must adhere to the goals of FireSmart, as outlined in Section 5.2.1.

FireSmart Compliance within the Area of Interest

There is a wide range of FireSmart compliance on private properties in the AOI. There are large differences in the degree to which FireSmart best practices are visible within individual HIZs, and in neighbourhoods throughout communities in the FVRD Zone A. Landscaping in the AOI is also in a range of FireSmart compliance. Generally speaking, many homes in interface areas do not maintain 10 m of defensible space between property footprints and surrounding forested areas. Accumulations of conifer foliage in roof corners and gutters, and storage of combustible items under decks, carports, and other horizontal surfaces was not uncommon. On the other hand, many residences are surrounded by lawn,

agricultural fields, and/or 10 m defensible space, all of which are FireSmart compliant. Aside from differing levels of awareness, understanding and acceptance of recommended FireSmart guidelines by residential and commercial property owners, there are a number of other factors that add variability to the level of FireSmart compliance within the AOI. Ultimately, these also impact the vulnerability of structures and the amount of effort required to achieve a FireSmart rating for individual homes, neighbourhoods or the communities as a whole. These factors include but are not limited to: the age of homes or subdivision; prevailing design features and favored building materials of the era; proximity to forested area (both on private land and adjacent Crown land); density, lot size and lay-out of the subdivision; positioning of the home or neighbourhood in relation to slope, aspect and prevailing winds; and the stage and maturity of landscaping.

Neighbourhoods in the FVRD Zone A AOI were unofficially surveyed during field work. The following observations were made:

- Wildfire hazard levels range from moderate to high across neighbourhoods within the AOI;
- The bulk of hazards are associated with conditions of natural and landscaped vegetation immediately surrounding residential properties;
- For new development, where landscaping is not yet completed, educational approaches may aid in promoting fire resistant landscaping options and achieving defensible space in the HIZ;
- Hazards are magnified in some neighbourhoods due to distance from nearest water supply or fire hydrant location; and,
- All neighbourhoods have good opportunities to mitigate risk through individual and collective action.

RECOMMENDATION #20: The FVRD should hire a qualified professional (QP) or consider training local fire services staff members as Local FireSmart Representatives to assist the various communities in complying with FireSmart principles at the neighbourhood and individual home-level.

5.2.3 Priority Areas within the AOI for FireSmart

This section identifies priority areas within the AOI that would benefit from FireSmart planning and activities.

These priorities are based on general field observations and input from the FVRD and are not based on a scientific sample or formal data collection. Recommended FireSmart activities are essentially the same for each neighbourhood or area; however, it is recommended that the FVRD prioritize the neighbourhoods in

Table 11. In addition, every neighbourhood within the AOI should continue to improve upon existing FireSmart activities and equally participate in the FVRD's FireSmart program.

Table 11. Summary of FireSmart Priority Areas.

Area	FireSmart Y/N	FireSmart Canada Recognition Received Y/N	Recommended FireSmart Activities
Priority Area #1: Sunshine Valley	N	N	The following is a non-extensive list of FireSmart activities for which the FVRD can engage suggested neighbourhood residents: 1) Provide guidance to ensure landscaping is to an established FireSmart standard; 2) Incentivise private landowners to engage in retrofitting homes with building materials and design based on NFPA 1144 or FireSmart standards; 3) Encourage prompt removal of combustible construction materials or yard waste from private properties; and 4) Coordinate monthly or bi-monthly yard waste removal days prior to and during the fire season to reduce WUI fire hazard.
Priority Area #2: Nahatlatch rural residences	N	N	
Priority Area #3: Chaumox	N	N	
Priority Area #4: Yale, residences north of Highway 1	N	N	
Priority Area #5: Canyon Alpine	N	N	
Priority Area #6: Boston Bar, residences on east side of Highway 1	N	N	
Priority Area #7: Dogwood Valley	N	N	
Priority Area #8: Blue Lake Resort	N	N	
Priority Area #9: Othello	N	N	
Priority Area #10: Critical infrastructure	Y (partially)	N/A	Based on field observations, most critical infrastructure has had some level of FireSmart setback from forested areas. Consider conducting frequent (2-3 years) maintenance treatments to ensure the wildfire risk does not reach higher than moderate. It is recommended that fuel treatments be considered for areas adjacent to critical infrastructure in order to bolster the effect of previous FireSmart treatments. FireSmart treatments may include thinning from below to reduce ladder fuels and crown fire potential, pruning of retained trees to 3 m, and reducing surface fuels. Additionally, consider adding regular brushing activities to the maintenance treatment schedule to control weeds and grasses around critical infrastructure.

5.3 COMMUNICATION AND EDUCATION

Establishing effective communications and actively engaging key stakeholders in risk reduction activities are keystones to building a FireSmart community. Without the support and involvement of residents, businesses, public officials, and industry, the efforts of public officials, fire departments, and others to reduce wildfire losses will be hindered. In many communities, there is a general lack of understanding about interface fire, the relationship between ignition potential and loss of homes, and the simple steps that can be taken to minimize risk on private land. In addition, public perceptions regarding responsibility for risk reduction and the ability of firefighters to safely intervene to protect homes during a wildfire are often underdeveloped or inaccurate.

Based on the consultation completed during the development of this Plan, it is evident that FVRD staff and some residents have a good level of awareness of interface fire risk and a strong level of commitment to continue to grow their awareness and understanding. However, field observations highlighted the need to further educate the community at large on what private landowners can do to build a FireSmart community and take personal responsibility for the ignition potential of their homes, businesses, lands, and neighbourhoods. Often, the risk of wildfire is at the forefront of public awareness during or after major wildfire events, whether close to home or further afield. The challenge is to retain this level of awareness beyond these times. The communication and education objectives for the FVRD are:

- To improve public understanding of fire risk and personal responsibility by increasing resident and property owner awareness of the wildfire threat in their community, to establish a sense of responsibility for risk mitigation among property owners, and to empower them to act;
- To enhance the awareness of, and participation by, elected officials and all WUI stakeholders regarding proactive WUI risk mitigation activities; and,
- To reduce or avoid ignitions from industrial sources.

Bringing organizations together to address wildfire issues that overlap physical, jurisdictional or organizational boundaries is a good way to help develop interagency structures and mechanisms to reduce wildfire risk. Engagement of various stakeholders can help with identifying valuable information about the landscape and help provide unique and local solutions to reducing wildfire risk. The FVRD should consider creating an Interface Steering Committee to coordinate wildfire risk reduction efforts. The steering committee could include First Nations and key stakeholders such as FVRD staff, BCWS, BC Parks, recreational groups/representatives, industrial operators, woodlot owners, and forest tenure license holders.

Moving from the CWPP to implementation of specific activities requires that the community is well informed of the reasons for, and the benefits of, specific mitigation activities. In order to have successful implementation, the following communication and public education recommendations are made:

RECOMMENDATION #21: This report and associated maps to be made publicly available through webpage, social media, and public FireSmart meetings. In addition, this CWPP should be shared with

local industry partners; in particular industrial forest companies who may be interested in collaborating on direct fuel management treatments or with other sections of this CWPP document.

RECOMMENDATION #22: Complete or schedule periodic updates of the CWPP to gauge progress and update the threat assessment (hazard mapping) for changes in fuels, forest health, land planning, stand structure or changes to infrastructure in the interface. The frequency of updates is highly dependent upon major changes which would impact the FVRD's wildfire threat assessment or the rate at which wildfire risk reduction efforts are implemented. An evaluation of major changes (including funding program changes that may lead to new opportunities) and the potential need for a CWPP update should be initiated every 5 - 7 years.

RECOMMENDATION #23: Develop a social media strategy and ensure that its full power is leveraged to communicate fire bans, high or extreme Fire Danger days, wildfire prevention initiatives and programs, easily implementable FireSmart activities, updates on current fires and associated air quality, road closures, and other real-time information in an accurate and timely manner.

RECOMMENDATION #24: Promote FireSmart approaches for wildfire risk reduction to FVRD residents through Town Hall meetings, workshops and/or presentations. Aim to conduct the engagement/promotion campaign prior and during the fire season. Consider supplying FireSmart materials to homeowners in the interface during these engagement campaigns.

RECOMMENDATION #25: Promote improved planning and preparedness of agriculture producers in the FVRD and encourage FireSmart practices on private farm land through distribution or sharing of wildfire action planning resources prepared specifically for the agriculture sector by the BC Agriculture & Food Climate Action Initiative (i.e., on FVRD website, mailouts). Resources include a Wildfire Preparedness and Mitigation Plan - Guide and Workbook.[93]

RECOMMENDATION #26: Work towards FireSmart community recognition, at the neighbourhood level and facilitate uptake into the FireSmart Canada Community Recognition Program (FSCCRP). This will help reduce fire risk and aid in further funding applications.

RECOMMENDATION #27: Facilitate the FSCCRP uptake within the FVRD Zone A and enhance its applications by including the following: 1) inviting BCWS crews to participate in and support the annual FireSmart events set up by participating neighbourhoods. 2) Encourage individual homeowner participants to complete the self-administered FireSmart home assessment tool. 3) Include within the FireSmart Canada Community Assessment Report the standard recommendation that participating neighbourhoods hold a home hazard assessment workshop as one of their FireSmart events.

RECOMMENDATION #28: Promote the use of the FireSmart Home Partners Program offered by the Partners in Protection Association, which facilitates voluntary FireSmart assessments on private property. Use the opportunity to educate the home or business owner about the hazards which exist on their property and provide easy improvements to reduce their risk.

[93] https://www.bcagclimateaction.ca/library/wildfire-preparedness/

RECOMMENDATION #29: Encourage schools to adopt and deploy existing school education programs to engage youth in wildfire management and risk reduction. There is emergency preparedness curriculum available provincially, including Master of Disaster and the FireSmart BC Education Package for kindergarten to grade 12 students. Other options/value-added activities include consulting with Association of BC Forest Professionals (ABCFP) and British Columbia Wildfire Service (BCWS) (Fraser Fire Zone), as well as local fire department and FireSmart representatives to facilitate and recruit volunteer teachers and experts to help with curriculum development to be delivered in elementary and/or secondary schools (field trips, guest speakers, etc.).

RECOMMENDATION #30: Develop and work with all key stakeholders (industrial operators, local First Nations, MFLNRORD, BCWS, recreational groups/representatives, FVRD staff) to formalize an Interface Steering Committee. The purpose of the steering committee would be to identify wildfire related issues in the area and to develop collaborative solutions to minimize wildfire risks. The following subject areas are recommended for the group to explore: 1) Development of large, landscape level fuel breaks; 2) Public education and awareness needs; 3) Multi-disciplinary, multi-jurisdictional fuel treatment projects/hazard abatement projects; 4) Development of a funding strategy; and 5) Reduction of human-caused fires, fire prevention and right of way management.

RECOMMENDATION #31: Work towards educating homeowners within areas outside of primary fire service areas located around town centres. It is common, especially in the case of second homeowners/vacation owners, for them to be unaware of the lack of fire services or response capabilities in their area (in the event they call 911).

RECOMMENDATION #32: Promote and provide information to private landowners related to residential sprinklers as a FireSmart prevention measure.

5.4 OTHER PREVENTION MEASURES

In addition to fuel treatment and community communication and education, fire prevention in the AOI is also addressed via the following avenues: 1) public display of danger class rating signs throughout the AOI, which should updated on a weekly basis; 2) fire ban alignment with provincial fire bans; 3) potential enforcement of restricted access to back country areas similar to provincial requirements; and 4) enforcement of local bylaws such as the Open Fire bylaw. The aforementioned activities are either currently being applied or have potential to be applied in order to reduce the potential and/or threat of wildfire ignitions within the AOI.

Risk of human-caused ignition within the AOI is not limited to private property owners and individual residents. Power lines and industrial activities pose a risk of ignition, particularly in areas where cured fuels or fuel accumulations exist. Vegetation maintenance under electric line right-of-ways is undertaken by BC Hydro; however, fuels accumulation under right-of-ways was still identified a safety concern by members of the Wildfire Working Group. There is currently no partnership with BC Hydro regarding right-of-way maintenance in the FVRD Zone A AOI.

Tree failures adjacent to power lines (transmission and distribution) are common occurrences and represent significant risks to ignition within the AOI. Railway operations also pose a risk of ignition, and represent a significant component of industrial activity within this AOI. Mechanisms of ignition may be related to the train operations themselves (exhaust emissions; overheated brake shoes or overheating while braking; and worn wheel bearings) or to track maintenance activities (rail grinding, cutting, or welding).[94] A cooperative approach for addressing the industrial area concerns must be undertaken by the FVRD and pertinent industrial partners.

RECOMMENDATION #33: Work with industrial operators such as BC Hydro, Canadian National Railway and Canadian Pacific Railway to advocate that high risk activities, such as grubbing/brushing, right-of-way mowing work, and rail grinding do not occur during high fire danger times to reduce chance of ignitions as per the *Wildfire Act* and *Regulation*.

RECOMMENDATION #34: Work with industrial operators (i.e., BC Hydro and railways) to advocate that rights-of-way do not contain fine fuel accumulations (easily cured) or high conifer regeneration prior to and during the fire season and are maintained in a low hazard state (to serve as fuel breaks).

SECTION 6: WILDFIRE RESPONSE RESOURCES

This section provides a high-level overview of the local government resources accessible for emergency response and preparedness use. In emergency situations when multiple fires are burning in different areas of the Province, resource availability may be scarce. Therefore, local government preparedness and resource availability are critical components of efficient wildfire prevention and planning. Deployment of provincial resources occurs as per the process detailed in the *Provincial Coordination Plan for Wildland Urban Interface Fires* document[95]. The aforementioned document establishes a protocol for collaborative and integrated emergency management in the event of WUI fires within British Columbia.

This section provides analysis of and recommendations for all fire departments whose response zones overlap the AOI, however, only some of these fire departments are under the jurisdiction of the FVRD. Discussion is focused on the fire departments the FVRD presently manages, with the exception of the Sunshine Valley volunteer fire department (VFD), which is a non-profit public safety society. The Sunshine Valley VFD is included because it is within the AOI, is not managed by any other regional district or municipality, and community planning is supported by the FVRD.

[94] Wildland Fires Resulting from Railway Operations - A Public Safety Threat. Railway Fire Prevention Task Team, Canadian Interagency Forest Fire Centre. 2007. Retrieved from: https://www.tc.gc.ca/media/documents/rsa-lsf/CIFFC.pdf

[95] Provincial Coordination Plan for Wildland Urban Interface Fires. 2016. Available online at: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/bc-provincial-coord-plan-for-wuifire_revised_july_2016.pdf

6.1 LOCAL GOVERNMENT AND FIRST NATION FIREFIGHTING RESOURCES

Firefighting efforts and effectiveness can be impacted by access to secondary power sources, water pressure and supply, and existing local government contingency plans. In the event of a wildfire emergency situation and loss of power, the FVRD has access to mobile diesel generators to power critical infrastructure such as the Fire Halls and the EOC. All FVRD water and wastewater sites have backup generators and the FVRD owns one mobile generator and has a contact which provides rentals 24/7. However, should a wide-scale outage occur, known vulnerabilities to secondary power sources include mechanical failure and potential fuel shortages. Although the local government has not identified any issues with water pressure within areas that have fire hydrant service, there are known limitations to water supply in areas with older private water systems, or for residents located outside of fire protection areas. Specific limitations of the FVRD water system with regards to wildfire suppression are detailed in Section 6.1.2.

Formal mutual aid agreements are in effect between the primary fire departments within the AOI, and in the event of a WUI fire emergency, these agreements are activated as required. WUI fire events may also lead to aid requests with BCWS.

6.1.1 Fire Department and Equipment

Fire protection within the AOI is primarily the responsibility of three volunteer fire departments (VFD): the Boston Bar/North Bend VFD; the Yale VFD; and the Sunshine Valley VFD. Additionally, portions of AOI outside of the Fire Protection Service areas of the three VFDs are serviced by the Agassiz (District of Kent), Hope (District Municipality of Hope) Fire Departments. During the summer, a BCWS initial attack crew is stationed in Boston Bar to assist the local fire department in case of a wildfire event.[96] The fire response zones for the Boston Bar VFD and the Yale VFD are mandated by the FVRD, however, the Sunshine Valley VFD is not. In total, the various Fire Service Areas (FSA) cover the entirety of the AOI, inclusive all major communities including First Nations Indian Reserves. However, many FSAs cover remote areas with poor access. As the primary responsibility of the VFDs is to protect structures within their respective communities, they can attend to these areas if the fire represents a threat to homes or businesses, however, BCWS is generally better equipped to action fires in remote locations. Table 12 provides an overview of the fire services capacity in the AOI, including fire department personnel and equipment.

Fire protection equipment includes both structural and some wildfire response gear. Personnel are almost exclusively volunteer. Several key concerns about primary fire department capacity were expressed by Wildfire Working Group members. The Boston Bar VFD is one of the smallest in the province[97] and low numbers and attrition are a significant challenge to providing service in this FSA. The Boston Bar VFD has full structural response capabilities, and is in the process of acquiring some wildfire

[96]Personal communication, BCWS. December 19, 2019.
[97]Personal communication. BCWS, Jordan Struthers. December 17, 2019.

personal protective equipment (PPE); however, financial constraints have affected the ability of the Boston Bar VFD to update other older equipment. In Yale and Sunshine Valley, attrition of VFD members and ability to respond to daytime calls due to employment commitments, are significant challenges to providing service. Yale VFD also has full structural capabilities, and is acquiring wildfire PPE; at the time of writing, Yale VFD anticipates receiving a new engine in the coming year. Sunshine Valley VFD possesses both wildfire and structure firefighting equipment, but requires an additional tender in order to fulfill the Superior Tanker Shuttle Service Requirements of the Fire Underwriters Survey.

Table 12. Fire department capacity and equipment within the AOI.

Fire Service Areas*	Fire Department	Number of Stations	Number of Members	Apparatus type and number
Boston Bar Hall 1, Electoral Area A	Boston Bar/ North Bend Volunteer Fire Department	2	12 volunteer firefighters	2 Engines, 1 Tender, 1 Squad
Yale Hall 1, Electoral Area B Yale	Yale Volunteer Fire Department	2	19 volunteer firefighters	2 Engines, 1 Tender
Sunshine Valley	Sunshine Valley Volunteer Fire Department	1	20 volunteer firefighters	2 Engines, 1 Rescue, 1 Tender
Agassiz Zone 4, Agassiz Rural, Agassiz Deer Lake	Agassiz Fire Department	1	2 career; up to 30 paid on-call firefighters	1 Utility (crew cab), 2 Engines, 1 Tender shuttle, 2 Rescue, and wildfire equipment (water bladders, portable pumps, hand tools, forestry hose, and saws).
Hope Hall 2, Hope Hall 3, Hwy 7 Hope, East Hope, Peters IR 1	Hope Fire Department	3	1 paid Fire Chief; 25 paid on-call firefighters	3 Engines, 2 Tenders, a CAFS Squad, 1 Command, and Incident Support Unit.

*FSAs that are the primary responsibility of the local VFDs (i.e., directly surrounding major communities) are indicated in **bold** text.

Within the AOI, there are both formal and informal mutual aid agreements in place between all VFDs that are utilized on a regular basis. The Boston Bar and Yale VFDs are both regional district departments and a mutual aid agreement between these two VFDs is in place. A mutual aid agreement between the Hope FD, outside the AOI, and Yale VFD also exists. A mutual aid agreement between Hope, Yale, and Boston Bar is in preliminary stages but is not yet finalized.

Members of the primary fire departments within the AOI undergo training focused on structural firefighting, about once per year. Boston Bar VFD and the Yale VFD both have trainers to complete the structure protection program wildland firefighter training (SPP-WFF1). The Yale VFD re-trains this program annually, and incorporates interface scenarios into regular training exercises. The Boston Bar VFD expressed that the travel distance required to complete external training, or for external instructors

to come and teach, is a significant barrier in staying up-to-date with courses. The Sunshine Valley VFD has a junior firefighter work experience program which has operated since 2018, but this has not been implemented in any of the other VFDs in the AOI.

The level of cross-training and working relationship with MFLNRORD's BCWS is also variable by fire department. In Hope, there are frequent (weekly) interactions between BCWS and the municipal fire department, and cross-training at least every two years. There is an established relationship with the Yale fire department but no reports of cross-training activity. There are no reports of recent interagency training with the Boston Bar VFD, however, a BCWS initial attack crew is stationed in the community during the fire season. In the Sunshine Valley, there are meetings and cross-training events on a 3 to 5 year cycle.[98] BCWS rotates through all communities within the AOI and provides training and services to communities that are most in need. Annual training occurs with select municipalities yearly on a as needed basis.[99]

It is recommended that all fire services members within the FVRD Zone A AOI have at a minimum S100 and/or SPP-WFF1 (or equivalent), and that the fire department members engage in yearly practical wildland fire training with BCWS that covers at a minimum: pump, hose, hydrant, air tanker awareness, and employment of SPUs. The aforementioned cross-training opportunity could include, for example, a joint wildfire simulation exercise. This level of training would improve the local fire departments' commitment to wildfire preparedness.

Limited information was available for call-outs for fire departments within the AOI. The Sunshine Valley VFD had the highest number of call-outs to date in 2018, five of which were wildland fires. The majority of call-outs in 2018 were related to motor vehicle accidents or medical incidences.

6.1.2 Water Availability for Wildfire Suppression

Water is the single most important suppression resource. In an emergency response scenario, it is critical that a sufficient water supply be available. The Fire Underwriters Survey summarizes their recommendations regarding water works systems fire protection requirements, in *Water Supply for Public Fire Protection* (1999).[100] Some key points from this document include the need for:

- Duplication of system parts in case of breakdowns during an emergency;
- Adequate water storage facilities;
- Distributed hydrants, including hydrants at the ends of dead-end streets;
- Piping that is correctly installed and in good condition; and

[98] Personal communication. BCWS. December 17, 2019.
[99] Personal communication. BCWS, Jordan Struthers. December 17, 2019.
[100] http://www.scm-rms.ca/docs/Fire%20Underwriters%20Survey%20-%201999%20Water%20Supply%20for%20Public%20Fire%20Protection.pdf

- Water works planning should always take worst-case-scenarios into consideration. The water system should be able to serve more than one major fire simultaneously, especially in larger urban centers.

Water service within the FVRD Zone A is an important component of emergency response for a wildland urban interface fire in the event of a large-scale emergency, and in particular for structural fires. As previously noted in Sections 3.2.3 and 3.3.1, water systems are supplied by both groundwater and surface sources. Currently, water systems meet usage demand, except in the Sunshine Valley. In this case Wildfire Working Group members stated that water supply is currently inadequate to fight wildfires or large structural fires (greater than four stories). Sunshine Valley is supplied primarily by surface water sources, including snowmelt sources, which may be constricted by seasonal low flows. One water body which has been used as a backup for drafting water, Cedar Lake, has dried up in previous years.

Wildfire Working Group members stated that most studies and reports studying impacts of climate change on the region, including impacts of climate change on water quality and/or quantity are focused predominantly on agriculture and may not, therefore, be directly applicable to some of the communities in the Zone A AOI. Members also stated that generally, water systems are small, and that Boston Bar and North Bend are supplied by surface water sources, which are vulnerable to effects of climate change. No plans are in place in case of loss of water supply in these areas, which could lead to reliance on trucked-in water for suppression and community use.

For suppression within the AOI, hydrant service is limited to the areas around community centers. It is available in the majority of Yale, part of Dogwood Valley, the Sunshine Valley, most of Boston Bar, and the majority of North Bend; hydrant service is not present beyond any Electoral Area boundaries. Insufficient water pressure within those water systems was not identified as a suppression challenge, except in the Sunshine Valley, where none of the water sources meet NFPA requirements for water flow. Overall, there are large rural areas of the FVRD without hydrant service and this may present a suppression challenge in the case of large structural, interface, or wildland fires.

Secondary power sources are in place across all systems, including lift stations and all water systems, which would last for 3-4 days without refueling.[101] Stand-by generators are available as backup power to pump water, as well as a skid-mounted portable generator and a high-capacity pump. In the event of a prolonged and/or extensive power outage, fuel shortages would pose a risk to these systems. Wildfire Working Group members stated that FVRD Zone A firefighters have the capability to draw from any natural water source and at least some departments have maps which indicate appropriate water bodies to draw from. Information sharing about locations for drawing from natural waters sources occurs with BCWS. It should be noted that some of these sources are potentially at risk of drying or experiencing reduced water levels during drought events, which typically coincide with high and extreme fire danger rating days.

[101] Personal communication, Wildfire Working Group.

RECOMMENDATION #35: All new rural development outside existing FVRD water systems should have a water system which meets or exceeds minimum standards of NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*[102]. FVRD fire services and/or Engineering and Community Services should review the water supply to ensure it provides sufficient placement, flow, and reliability for suppression needs and that secondary power is available in the event of power outages.

RECOMMENDATION #36: Consider completing a fire flow/water vulnerability assessment to identify where upgrades to systems, flows, hydrant number or location, and water storage, or secondary power is required. Prioritize and rank projects and complete or require upgrades as resources allow.

6.1.3 Access and Evacuation

Emergency access and evacuation planning is of particular importance in the event of a wildfire event or other large-scale emergency. The FVRD has developed an Emergency Management Response and Recovery Plan (EMRRP) in 2013 which includes basic contingencies in the event of a wildland/interface fire (i.e., contacts and roles of local government personnel). However, the EMRRP does not specify evacuation routes to be used during an emergency situation. The FVRD is currently developing a phased comprehensive Emergency Management Plan that will repeal and replace all previous documents. In addition, the FVRD webpage has an Emergency Services section which includes information on emergency preparedness for families, updates on any current emergencies, and emergency response procedures. As part of the FVRD emergency planning framework, each Electoral Area has an Emergency Planning Committee that assesses each evacuation situation as it arises, basic contingencies in the event of a wildland/interface fire, and the designated EOC. FVRD can request assistance of neighbouring Local Authorities and First Nations where they are not directly impacted by the same emergency. Any building anywhere can be designated as an EOC or Emergency Coordination Centre under a State of Local Emergency. FVRD recognizes the benefit of having EOC portability due to their local hazards and geography.

It is recommended that the FVRD develop a detailed evacuation plan that includes the following provisions:

- Mapping and identification of safe zones, marshaling points and aerial evacuation locations;
- Creation of a Spontaneous Volunteer Management plan that would identify the method to task unaffiliated volunteers with key tasks during emergencies; and
- Development of an education/communication strategy to deliver emergency evacuation procedures to residents.

RECOMMENDATION #37: Complete and participate in regular testing of, and updates to, the evacuation plan for the FVRD.

[102] National Fire Protection Association (NFPA).2017. Standard on Water Supplies for Suburban and Rural Fire Fighting. Retrieved online at: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1142

Road networks in a community serve several purposes including providing access for emergency vehicles, providing escape/evacuation routes for residents, and creating fuel breaks. Access and evacuation during a wildfire emergency often must happen simultaneously and road networks should have the capacity to handle both. In the event of a wildfire emergency, in many areas there is only one reliable, paved access/egress route in and out of communities within the AOI. For many communities north of Hope, this route is Highway 1; for the Sunshine Valley, this route is Highway 3. Evacuation would be conducted by First Responders, RCMP and the Search and Rescue (SAR) team. If a wildfire were to block Highway 1 or Highway 3, evacuation from the AOI would be difficult. Smoke and poor visibility, car accidents, wildlife, and other unforeseen circumstances can further complicate evacuations and hinder safe passage. Adding to this hazard is the historic occurrence of slides in the AOI, which have cut off access to some communities in the past. In multiple instances, CP and CN rail lines transect important vehicular routes, creating the possibility for blocked evacuation or access for suppression crews due to train stoppages.

Within the AOI, most critical infrastructure is located close to the main, paved roads; access for critical infrastructure is therefore not a concern for suppression efforts or response times. However, there is a significant portion of land within the AOI which is inaccessible by roads or road conditions are marginal. As such, a review of the Fire Service Areas and the accessibility, the risks and benefits of the current boundaries is recommended.

RECOMMENDATION #38: Conduct a review of the Fire Service Area (FSA) boundaries, fire department capabilities, and demand for services to determine if FSA boundaries should be updated or if additional resources or training is required to meet the demand in each FSA.

Wildfire Working Group members report that in some areas, particularly around Yale, secondary egress routes exist through adjacent private properties. These areas are unmapped, although they are locally known to residents and the VFD. It is recommended that these locations be mapped and shared with BCWS, to create transparency and predictability in the event of a wildfire event. An additional concern for access put forward by members of the Yale and Boston Bar VFDs in the Wildfire Working Group, is the distance VFD members must travel to reach fire halls. Response time to a wildfire event may be delayed depending on where VFD members must travel from and the location of the fire.

The governance structure and provision of services to the Sunshine Valley is complex. It is not currently included in the FVRD evacuation planning. Instead, the community is working towards the completion of its own evacuation plan. As part of this planning process, alternatives to Highway 1 for eastward access and egress routes are being examined. An old highway leading out of Huckleberry Village near the Hope Slide lookout has been named as one option; however, funding has not yet been finalized to develop it.

RECOMMENDATION #39: Complete and participate in regular testing of, and updates to, an evacuation plan for the Sunshine Valley. Collaboration or consultation with the FVRD is recommended in the event that an emergency requires a joint response.

BCWS staff noted that forest service roads within the AOI are slowly being deactivated as a result of the decline in forest industry operations. A potential response to this reduction in access is the construction of, or maintenance of forest service roads as recreation trails in interface locations. When built to support ATVs trails can provide access for ground crews and act as fuel breaks for ground fires, particularly in natural areas. Strategic recreational trail development to a standard that supports ATVs, and further to install gates or other barriers to minimize access by unauthorized users can be used as a tool that increases the ability of local fire departments to access interface areas.

RECOMMENDATION #40: Include a qualified professional with experience in operational wildland/interface fire suppression in the planning and strategic siting of future trails and parks.

The creation of a map book or spatial file that displays the trail network available for fire departments to access during an emergency or for fire suppression planning must accompany any fire access trail building activities. In order to effectively use the trails as crew access or as fuel breaks during suppression efforts, it is recommended that a Total Access Plan be developed. This plan should be made available to the FVRD Zone A fire departments and the BCWS in the event that they are aiding suppression efforts on an interface fire in the AOI. The plan should include georeferenced maps with associated spatial data and ground-truthed locations of potential optimal firebreaks. It should identify the type of access available for each access route, identify those trails that are gated or have barriers, and provide information as to how to unlock/remove barriers. Further, the plan should ensure that trails and roads are identified based on updated information, and that trails and roads recommended for access are actively being maintained. The plan should also identify those natural areas where access is insufficient. Access assessment should consider land ownership, proximity of values at risk, wildfire threat, opportunities for use as fuel break/control lines, trail/road network linkages where fuel-free areas or burn off locations can be created or used as potential sprinkler locations, and requirements for future maintenance activities such as operational access for fuel treatments and other hazard reduction activities. In addition to providing the safest, quickest, and easiest access routes for emergency crews, a Total Access Plan would minimize the need for using machinery or motorized access in an otherwise undisturbed area. This would reduce the risk of soil disturbance, environmental damage, and rehabilitation costs.

RECOMMENDATION #41: Develop a Total Access Plan for the FVRD to create, map and inventory trail and road network in natural areas for suppression planning, identification of areas with insufficient access and to aid in strategic planning. Georeferenced maps with ground-truthed locations of potential optimal firebreaks should be developed as part of the Total Access Plan and shared with fire suppression personnel and BCWS to support emergency response in the event of a wildfire. The plan should be updated every five years, or more regularly, as needed to incorporate additions and/or changes.

6.1.4 Training

The fire departments within the FVRD Zone A maintain a current level of structural protection training as described in Section 6.1.1. Additionally, all members have yearly refreshers and/or certification in

SPP-WFF1 (Wildland Firefighter Level 1). Provision of training opportunities for structural firefighters in the realm of wildland firefighting is critical to building capacity for suppression and emergency management at the local level. It is recommended that all fire department members at minimum have SPP-WFF1 (or equivalent) if they are going to be responding at the request of the province to be deployed on a wildfire, and that the fire departments engage in yearly practical wildland fire training with BCWS. SPP-WFF1 is a new S-100 and S-185 equivalent course for structure firefighters only, and as such, BCWS has phased out instruction of S-100 training for fire departments.

The fire departments maintain communication with BCWS throughout the year, as required by the fire season demands; however, the level of engagement with the BCWS is inconsistent between fire departments. It is recommended that the fire departments work cooperatively with the BCWS (Fraser Fire Zone - Cultus/Haig Fire Base) to conduct yearly mock exercises, where information and technical/practical knowledge are shared, such as: fireline construction, Mark 3 pump operations, sprinkler protection, skid unit operations, portable water tank deployment, hydrant hookup methods, and wildland hose operations. These practices could also provide an avenue to discuss working together on inter-agency fires. Additional training options could include engaging adjacent fire departments within the AOI and outside the AOI (e.g., District of Kent, District Municipality of Hope, Popkum, etc.) to conduct joint training so as to further strengthen regional emergency response and firefighting training.

RECOMMENDATION #42: FVRD Zone A fire departments should continue working with BCWS to initiate and/or maintain an annual structural and interface training program. As part of the training, it is recommended to conduct annual reviews to ensure PPE and wildland equipment resources are complete, in working order, and the crews are well-versed in their set-up and use. It is recommended the FVRD and adjacent municipal fire departments engage in yearly practical wildland fire training with BCWS that covers at a minimum: pump, hose, hydrant, air tanker awareness, and deployment of SPUs. Interface training should include completion of a joint wildfire simulation exercise and safety training specific to wildland fire and risks inherent with natural areas. It is recognized that BCWS crew resources are limited and their availability and is highly dependent upon the current fire season and other BCWS priorities.

RECOMMENDATION #43: FVRD Zone A fire departments should engage in regular communication with the BCWS Fraser Fire Zone - Cultus/Haig Fire Base to foster a strong relationship and identify potential cooperative wildfire risk reduction opportunities.

RECOMMENDATION #44: Ensure that the FVRD Zone A fire departments maintain the capability to effectively suppress wildland fires by training members in SPP-WFF1 (or S-100 and S-185 combined), at a minimum. Consider expanding the training programs to maintain high level of member education and training specific to interface and wildland fires. SPP-115 (formerly S-115) trains structural firefighters on the use of wildfire pumps and hose, and fire service hose and hydrants in the application of structural protection units (SPUs). FVRD Zone A fire departments should continue the practice of staying up-to-date on wildfire training opportunities, and to train members in this capacity, as training resources/budgets allow.

6.2 STRUCTURE PROTECTION

The Zone A fire departments are adequately resourced in structural fire suppression equipment, and are in the process of acquiring some wildfire firefighting equipment (see Section 6.1.1 for additional detail). The FVRD Zone A fire departments are not equipped with a Structural Protection Unit (SPU). The UBCM owns four complete SPUs, each equipped to protect 30 – 35 structures. The kits are deployed by the MFLNRORD/BCWS incident command structure and are placed strategically across the province during the fire season based on fire weather conditions and fire potential. When the kits are not in use, they may be utilized by fire departments for training exercises. SPUs can be useful tools in the protection of rural/interface homes in the event of a wildfire. An important consideration in protecting the WUI zone from fire is ensuring that homes can withstand an interface fire event. Structure protection is focused on ensuring that building materials and construction standards are appropriate to protect individual homes from interface fire. Materials and construction standards used in roofing, exterior siding, window and door glazing, eaves, vents, openings, balconies, decks, and porches are primary considerations in developing FireSmart neighbourhoods. Housing built using appropriate construction techniques and materials in combination with fire resistant landscaping are less likely to be impacted by interface fires.

While many BC communities established to date were built without significant consideration of interface fire, there are still ways to reduce home vulnerability. Changes to roofing materials, siding, and decking can be achieved over the long-term through voluntary upgrades, as well as changes in bylaws and building codes. The FireSmart approach has been adopted by a wide range of governments and is a recognized process for reducing and managing fire risk in the wildland urban interface. More details on FireSmart construction can be found in the "*FireSmart Begins at Home Manual*"[103].

It is recommended that homeowners take a building envelope–out approach, that is, starting with the home and working their way out. Addressing little projects first can allow for quick, easy, and cost-effective risk reduction efforts to be completed sooner, while larger, more costly projects can be completed as resources and planning allow. For example, prior to the fire season, clearing roofs and gutters of combustible materials (leaves and needles), cleaning out any combustible accumulations or stored materials from under decks, moving large potential heat sources such as firewood, spare building materials or vehicles as far from the structure as possible, maintaining a mowed and watered lawn, removing dead vegetation, and pruning trees are actionable steps that residents can start working on immediately. The following link accesses an excellent four-minute video demonstrating the importance of FireSmart building practices during a simulated ember shower: http://www.youtube.com/watch?v=_Vh4cQdH26g.

The structure protection objectives for the FVRD are to:

[103]Available at https://firesmartcanada.ca/resources/ (FireSmart Canada) and https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/firesmart (BC FireSmart)

- Encourage private homeowners to voluntarily adopt FireSmart principles on their properties and to reduce existing barriers to action;
- Enhance protection of critical infrastructure from wildfire (and post-wildfire impacts); and,
- Enhance protection of residential/commercial structures from wildfire.

RECOMMENDATION #45: Work with local distributors and homeowners within FVRD Zone A and its communities to improve education of homeowners and remove some barriers to FireSmart action. Local distributors can include: hardware stores, garden centers, and retail providers. Initiatives may include: 1) Developing and delivery of FireSmart workshop(s) for local distributors on FireSmart issues and solutions/advice for homeowners. These distributors can be educated upon which supplies are FireSmart and in what configuration they can be used (for example, external sprinkler system equipment, aggregates and ground cover, wire mesh for vents, deck skirting); 2) Advocating for a FireSmart branding in the retail stores (could be stickers on shelf pricing or a FireSmart-specific section) to increase public exposure to projects that can be done at a relatively low cost; 3) Developing general cost implications of improvements so property owners can prioritize replacements.

RECOMMENDATION #46: Develop programs which serve to remove barriers to action for homeowners by providing methods for them to cheaply and easily dispose of wood waste removed from their property. Programs may include scheduled community chipping opportunities, yard waste dumpsters available by month in neighbourhoods, waiving of tipping fees, or scheduled burning weekends. Programs should be available during times of greatest resident activity (likely spring and fall).

RECOMMENDATION #47: Complete a vulnerability assessment of all critical infrastructure, secondary power sources, and fuel availability. Review current capability of secondary power sources, identify vulnerabilities, and prioritize needs, in the case of prolonged or extensive power outages. Upgrade or realign resources, as prioritized.

RECOMMENDATION #48: Consider acquiring a Type 2 SPU trailer to improve wildfire response (provides protection for 25-30 residences) in Zone A. The SPU could be moved between fire departments within the AOI depending on training and demand for use.

REFERENCES

BCWS. 2019. Wildfire Causes. Retrieved from: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-response/fire-characteristics/causes

Dale, V., L. Joyce. S. McNulty, R. Neilson, M. Ayres, M. Flannigan, P. Hanson, L. Irland, A. Lugo. C. Peterson, D. Simberloff, F. Swanson, B. Stocks, B. Wotton. *Climate Change and Forest Disturbances*. BioScience 2001 51 (9), 723-734.

Flannigan M.D., M.A. Krawchuk, W. J. de Groot, B.M. Wotton, L.M. Gowman, 2009. Implications of changing climate for global wildland fire. International Journal of Wildland Fire 18, 483-507.

Fraser Valley Regional District. Official Community Plan for Boston Bar – North Bend – Canyon Alpine, Bylaw No. 804, 1994. Retrieved from: https://www.fvrd.ca/assets/Government/Documents/Bylaws/Planning~and~Land~Use/Area%20A%20-%20OCP%20Bylaw%20804%20-%20Boston%20Bar,%20North%20Bend%20and%20Canyon%20Alpine.pdf

Fraser Valley Regional District. Official Community Plan for Portions of Electoral Area "B" Yale, Emory Creek, Dogwood Valley, and Choate, Bylaw No. 150, 1998. Retrieved from: https://www.fvrd.ca/assets/Government/Documents/Bylaws/Planning~and~Land~Use/Area%20B%20-%20OCP%20Bylaw%20150%20-%20Yale,%20Emory%20Creek,%20Dogwood%20Valley%20and%20Choate.pdf

Fraser Valley Regional District. Official Community Plan for Portions of Electoral Areas "B" and "C", Regional District of Fraser-Cheam. Bylaw No. 800, 1986. Retrieved from: https://www.fvrd.ca/assets/Government/Documents/Bylaws/Planning~and~Land~Use/Area%20B%20and%20C%20-%20OCP%20Bylaw%20800%20-%20Portions%20of%20Electoral%20Areas%20B%20and%20C.pdf

Hall, E. 2010. Maintaining Fire in British Columbia's Ecosystems: An Ecological Perspective. Report submitted to the Wildfire Management Branch, Ministry of Forests and Range.

The Province of British Columbia. 1995. Biodiversity Guidebook. Retrieved from: https://www.for.gov.bc.ca/hfd/library/documents/bib19715.pdf

Ministry of Forests, Lands and Natural Resource Operations. 2015. Coast Area 2015-17 Coastal Timber Supply Area Forest Health Overview. Retrieved from: https://www.for.gov.bc.ca/ftp/HFP/external/!publish/Forest_Health/TSA_FH_Strategies/2015-Coast%20FH%20Strategy.pdf

APPENDIX A – LOCAL WILDFIRE THREAT PROCESS

The key steps to complete the local wildfire threat assessment are outlined below:

1. Fuel type attribute assessment, ground truthing/verification and updating as required to develop a local fuel type map (Appendix A-1).
2. Consideration of the proximity of fuel to the community, recognizing that fuel closest to the community usually represents the highest hazard (Appendix A-2).
3. Analysis of predominant summer fire spread patterns using wind speed and wind direction during the peak burning period using ISI Rose(s) from BCWS weather station(s) (Appendix A-3). Wind speed, wind direction, and fine fuel moisture condition influence wildfire trajectory and rate of spread.
4. Consideration of topography in relation to values (Appendix A-4). Slope percentage and slope position of the value are considered, where slope percentage influences the fire's trajectory and rate of spread and slope position relates to the ability of a fire to gain momentum uphill.
5. Stratification of the WUI based on relative wildfire threat, considering all of the above.
6. Consider other local factors (i.e., previous mitigation efforts, and local knowledge regarding hazardous or vulnerable areas)
7. Identify priority wildfire risk areas for field assessment.

The basis for the prioritization of field assessment locations is further detailed in Section 4.3. Wildfire Threat Assessment plot worksheets are provided in Appendix C (under separate cover), plot locations are summarized in Appendix F, and the field data collection and spatial analysis methodology is detailed in Appendix H.

A-1 FUEL TYPE ATTRIBUTE ASSESSMENT

The Canadian Forest Fire Behaviour Prediction (FBP) System outlines five major fuel groups and sixteen fuel types based on characteristic fire behaviour under defined conditions.[104] Fuel typing is recognized as a blend of art and science. Although a subjective process, the most appropriate fuel type was assigned based on research, experience, and practical knowledge; this system has been used within BC, with continual improvement and refinement, for 20 years.[105] It should be noted that there are significant limitations with the fuel typing system which should be recognized. Major limitations include: a fuel typing system designed to describe fuels which do not occur within the AOI, fuel types which cannot accurately capture the natural variability within a polygon, and limitations in the data used to create

[104] Forestry Canada Fire Danger Group. 1992. Development and Structure of the Canadian Forest Fire Behavior Prediction System: Information Report ST-X-3.

[105] Perrakis, D.B., Eade G., and Hicks, D. 2018. Natural Resources Canada. Canadian Forest Service. *British Columbia Wildfire Fuel Typing and Fuel Type Layer Description* 2018 Version.

initial fuel types.[105] Details regarding fuel typing methodology and limitations are found in Appendix G. There are several implications of the aforementioned limitations, which include: fuel typing further from the developed areas of the study has a lower confidence, generally; and, fuel typing should be used as a starting point for more detailed assessments and as an indicator of overall wildfire threat, not as an operational, or site-level, assessment.

Table 13 summarizes the fuel types by general fire behaviour (crown fire and spotting potential). In general, the fuel type that may be considered hazardous in terms of fire behaviour and spotting potential in the AOI is C-3, particularly if there are large amounts of woody fuel accumulations or denser understory ingrowth. C-5 fuel types have a moderate potential for active crown fire when wind-driven.[105] An M-1/2 fuel type can sometimes be considered hazardous, depending on the proportion of conifers within the forest stand; conifer fuels include those in the overstory, as well as those in the understory. An O-1b fuel type often can support a rapidly spreading grass or surface fire capable of damage or destruction of property, and jeopardizing human life, although it is recognized as a highly variable fuel type dependent upon level of curing.[106] These fuel types were used to guide the threat assessment.

Forested ecosystems are dynamic and change over time: fuels accumulate, stands fill in with regeneration, and forest health outbreaks occur. Regular monitoring of fuel types and wildfire threat assessment should occur every 5 – 10 years to determine the need for threat assessment updates and the timing for their implementation.

Table 13. Fuel Type Categories and Crown Fire Spot Potential. Only summaries of fuel types encountered within the AOI are provided (as such, other fuel types, i.e., C-1, C-2, C-4 are not summarized below).

Fuel Type	FBP/CFFDRS Description	Study Area Description	Wildfire Behaviour Under High Wildfire Danger Level	Fuel Type – Crown Fire/Spotting Potential
C-3	Mature jack or lodgepole pine	Fully stocked, late young forest (western red cedar, hemlock, and/or Douglas-fir), with crowns separated from the ground	Surface and crown fire, low to very high fire intensity and rate of spread	High*
C-5	Red and white pine	Well-stocked mature forest, crowns separated from ground. Moderate understory herbs and shrubs. Often accompanied by dead woody fuel accumulations.	Moderate potential for active crown fire in wind-driven conditions. Under drought conditions, fuel consumption and fire intensity can be higher due to dead woody fuels	Low

[106] Ibid.

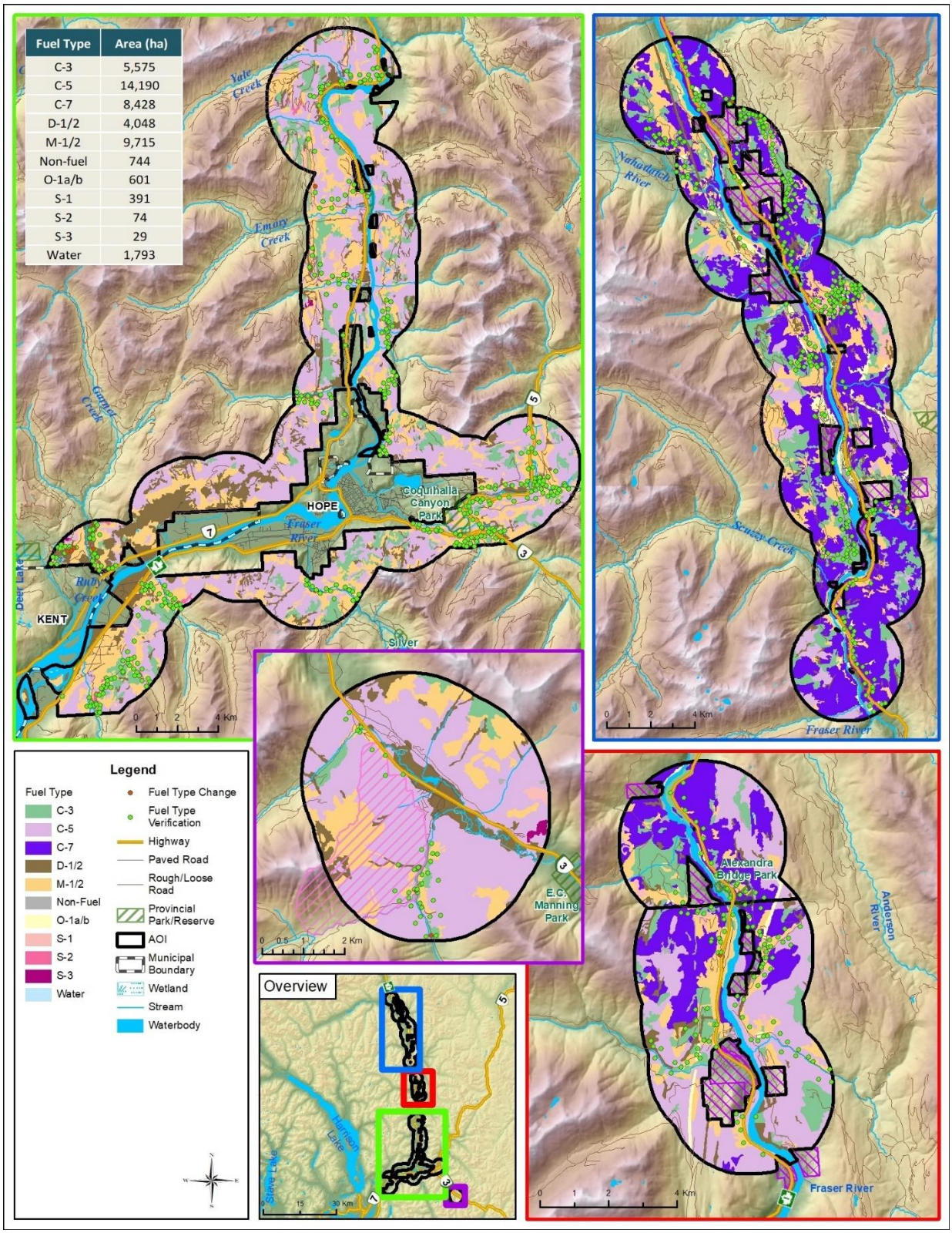
Fuel Type	FBP/CFFDRS Description	Study Area Description	Wildfire Behaviour Under High Wildfire Danger Level	Fuel Type – Crown Fire/Spotting Potential
C-7	Ponderosa pine – Douglas-fir	Open, uneven-aged forest, crowns separated from the ground except in conifer thickets, understory of discontinuous grasses, herbs.	Surface fire spread, torching of individual trees, rarely crowning (usually limited to slopes > 30%), moderate to high intensity and rate of spread	Low
O-1a/b	Grass	Matted and standing grass communities. Continuous standing grass with sparse or scattered shrubs and down woody debris. Vegetated, non-treed areas dominated by shrubs or herbs in dry ecosystems. Areas of very scattered trees. Hay fields. Areas harvested 7 – 24 years ago (dense or open and >4 m in height). Scotch-Broom dominated right-of-ways.	Rapidly spreading, high-intensity surface fire when cured	Low
M-1/2	Boreal mixedwood (leafless and green)	Moderately well-stocked mixed stand of conifers and deciduous species, low to moderate dead, down woody fuels.	Surface fire spread, torching of individual trees and intermittent crowning, (depending on slope and percent conifer)	<26% conifer (Very Low); 26-49% Conifer (Low); >50% Conifer (Moderate)
D-1/2	Aspen (leafless and green)	Deciduous stands	Always a surface fire, low to moderate rate of spread and fire intensity	Low
S-1/2/3	Slash (jack/lodgepole pine, white spruce/balsam, and coastal cedar/hemlock/ Douglas-fir, respectively)	Jack or lodgepole pine slash, white pine/ balsam slash, coastal cedar/ hemlock/ Douglas-fir slash	Moderate to high rate of spread and high to very high intensity surface fire	Low to High
W	N/A	Water	N/A	N/A
N	N/A	Non-fuel: irrigated agricultural fields, golf courses, alpine areas void or nearly void of vegetation, urban or developed areas void or nearly void of forested vegetation.	N/A	N/A

**C-3 fuel type is considered to have a high crown fire and spotting potential within the study area due to the presence of moderate to high fuel loading (dead standing and partially or fully down woody material), and continuous conifer ladder fuels (i.e., western redcedar, Cw, and/or Douglas-fir, Fd).*

During field visits, thirteen recurring patterns of fuel type errors were found in the provincial dataset. They were:

- C-5 fuel types being incorrectly identified by the PSTA as M-1/2,
- M-1/2 fuel types identified as D-1/2,
- M-1/2 fuel types identified as C-5,
- C-3 fuel types identified C-5,
- S-2 fuel types identified as D-1/2,
- C-3 fuel types identified as M-1/2,
- D-1/2 fuel types identified as M-1/2,
- C-7 fuel types identified as O-1a/b,
- D-1/2 fuel types identified as N,
- O-1a/b fuel types identified as C-7,
- C-3 fuel types identified as O-1a/b,
- M-1/2 fuel types identified as S-3, and
- M-1/2 fuel types identified as O-1a/b.

All fuel type updates were approved by BCWS, using stand and fuel descriptions and photo documentation for the review process (see Appendix B for submitted fuel type change rationales).



Map 8. Updated Fuel Type.

A-2 PROXIMITY OF FUEL TO THE COMMUNITY

Fire hazard classification in the WUI is partly dictated by the proximity of the fuel to developed areas within a community. More specifically, fuels closest to the community are considered to pose a higher hazard in comparison to fuels that are located at greater distances from values at risk. As a result, it is recommended that the implementation of fuel treatments prioritizes fuels closest to structures and/or developed areas, in order to reduce hazard level adjacent to the community. Continuity of fuel treatment is an important consideration, which can be ensured by reducing fuels from the edge of the community outward. Special consideration must be allocated to treatment locations to ensure continuity, as discontinuous fuel treatments in the WUI can allow wildfire to intensify, resulting in a heightened risk to values. In order to classify fuel threat levels and prioritize fuel treatments, fuels immediately adjacent to the community are rated higher than those located further from developed areas. Table 14 describes the classes associated with proximity of fuels to the interface.

Table 14. 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.

**Distances are based on spotting distances of high and moderate fuel type spotting potential and threshold to break crown fire potential (100m). These distances can be varied with appropriate rationale, to address areas with low or extreme fuel hazards.*

A-3 FIRE SPREAD PATTERNS

Wind speed, wind direction, and fine fuel moisture condition influence wildfire trajectory and rate of spread. The influence of topography on fire spread patterns is discussed in Appendix A-4. Wind plays a predominant role in fire behaviour and direction of fire spread and is summarized in the Initial Spread Index (ISI) Roses from the local representative BCWS weather station – Anderson Creek. The Initial Spread Index (ISI) is a numeric rating of the expected rate of fire spread that combines the effects of wind speed and fine fuel moisture.[107] Hourly ISI roses depicting the frequency of ISI values by wind direction are available for each BCWS weather station. Hourly ISI roses can help plan the location of fuel treatments on the landscape to protect values at risk based on the predominant wind direction and frequency of higher ISI values. Wildfire that occurs upwind of a value poses a more significant threat to that value than one which occurs downwind.

Anderson Creek Weather Station

During the fire season (April – October) from 2007 to 2015, higher ISI values were most frequently associated with daytime (6 am to 6 pm) winds from the southwest (Figure 4). Overnight (6 pm to 6 am) the wind direction is from the northeast (north to east). Figure 4 shows the daily average of ISI counts over that time period, showing predominant westerly to southwesterly winds. The highest ISI value recorded over the time period was 35.

[107] https://cwfis.cfs.nrcan.gc.ca/background/summary/fwi

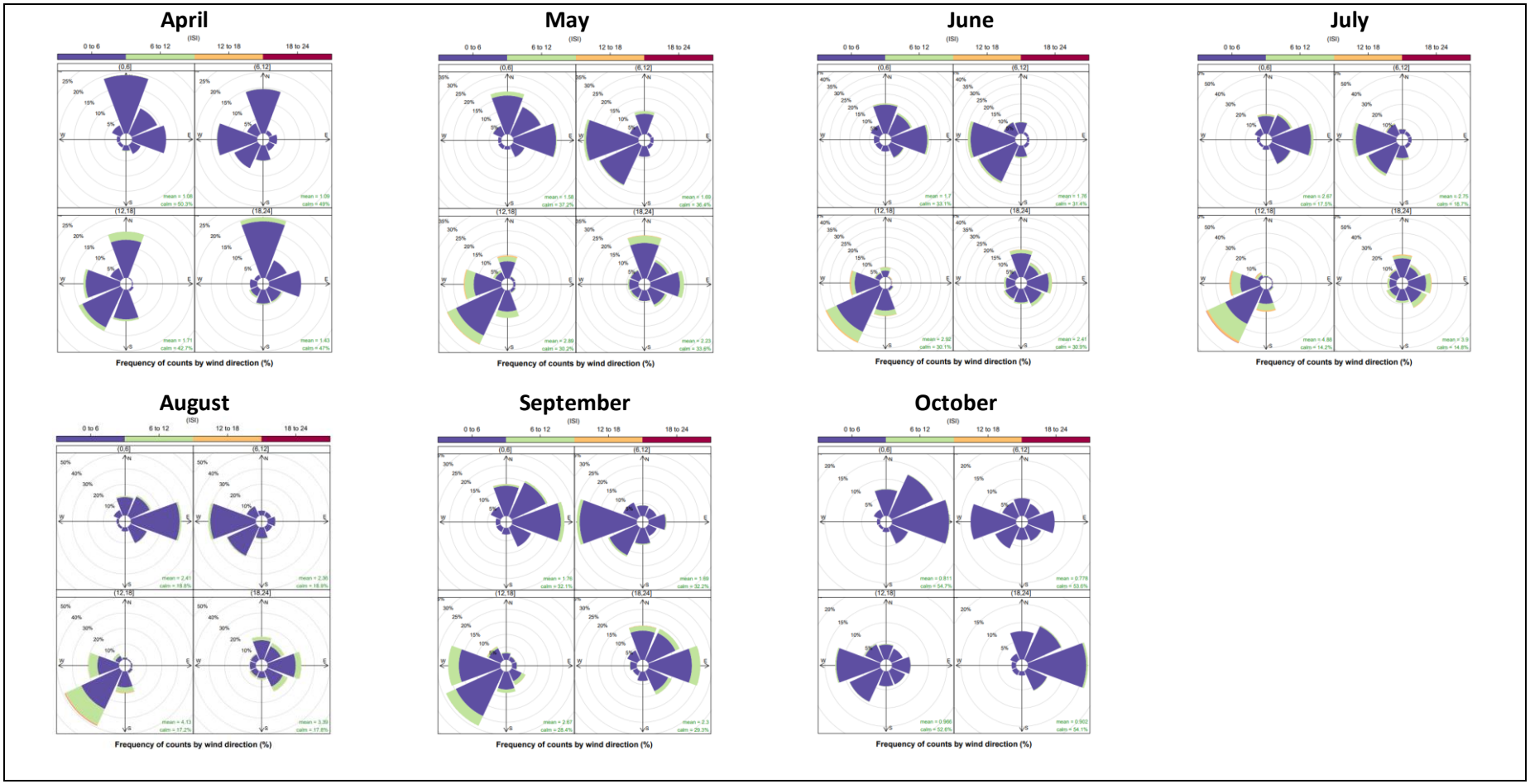


Figure 4. Hourly ISI roses depicting frequency of ISI counts by wind direction for the fire season April – October 2007 – 2015. Data taken from the Anderson Creek weather station.[108]

[108] https://www.for.gov.bc.ca/ftp/HPR/external/!publish/Website/ISI%20Roses/Hourly_ISI_Roses/Coastal_Hourly/CoFC_AndersonCreek_HourlyISIRoses_20160914.pdf

A-4 TOPOGRAPHY

Topography is an important environmental component that influences fire behaviour. Considerations include slope percentage (steepness) and slope position where slope percentage influences the fire's trajectory and rate of spread and slope position relates to the ability of a fire to gain momentum uphill. Other factors of topography that influence fire behaviour include aspect, elevation and land configuration.

Slope Class and Position

Slope steepness affects solar radiation intensity, fuel moisture (influenced by radiation intensity) and influences flame length and rate of spread of surface fires. Table 15 summarizes the fire behaviour implications for slope percentage (the steeper the slope the faster the spread). In addition, Slope position affects temperature and relative humidity as summarized in Table 16. A value placed at the bottom of the slope is equivalent to a value on flat ground (see Table 15). A value on the upper 1/3 of the slope would be impacted by preheating and faster rates of spread (Table 16). The majority of the AOI (74%) is on less than 20% slope and will likely not experience accelerated rates of spread due to slope class. Approximately 26% percent of the study area is likely to experience an increased or high rate of spread. On the larger topographic scale, the communities in the AOI and surrounding agricultural, industrial, commercial, recreational and residential developments would be considered bottom of the slope or valley bottom or mid-slope.

Table 15. Slope Percentage and Fire Behaviour Implications.

Slope	Percent of AOI	Fire Behaviour Implications
<20%	74%	Very little flame and fuel interaction caused by slope, normal rate of spread.
21-30%	13%	Flame tilt begins to preheat fuel, increase rate of spread.
31-45%	8%	Flame tilt preheats fuel and begins to bathe flames into fuel, high rate of spread.
46-60%	3%	Flame tilt preheats fuel and bathes flames into fuel, very high rate of spread.
>60%	2%	Flame tilt preheats fuel and bathes flames into fuel well upslope, extreme rate of spread.

Table 16. Slope Position of Value and Fire Behaviour Implications.

Slope Position of	Fire Behaviour Implications
Bottom of Slope/ Valley Bottom	Impacted by normal rates of spread.
Mid Slope - Bench	Impacted by increase rates of spread. Position on a bench may reduce the preheating near the value. (Value is offset from the slope).
Mid slope – continuous	Impacted by fast rates of spread. No break in terrain features affected by preheating and flames bathing into the fuel ahead of the fire.
Upper 1/3 of slope	Impacted by extreme rates of spread. At risk to large continuous fire run, preheating and flames bathing into the fuel.

APPENDIX B – WILDFIRE THREAT ASSESSMENT – FBP FUEL TYPE CHANGE RATIONALE

Provided separately as PDF package.

APPENDIX C – WILDFIRE THREAT ASSESSMENT WORKSHEETS AND PHOTOS

Provided separately as PDF package.

APPENDIX D – MAPS

Provided separately as PDF package

APPENDIX E – WILDLAND URBAN INTERFACE DEFINED

The traditional and most simple definition for the wildland/urban interface (WUI) is "the place where the forest meets the community". However, this definition can be misleading. Incorrectly, it implies that neighbourhoods and structures well within the perimeter of a larger community are not at risk from wildfire. As well, it fails to recognize that developments adjacent to grassland and bush are also vulnerable.

A more accurate and helpful definition of the WUI is based on a set of conditions, rather than a geographical location: "the presence of structures in locations in which conditions result in the potential for ignition of structures from the flames, radiant heat or embers of a wildland fire." This definition was developed by the National Fire Protection Association and is used by the US Firewise program. It recognizes that all types of wildland fuel/fire can lead to structural ignition (i.e., forest, grassland, brush) and also identifies the three potential sources of structural ignition.

Two situations are differentiated. Locations where there is a clean/abrupt transition from urban development to forest lands are usually specified as the "interface" whereas locations where structures are embedded or mingled within a matrix of dense wildland vegetation are known as the "intermix". An example of interface and intermixed areas is illustrated in Figure 5.

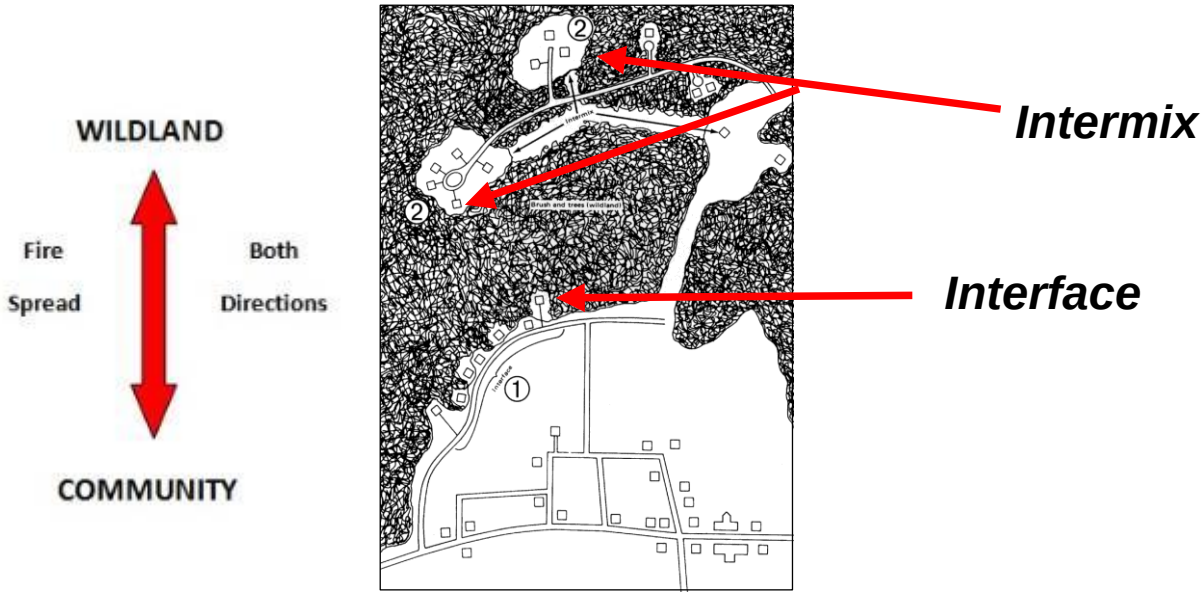


Figure 5. Illustration of intermix and interface situations.

Within the WUI, fire has the ability to spread from the forest into the community or from the community out into the forest. Although these two scenarios are quite different, they are of equal importance when considering interface fire risk. Regardless of which scenario occurs, there will be consequences for the community and this will have an impact on the way in which the community plans and prepares itself for interface fires.

Fires spreading into the WUI from the forest can impact homes in two distinct ways:

1. From sparks or burning embers carried by the wind, or convection that starts new fires beyond the zone of direct ignition (main advancing fire front), that alight on vulnerable construction materials or adjacent flammable landscaping (roofing, siding, decks, cedar hedges, bark mulch, etc.) (Figure 6).

2. From direct flame contact, convective heating, conductive heating or radiant heating along the edge of a burning fire front (burning forest), or through structure-to-structure contact. Fire can ignite a vulnerable structure when the structure is in close proximity (within 10 meters of the flame) to either the forest edge or a burning house (Figure 7).

Figure 6. Firebrand caused ignitions: burning embers are carried ahead of the fire front and alight on vulnerable building surfaces.

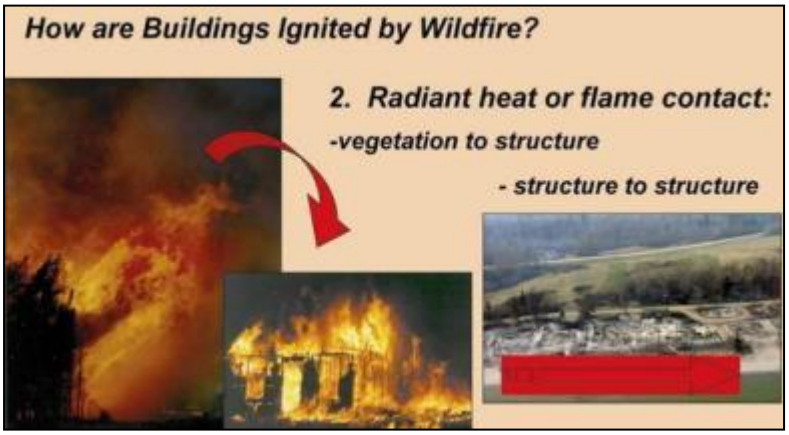


Figure 7. Radiant heat and flame contact allow fire to spread from vegetation to structure or from structure to structure.

Current research confirms that the majority of homes ignited during major WUI events trace back to embers as their cause (e.g., 50% – 80^{+} %). Firebrands can be transported long distances ahead of the wildfire, across any practicable fire guards, and accumulate on horizontal surfaces within the home ignition zone in densities that can reach 600^{+} /m^{2}. Combustible materials found within the home ignition zone combine to provide fire pathways allowing spot fires ignited by embers to spread and carry flames or smoldering fire into contact with structures.

APPENDIX F – WUI THREAT PLOT LOCATIONS

Table 17 displays a summary of all WUI threat plots completed during CWPP field work. The original WUI threat plot forms and photos will be submitted as a separate document. The following ratings are applied to applicable point ranges:

- Wildfire Behaviour Threat Score – Low (0-40); Moderate (41 – 95); High (96 – 149); Extreme (>149); and,
- WUI Threat Score – Low (0 – 13); Moderate (14 – 26); High (27 – 39); Extreme (>39).

Table 17. Summary of WUI Threat Assessment Worksheets.

WUI Plot #	Geographic Location	Wildfire Behaviour Threat Class	WUI Threat Class*
AINS-1	Ainslie FSR	High	Low
AINS-2	Ainslie FSR	Moderate	N/A
AINS-3	Ainslie FSR	High	Moderate
AINS-4	Ainslie FSR	High	Low
ALEX-1	Alexandra Bridge	High	Moderate
AMER-1	American Creek FSR	Moderate	N/A
AND-1	Anderson Creek FSR	Moderate	N/A
BEND-1	North Bend FSR	High	Moderate
EMR-1	Emory Creek Park FSR	Moderate	N/A
EMR-2	Emory Creek Park FSR	Moderate	N/A
EMR-3	Emory Creek Park FSR	Moderate	N/A
GARN-1	Garnet Creek FSR	High	Low
HOPE-1	Hope Creek FSR	Moderate	N/A
HUNT-1	Hunter FSR	High	Moderate
JONE-1	Jones Lake FSR	High	Low
NAHA-1	Nahatlatch FSR	High	High

WUI Plot #	Geographic Location	Wildfire Behaviour Threat Class	WUI Threat Class*
NAHA-2	Nahatlatch FSR	High	High
NICK-1	BC Nickelmine Road	Moderate	N/A
PEER-1	Peers Creek FSR	Moderate	N/A
PEER-2	Peers Creek FSR	Moderate	N/A
PEER-3	Peers Creek FSR	High	High
SCUZ-1	Scuzzy Creek FSR	High	High
SCUZ-2	Scuzzy Creek FSR	High	Moderate
SILV-1	Silver Lake Road	High	N/A
SILV-2	Silver Lake Road	Moderate	N/A
SPIR-1	Near Spirit Caves trail	Moderate	N/A
SPUZ-1	Spuzzum FSR	Moderate	N/A
SQUE-1	Squeah FSR	Moderate	N/A
SQUE-2	Squeah FSR	High	Moderate
SQUE-3	Squeah FSR	High	Moderate
SUN-1	Sunshine Valley	High	Low
SUN-2	Sunshine Valley	High	Moderate
TSIL-1	Tsileuh FSR	Moderate	N/A
URO-1	U Road FSR	High	Low
URO-2	U Road FSR	Moderate	N/A

*Note that WUI threat scores are only collected for untreated polygons that rate high or extreme for Wildfire Behaviour Threat score. WUI threat scores are collected regardless of Wildfire Behaviour Threat score for treated polygons.

APPENDIX G – FUEL TYPING METHODOLOGY AND LIMITATIONS

The initial starting point for fuel typing for the study area was the 2019 provincial fuel typing layer provided by BCWS as part of the *2019 Provincial Strategic Threat Analysis* (PSTA) data package. This fuel type layer is based on the FBP fuel typing system. PSTA data is limited by the accuracy and availability of information within the Vegetation Resource Inventory (VRI) provincial data; confidence in provincial fuel type data is very low on private land. The PSTA threat class for all private land within the AOI was not available. Fuel types within the study area have been updated using orthoimagery of the study area with representative fuel type calls confirmed by field fuel type verification. Polygons not field-verified were assigned fuel types based upon similarities visible in orthophotography to areas field verified. Where polygons were available from the provincial fuel typing layer, they were utilized and updated as necessary for recent harvesting, development, etc.

It should be noted that fuel typing is intended to represent a fire behaviour pattern; a locally observed fuel type may have no exact analog within the FBP system. The FBP system was almost entirely developed for boreal and sub-boreal forest types, which do not occur within the study area. As a result, the AOI fuel typing is a best approximation of the Canadian Forest Fire Danger Rating System (CFFDRS) classification, based on the fire behaviour potential of the fuel type during periods of high and extreme fire danger within the South Coast region. Additionally, provincial fuel typing depends heavily on Vegetation Resource Inventory (VRI) data, which is gathered and maintained in order to inform timber management objectives, not fire behaviour prediction. For this reason, VRI data often does not include important attributes which impact fuel type and hazard, but which are not integral to timber management objectives. Examples include: surface fuels and understory vegetation.

In some cases, fuel type polygons may not adequately describe the variation in the fuels present within a given polygon due to errors within the PSTA and VRI data, necessitating adjustments required to the PSTA data. In some areas, aerial imagery is not of sufficiently high resolution to make a fuel type call. Where fuel types could not be updated from imagery with a high level of confidence, the original PSTA fuel type polygon and call were retained.

For information on the provincial fuel typing process used for PSTA data as well as aiding in fuel type updates made in this document, please refer to Perrakis, Eade, and Hicks 2018.[109]

[109]Perrakis, D.B., Eade G., and Hicks, D. 2018. Natural Resources Canada. Canadian Forest Service. *British Columbia Wildfire Fuel Typing and Fuel Type Layer Description* 2018 Version.

APPENDIX H – WUI THREAT ASSESSMENT METHODOLOGY

As part of the CWPP process, spatial data submissions are required to meet the defined standards in the Program and Application Guide. As part of the program, proponents completing a CWPP or CWPP update are provided with the Provincial Strategic Threat Analysis (PSTA) dataset. This dataset includes:

- Current Fire Points
- Current Fire Polygons
- Fuel Type
- Historical Fire Points
- Historical Fire Polygons
- Mountain pine beetle polygons (sometimes not included)
- PSTA Head Fire Intensity
- PSTA Historical Fire Density
- PSTA Spotting Impact
- PSTA Threat Rating
- Structure Density
- Structures (sometimes not included)
- Wildland Urban Interface Buffer Area

The required components for the spatial data submission are detailed in the Program and Application Guide Spatial Appendix – these include:

- AOI
- Fire Threat
- Fuel Type
- Photo Location
- Proposed Treatment
- Structures
- Threat Plot
- Wildland Urban Interface

The provided PSTA data does not necessarily transfer directly into the geodatabase for submission, and several PSTA feature classes require extensive updating or correction. In addition, the Fire Threat determined in the PSTA is fundamentally different than the Fire Threat feature class that must be submitted in the spatial data package. The Fire Threat in the PSTA is based on provincial scale inputs - fire density; spotting impact; and head fire intensity, while the spatial submission Fire Threat is based on the components of the Wildland Urban Interface Threat Assessment Worksheet. For the scope of this project, completion of WUI Threat Assessment plots on the entire AOI is not possible, and therefore an analytical model has been built to assume Fire Threat based on spatially explicit variables that correspond to the WUI Threat Assessment worksheet.

Field Data Collection

The primary goals of field data collection are to confirm or correct the provincial fuel type, complete WUI Threat Assessment Plots, and assess other features of interest to the development of the CWPP update. This is accomplished by traversing as much of the study area as possible (within time, budget and access constraints). Threat Assessment plots are completed on the 2012 version form, and as per the Wildland Urban Interface Threat Assessment Guide.

For clarity, the final threat ratings for the study area were determined through the completion of the following methodological steps:

1. Update fuel-typing using orthophotography provided by the client and field verification.
2. Update structural data using critical infrastructure information provided by the client, field visits to confirm structure additions or deletions, and orthophotography
3. Complete field work to ground-truth fuel typing and threat ratings (completed 30 WUI threat plots on a variety of fuel types, aspects, and slopes and an additional 900+ field stops with qualitative notes, fuel type verification, and/or photographs)
4. Threat assessment analysis using field data collected and rating results of WUI threat plots – see next section.

Spatial Analysis

Not all attributes on the WUI Threat Assessment form can be determined using a GIS analysis on a landscape/polygon level. To emulate as closely as possible the threat categorization that would be determined using the Threat Assessment form, the variables in Table 18 were used as the basis for building the analytical model. The features chosen are those that are spatially explicit, available from existing and reliable spatial data or field data, and able to be confidently extrapolated to large polygons.

Table 18. Description of variables used in spatial analysis for WUI wildfire threat assessment.

WUI Threat Sheet Attribute	Used in Analysis?	Comment
FUEL SUBCOMPONENT		
Duff depth and Moisture Regime	No	Many of these attributes assumed by using 'fuel type' as a component of the Fire Threat analysis. Most of these components are not easily extrapolated to a landscape or polygon scale, or the data available to estimate over large areas (VRI) is unreliable.
Surface Fuel continuity	No	
Vegetation Fuel Composition	No	
Fine Woody Debris Continuity	No	
Large Woody Debris Continuity	No	
Live and Dead Coniferous Crown Closure	No	
Live and Dead Conifer Crown Base height	No	
Live and Dead suppressed and Understory Conifers	No	
Forest health	No	
Continuous forest/slash cover within 2 km	No	
WEATHER SUBCOMPONENT		
BEC zone	Yes	
Historical weather fire occurrence	Yes	
TOPOGRAPHY SUBCOMPONENT		
Aspect	Yes	

WUI Threat Sheet Attribute	Used in Analysis?	Comment
Slope	Yes	Elevation model was used to determine slope.
Terrain	No	
Landscape/ topographic limitations to wildfire spread	No	
STRUCTURAL SUBCOMPONENT		
Position of structure/ community on slope	No	
Type of development	No	
Position of assessment area relative to values	Yes	Distance to structure is used in analysis; position on slope relative to values at risk is too difficult to analyze spatially.

The field data is used to correct the fuel type polygon attributes provided in the PSTA. The corrected fuel type layer is then used as part of the initial spatial analysis process. The other components are developed using spatial data (BEC zone, fire history zone) or spatial analysis (aspect, slope). A scoring system was developed to categorize resultant polygons as having relatively low, moderate, high or extreme Fire Threat, or Low, Moderate, High or Extreme WUI Threat.

These attributes are combined to produce polygons with a final Fire Behaviour Threat Score. To determine the Wildland Urban Interface Score, only the distance to structures is used. Buffer distances are established as per the WUI Threat Assessment worksheet (<200, 200-500 and >500) for polygons that have a 'high' or 'extreme' Fire Behaviour Threat score. Polygons with structures within 200 m are rated as 'extreme', within 500 m are rated as 'high', within 2 km are 'moderate', and distances over that are rated 'low'.

There are obvious limitations in this method, most notably that not all components of the threat assessment worksheet are scalable to a GIS model, generalizing the Fire Behaviour Threat score. The WUI Threat Score is greatly simplified, as determining the position of structures on a slope, the type of development and the relative position are difficult in an automated GIS process. This method uses the best available information to produce the initial threat assessment across the study area in a format which is required by the UBCM CRI program.

Upon completion of the initial spatial threat assessment, individual polygon refinement was completed. In this process, the WUI threat plots completed on the ground were used in the following ways:

- Fuel scores were reviewed and applied to the fuel type in which the threat plot was completed;
- Conservative fuel scores were then applied to the polygons by fuel type to check the initial assessment; and
- High Wildfire Behaviour Threat Class polygons were reviewed in Google Earth to confirm their position on slope relative to values at risk.

In this way, we were able to consider fuel attributes outside the fuel typing layer, as well as assessment area position on slope relative to structures, which are included in the WUI threat plot worksheet.

Limitations

The threat class ratings are based initially upon (geographic information systems) GIS analysis that best represents the WUI wildfire threat assessment worksheet and are updated with ground-truthing WUI threat plots. WUI threat plots were completed in a variety of fuel types, slopes, and aspects in order to be able to confidently refine the GIS analysis. It should be noted that there are subcomponents in the worksheet which are not able to be analyzed using spatial analysis; these are factors that do not exist in the GIS environment.

The threat assessment is based largely on fuel typing, therefore the limitations with fuel typing accuracy (as detailed in Appendix A-1 and Appendix G) impacts the threat assessment, as well.