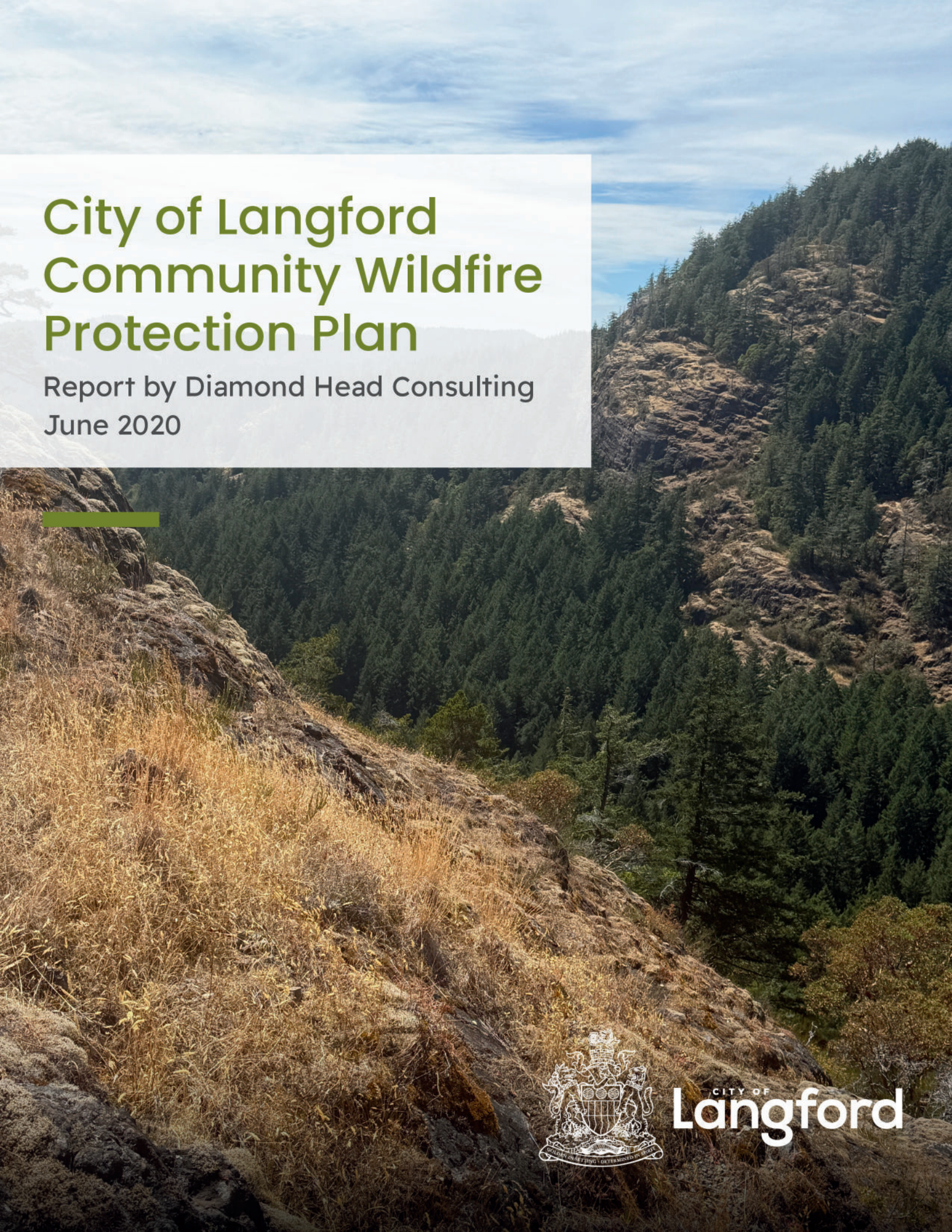
City of Langford Community Wildfire Protection Plan

Report by Diamond Head Consulting

June 2020



CITY OF Langford

Community Wildfire Protection Plan for City of Langford

Submitted on: June 2021

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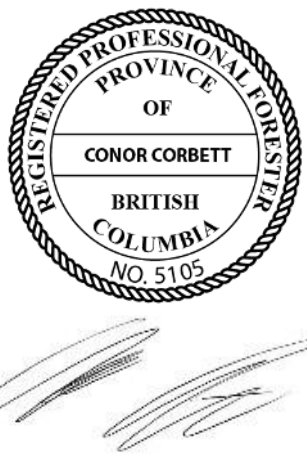

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Executive Summary

The City of Langford has been identifying and proactively managing wildfire risk for decades. The City's Fire Hazard plan created in 2002 was one of the first of its kind, predating the Community Wildfire Protection Plan (CWPP) program. This plan effectively identified wildfire risk and provided recommendations for managing this risk using a host of tools. Since this plan's creation, the understanding of wildfire risk has improved, specifically within the context of a changing climate. Urban development in the city has also changed the community's risk profile.

The CWPP program has created a province wide standard for wildfire risk management and analysis, as well as a host of tools for supplementing wildfire risk analysis and funding. This CWPP is a comprehensive update to the City's Fire Hazard plan and includes all land within the city as well as a two-kilometer buffer beyond city boundaries. This CWPP responds to the current and anticipated changes in the wildfire risk in and surrounding the city and makes recommendations to reduce vulnerability and increase resilience to wildfire.

The recognized values at risk identified in this plan include human life and safety, critical infrastructure, cultural values, species at risk, recreation, and timber resources. Critical infrastructure identified in and around the City plays an important role for the broader regional area, including critical drinking water infrastructure for the Capital Regional District. Protecting the City from wildfire is important not only for the City but for the broader region as well.

This plan discusses the threat and risk of wildfire within the wildland-urban interface. Threat refers to the likelihood of a wildfire occurring and its severity, based on the biophysical characteristics of the landscape and the predicted climatic regime. Risk is a measure of the likelihood that a wildfire will occur, its severity as well as what impacts it would cause to values. Values were identified in coordination with the City and stakeholders and focus on human safety and community assets. Additional recreational, cultural, economic, and social values were also considered.

Field work and desktop analysis identified the surrounding conifer forests as posing a *High* wildfire threat. The high density of the community, coupled with this threat, has classified many of these forests and natural areas as posing a *High* wildfire risk. High wildfire risk can be mitigated through many strategies. These include managing vegetation in certain areas, improving control of development in the wildland-urban interface, increasing educational outreach to the community for wildfire prevention, as well as a number of other FireSmart initiatives. Partnership with regional and provincial governing bodies as well as public education initiatives will further help Langford to reduce the risk from wildfire.

Summary of CWPP Recommendations

This report includes information about the current wildfire threat and risk within and surrounding Langford and provides many recommendations to be carried out by both local government and private residents. Some of these recommendations are easily implemented with a relatively low cost. Others, such as fuel treatments, require resources and support from the Provincial government and cooperation from other agencies. Recommendations have been prioritized based on both the ease of implementation as well as their relative impact on reducing wildfire risk.

There are funding sources available to help implement many of these recommendations. UBCM manages the Community Resilience Investment (CRI) Program which offers up to 100% funding for a range of wildfire mitigation initiatives. Many of the recommendations made in this report are eligible for CRI funding. Estimated costs for implementing these recommendations have been provided and are in addition to the City's existing operating budget.

Number	Recommendation	Priority	Timeline years	Estimated Cost
Rec 1	Continuously review the CWPP as a living document and complete an update every 5 years.	Medium	5+	$5,000 per update
Rec 2	Develop fuel treatment prescriptions for high priority interface fuel treatment areas. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #9 Fuel and Vegetation Management).	High	3-5	$50,000
Rec 3	Consult and coordinate with BC Hydro to create defensible spaces and reduce risk around all substations.	Medium	3-5	N/A
Rec 4	The City should assess the condition of fuels and wildfire risk around their facilities and develop fuel treatment prescriptions with the target of establishing a 30m defensible space around them. (CRI Activity #9 Fuel and Vegetation Management).	Medium	3-5	$30,000
Rec 5	Develop a partnership with the CRD to pursue treatment of CRD lands adjacent to the City (CRI Activity #9 Fuel and Vegetation Management).	High	3-5	$10,000

Rec 6	Train a staff member from the City of Langford as a Local FireSmart Representative through the Local FireSmart Representative workshop. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #6 Cross Training)	Medium	3-5	$1,000
Rec 7	Develop neighbourhood level FireSmart plans for priority neighbourhoods. This should include neighbourhood level FireSmart committees with the District, Fire Department, BCWS, and First Nations representatives. This should also include a variety of strategies with the objective of increasing private land resilience to wildfire. Participating communities should apply for FireSmart Community Recognition status and funding for mitigation projects through FireSmart Canada. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #1 Education and #8 FireSmart Activities for Residential Areas).	High	3-5	$50,000
Rec 8	Use recommended interface fuel treatment areas to promote similar projects on private lands. Showcase these treatments though a "FireSmart Day" with neighbourhood FireSmart committees. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #1 Education).	Medium	3-5	$5,000-$10,000
Rec 9	Develop and distribute FireSmart brochures to all houses within higher risk interface areas. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #1 Education).	Medium	3-5	$10,000-$20,000
Rec 10	Develop and distribute a list of ecologically suitable fire-resistant landscape plants (Appendix 4) to residents by mail and through local nurseries. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #1 Education).	Low	5+	$5,000-$10,000
Rec 11	Establish community chipping days in the spring to encourage residents to reduce vegetation fuel loads on private land. Provide a location where woody debris can be dropped off for chipping and request tree companies volunteer as a promotional event, similar to Christmas tree chipping events. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #8 FireSmart Activities for Private Land).	Low	5+	$10,000-$20,000
Rec 12	Review the Interface Fire Hazard DPA to ensure implementation meets the City's goals. Update mapping for areas of High and Extreme wildfire risk, and update the wildfire DPA accordingly. Funding for this review can be accessed through the UBCM Community Resiliency Investment Program (CRI #3 Development Considerations).	High	1-2	$10,000-$20,000

Rec 13	Ensure that Wildfire DPA applications are reviewed by City or Fire Department staff to ensure the objectives of the DPA are achieved. This will require coordination between City staff and Fire Department staff.	High	1-2	N/A
Rec 14	During significant public events have City and/or Fire Department staff on hand to provide educational material.	Medium	3-5	$5,000
Rec 15	Host public open houses for any planned treatments to forest fuels to allow public input and education.	Medium	3-5	$5,000
Rec 16	Conduct visits by Fire Service personnel into local schools to discuss wildfire prevention and preparedness.	Medium	3-5	$5,000
Rec 17	Update the City's digital media, including video and web content, to reflect this CWPP update. Provide print material at public locations including City Hall, Fire Departments, Community Centres, and Libraries. Risk maps should be presented at some of these locations.	Medium	3-5	$20,000-$40,000
Rec 18	Ensure all road edges are mowed frequently during the summer months.	Medium	3-5	N/A
Rec 19	Post wildfire danger signage along major transportation corridors, at campsites, parks and recreation, and at high use trail heads areas. Signages should address current fire danger, how to report a wildfire and, when relevant, emphasize the need to fully extinguish campfires and properly dispose of cigarettes.	Medium	3-5	$10,000-$20,000
Rec 20	Develop an annual fire season social media campaign to raise awareness of individual responsibility to prevent ignitions and of the enforcement of fire bans.	High	1-2	$10,000-$20,000
Rec 21	Work with BC Hydro to ensure that distribution lines, transmission corridors and substations are assessed regularly for tree risk and that the associated fuel hazards are abated.	Medium	3-5	N/A
Rec 22	Maintain the mutual aid agreements between the City and the surrounding Fire Protection Areas to enable sharing of suppression resources when responding to a wildfire.	High	1-2	N/A
Rec 23	Continue to require that all new fire hydrants systems for new development areas are able to serve adjacent high-risk interface areas.	Medium	3-5	N/A
Rec 24	Incorporate wildfire scenarios into the development of the evacuation plan.	High	1-2	N/A

Rec 25	Work with the CRD to maintain a coordinated evacuation plan in case of wildfire or other large disaster.	High	1-2	$10,000
Rec 26	Train all City firefighters in S100 Basic Fire Suppression and Safety training and S185 Fire entrapment avoidance and safety training. Funding is available for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #6 Cross training).	Medium	3-5	$5,000-$10,000
Rec 27	Conduct annual training exercises with the CRD to enhance response in the event of wildland urban interface fire. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #6 Cross training).	High	1-2	N/A

Table of Contents

List of Tables

List of Figures

Section 1 Introduction

1.1 Purpose

The City of Langford has recognized wildfire risk mitigation as a critical component of emergency preparedness and community planning. With extensive greenspace and parkland throughout the city limits, the interface between the forest and urban development and corresponding threat from wildfire is widespread. Wildfire risk is constantly evolving and changing due to environmental and developmental pressures, and can be mitigated through education, municipal policy, and forest management.

The purpose of this CWPP is to define the threat from wildfire to human life, property, and critical infrastructure, and to provide a framework to addresses this threat. This document identifies measures to mitigate the threat from wildfire through specific actions that will result in:

1. Reduced likelihood of a wildfire entering the community.
2. Reduced impacts and losses to property and critical infrastructure.
3. Reduced economic and social impacts to the community.
4. Future development that is resilient to wildfires.

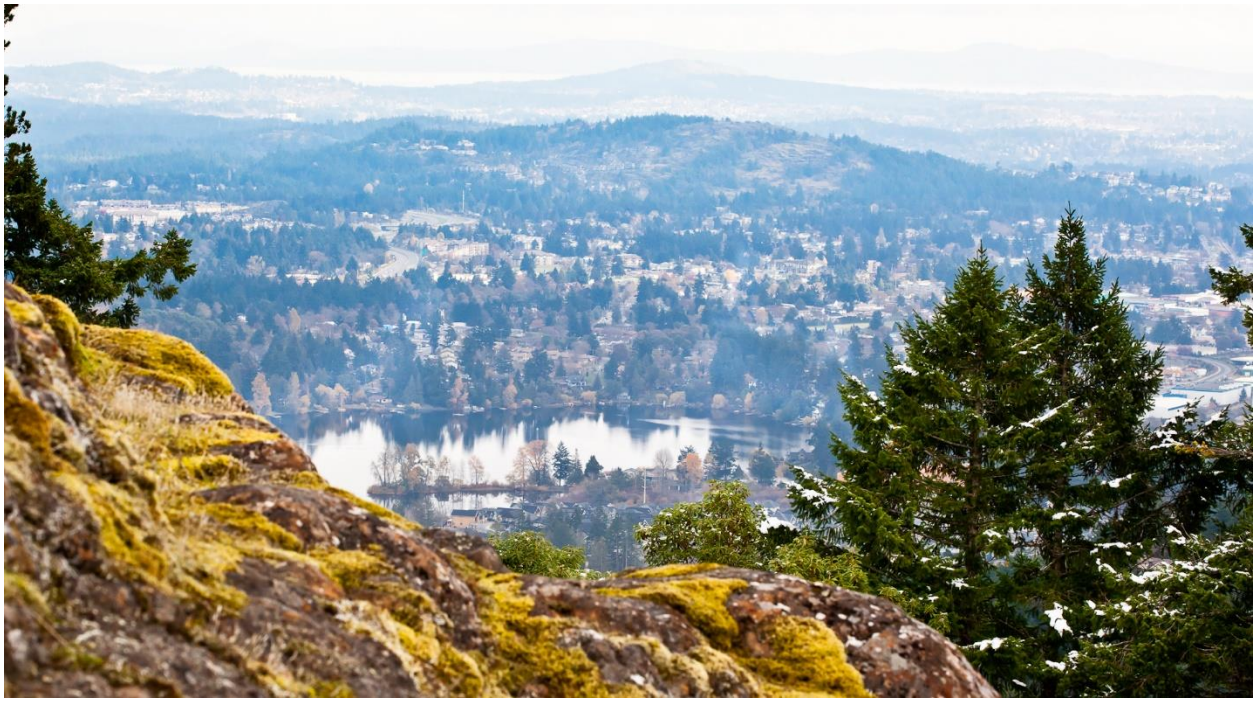


Photo 1 View of the City of Langford (credit: M.E. Sanseverino)

Wildfire Trends

Wildfires are impacting our communities more than ever before. Over the past decade there has been an average of 1,692 fires per year in British Columbia, burning an average of 151,000 ha (BC Wildlife Service, 2020). Approximately half of these fires were a result of human-caused ignitions. The total cost to the province over this decade has been almost 2.6 billion dollars (BC Wildfire Service, 2020). The 2018 fire season surpassed 2017 as the worst on record with more than 1.25 million hectares burned. The suppression costs for 2018 are currently estimated at $615 million dollars. In addition, the 2017 fire suppression costs came to $649 million with 65,000 people displaced due to evacuation orders (BC Wildlife Service, 2020). Both 2017 and 2018 fire seasons led to a Provincial State of Emergency being declared. In 2016, the most expensive natural disaster in Canadian history occurred in Fort McMurray, Alberta (Statistics Canada, 2017), burning 590,000 ha of forest at a fire suppression cost of over 100 million and destroying 2400 buildings, resulting in 3.77 billion dollars in insurance claims (Natural Resources Canada, 2017).

The trend towards an increasing area burned and fire suppression costs has been recorded not only in Western Canada but across North America (Marlon, et al., 2012). The trend is in large part attributed to climate change which is contributing to hot, dry summers and earlier springs. This is causing vegetation to start growing earlier, dry out earlier and for a longer period of time (Hope, McKenney, Pedlar, Stocks, & Gauthier, 2016). Since 1985, it is estimated that 50% of the increase in the area burned by wildfire in the western United States is due to human caused climate change (Abatzoglou & Williams, 2016). Worldwide, the length of the fire season increased by 19% from 1979 to 2013, with significantly longer seasons in the western United States (Jolly, et al., 2015). Research in British Columbia has estimated that the record-setting 2017 fire season was made 2-4 times more likely by climate change (Kirchmeier-Young, Gillett, Zwiers, Cannon, & Anslow, 2019).

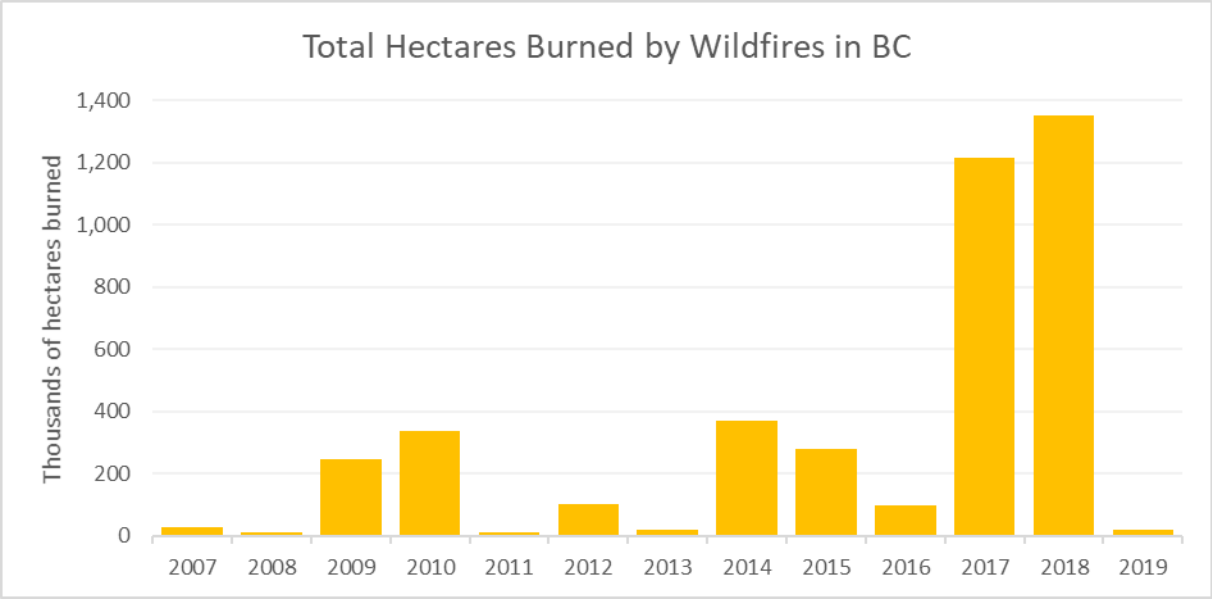


Figure 1 Total area (ha) burned by wildfires in BC by year in the past decade. (BC Wildlife Service)

In addition to the changing climate, forest fuels in BC have built up over time due to a history of effective fire suppression and tree mortality from forest health factors. Development and land-use activities have increased the area of wildland-urban interface (WUI) and the potential for human-caused ignitions near developed areas. Climate change, fuel build-up in our forests, and expanding WUI have created conditions that make fire suppression both challenging and expensive in BC.

Climate change models predict that the mean annual temperature will increase by 2.9°C to 6.2°C in the 2080s with more hot days (>25°C) and lower precipitation in the summer months (Capital Regional District, 2017). Warmer temperatures, earlier spring thaw, and potential for reduced summer rainfall would increase the likelihood of wildfire. Since we cannot immediately change climate, feasible strategies to protect our communities from wildfire need to focus on the factors that we can change now. This includes managing vegetation fuels in the WUI, building more resilient structures, improving suppression response and capability, reducing human-caused ignitions, and increasing public awareness of wildfire risk through education

1.2 CWPP Planning Process

CWPP Guiding Principles

The following guiding principles have been developed to help guide and support decision making and prioritize actions to manage wildfire risk in the City of Langford.

Guiding Principles	
Public Health and Safety	Public safety is the foremost priority for all wildfire management activities.
Protection of infrastructure	Community infrastructure, including private property, public structures, and facilities, is protected from wildfire.
Sustainable Planning	Growth and development improve quality of life, maintain a healthy environment, and ensure a prosperous future.
Environmental Protection and Enhancement	Ecosystems that support biodiversity and environmentally sensitive features are protected and enhanced.
Interagency Co-operation and Policy	Wildfire management planning, preparedness, prevention, suppression, ecosystem rehabilitation, and education occurs in co-operation with all relevant agencies and neighbouring local governments.
Public Awareness, Education and Advocacy	Public understanding, support and awareness of wildfire risk management is increased through effective education, advocacy, and communication.
Adaptive Management	The effectiveness of wildfire management initiatives is monitored and continuously improved by reviewing actions and decision-making processes.

Financial Responsibility	Wildfire management initiatives are prioritized and implemented adequately within reasonable, sustainable budgets and through innovative partnerships.

CWPP Implementation History and Planning Process

The City completed an Interface Fire Hazard Planning Model in 2002, which predates BC's CWPP standards and process. This plan began with a research and literature review of what options to local government were available to manage interface wildfire. Findings were summarized and presented to the City Fire Department and during a public open house and feedback from this consultation was integrated into the final 2002 plan. Strategies for managing interface wildfire focussed on development permit policy and process and education for private property owners.

One limitation to this original plan was the lack of pre-existing wildfire data available at the time of its production, as this plan predated the Provincial Strategic Threat Analysis (PSTA) wildfire data program. The available mapping was therefore coarse and not informative for analysing fire behavior potential. To update this 2002 plan City staff applied for and received funding from the Community Resiliency Investment (CRI) Program to update the existing CWPP. Upon receipt of this grant, City staff retained an external consultant to create the CWPP to 2019 CRI standards.

The Province of BC provided spatial data from the Provincial Strategic Threat Analysis (PSTA) which includes fuel typing, risk analysis and values at risk. This analysis predicts the fire behaviour potential of the natural areas within the Area of Interest (AOI) and maps the potential wildfire threat to values across the landscape. The PSTA was used as the base from which to prioritize interface areas for further assessment. Critical values were refined through consultation with stakeholders. Ground truthing of fuel types and wildfire threat assessments was completed to update fuel typing, risk analysis, and values at risk. The result was a refined spatial product defining values at risk, wildfire behaviour potential, and overall wildfire risk to the community. This analysis was used to develop and prioritize the wildfire mitigation actions recommended in this CWPP. These have been prioritised to help management focus on actions that will have the greatest benefit at the lowest cost.

A Living Document

The risk from wildfire will continue to change as urban development continues, forest conditions change, and with predicted changes in the climate. This plan is intended to be a living document that will be updated every five years to assess and respond to these changing conditions.

Number	Recommendation
Rec 1	Continuously review the CWPP as a living document and complete an update every 5 years.

CWPP Consultation Process

This CWPP update was developed in consultation with stakeholders from both the public and private sectors. These stakeholders include the City of Langford, the Capital Regional District (CRD), First Nations, and representatives from key industries. Stakeholders were engaged at the start of this project and at key intervals to provide input and feedback. The level of involvement and input varied depending on the level of interest and available resources.

Section 2 Local Area Description

2.1 CWPP Area of Interest

The Area of Interest (AOI) for this CWPP is the City of Langford (the City) plus a two-kilometre buffer surrounding the City limits. The City is in the southeast portion of Vancouver Island, in Greater Victoria's West Shore subregion. Langford is part of the Capital Regional District (CRD) and is the fastest-growing municipality within the CRD. The City borders District of Metchosin, the City of Colwood, the Town of View Royal, the District of Highlands, and the Juan de Fuca Electoral Area of the CRD. The City has an area of approximately 43.1 square kilometers (4,310 ha), and a population of approximately 35,000 (as of 2016). Buffering the City limits by two kilometers adds an area of 83.8 square kilometers (8,376 ha), making the total area of the AOI 126.9 square kilometers (12,692 ha).

Within the AOI there is one Indian Reserve (Goldstream IR 13), held in shared claim by the Pauquachin, Malahat, W̱JOŁEŁP (Tsartlip), Tsawout, and W̱SIḴEM (Tseycum) First Nations. The reserve has no permanent structures.

Photo 2 Langford Lake

Within the AOI there is a mix of land ownership. According to the provincial forest ownership layer: The City of Langford has jurisdiction over public lands within its boundaries amounting to 1.5% of the AOI. A total of 49% of the AOI is privately owned and 8% is Provincial Crown Land (Table 1, Figures 2 and 3). Within the City limits, approximately 2024 hectares, or 87% of the land, is privately owned.

Table 1 Broad land ownership within the AOI

Jurisdiction	Area within the AOI (ha)	% of area within the AOI
AOI	**12,692**	**100%**
Private land	6,245	49%
Provincial Crown land	956	8%
Capital Regional District	297	2%
City of Langford-owned	172	1%
Other Municipality-owned	3,127	25%
Federal	398	3%
Fresh Water	176	1%
All other classes	1,314	10%

Table 2 Detailed Land ownership within the AOI

Jurisdiction	Area within the AOI (ha)	% of area within the AOI
Crown - Community Watershed	470	4%
Crown - Forest Management Unit	1379	11%
Crown - Forest Recreation Reserves	0.4	0%
Crown - Local/Regional Park	2976	23%
Crown - Misc. Reserves	3	0%
Crown - Municipal Parcels	622	5%
Crown Lease - Misc. lease	0.4	0%
Crown Tenure - Woodlot Licence, Schedule B	0	0%
Federal - Dominion government Block/Federal Parcels	397	3%
Private	6270	49%
Unknown Ownership/Exceptions	18.5	0%

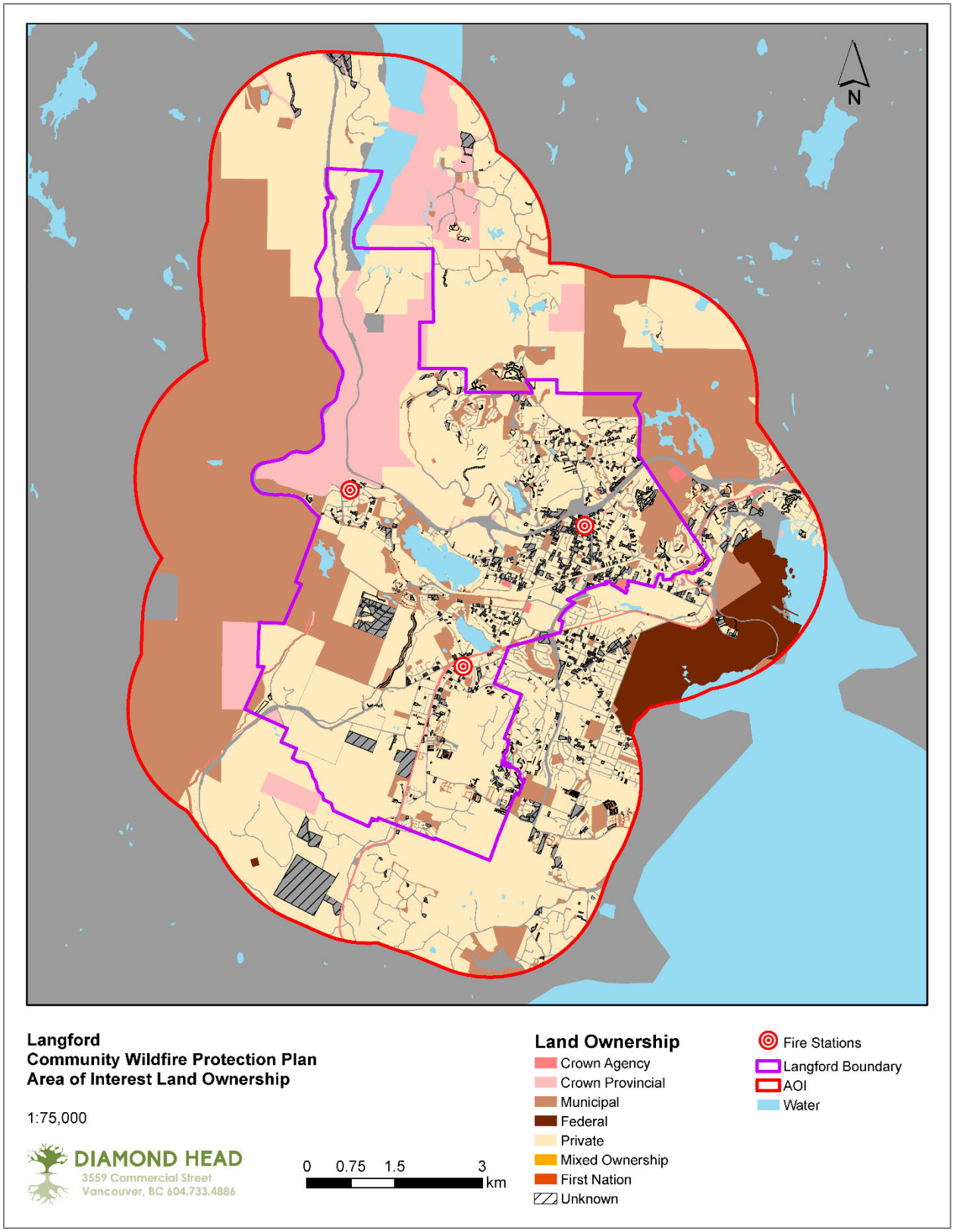


Figure 2 Land Ownership with the AOI

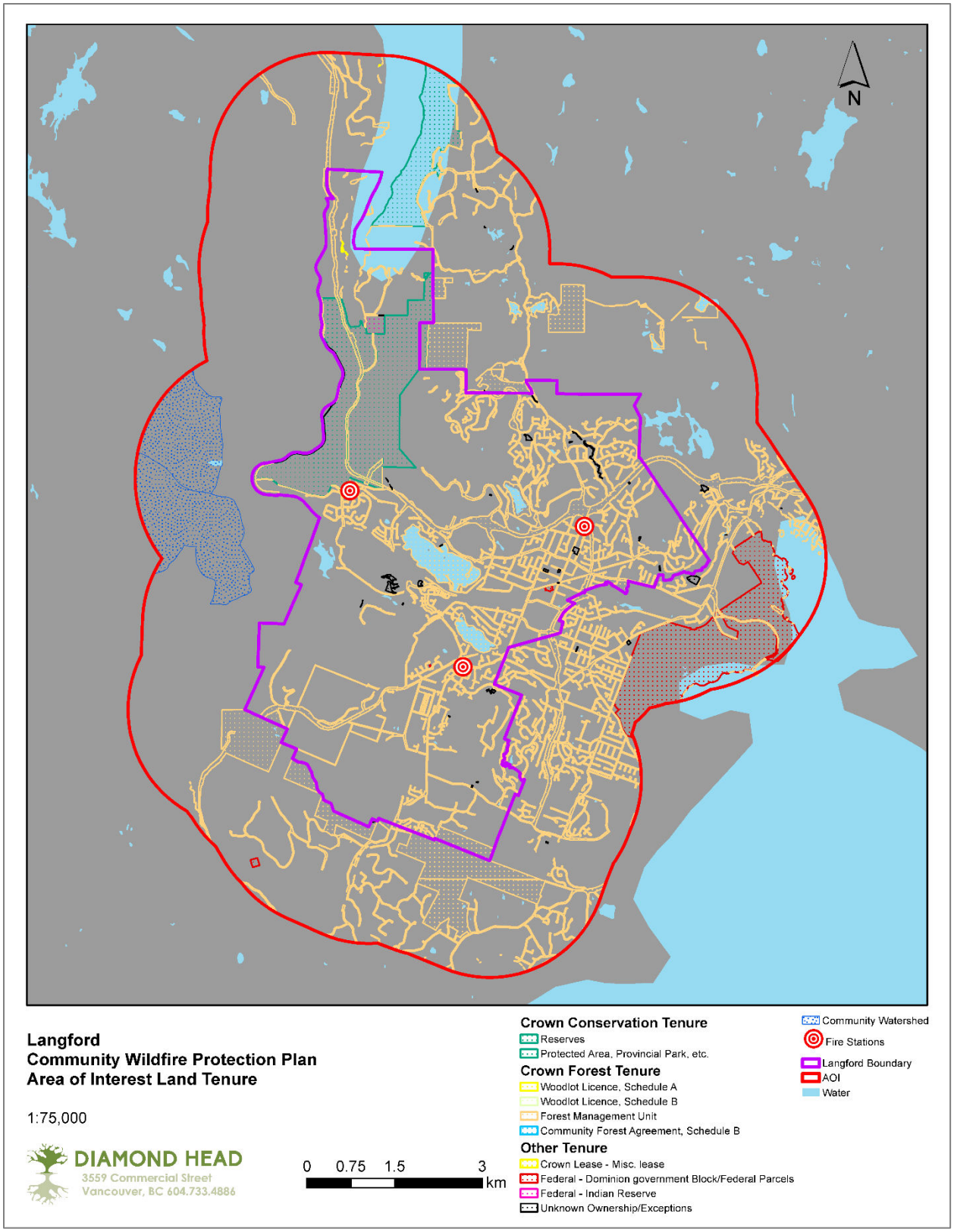


Figure 3 Land tenures in the AOI

2.2 Community Description

The City has a diverse economy, integrated with that of the larger CRD. Employment is focused in the services sector, including both commercial and public services such as health and education. Construction is an important component of private sector employment. Proximity to the Capital Region is a major economic factor, with many residents working in other CRD municipalities and residents of other nearby municipalities commuting to Langford.

Table 3 Employees by key sectors in Langford (Statistics Canada, 2017)

Sector	Employees
Agriculture, forestry, fishing and hunting	130
Mining, quarrying, and oil and gas extraction	90
Utilities	80
Construction	1,915
Manufacturing	705
Wholesale trade	470
Retail trade	2,660
Transportation and warehousing	760
Information and cultural industries	390
Finance and insurance	820
Real estate and rental and leasing	385
Professional, scientific and technical services	1,190
Management of companies and enterprises	15
Administrative and support, waste management and remediation services	880
Educational services	1,040
Health care and social assistance	2,725
Arts, entertainment and recreation	425
Accommodation and food services	1,690
Other services (except public administration)	930
Public administration	3,075

2.3 Past Wildfires, Evacuations, and Impacts

Historical wildfire data is provided as part of the PSTA dataset from the BC wildfire service. There have been 769 wildfires in the AOI since 1950, burning a total area of approximately 1,473 ha. (Figure 4 and Table 4). The ten largest fires account for two-thirds of the total area burned: most fires are small fires that are quickly controlled, while a small number of fires escape early control and become larger. The average size of a fire in the AOI since 1950 is 1.9 ha. If the largest ten fires are excluded, the average fire size drops to 0.65 ha. In the past 10 years there have been 9 fires that have burned approximately 3.4 hectares.

Table 4 Summary of wildfires in the AOI since 1950.

AOI Fires Summary	# of Fires	Area Burned (ha)
Total 1950 – 2018	769	1473
Total 2009 – 2018	9	3.4
Average #/year (1950 – 2018)	11	21.7
Modified Average #/year (10 largest fires excluded)	11	7.15

The average # of fires in the AOI over the past 10 years is 0.9 per year. This is 92% below the 1950-2018 average of 11 per year. The average area burned over the past 10 year is 0.34 ha per year. This is 95% below the 1950-2018 modified average. Despite this decrease in the number of fires and area burned within the AOI, the city experienced periods of heavy smoke and poor quality during the 2017 and 2018 fire seasons from wildfires elsewhere in the Pacific Northwest. This has had impacts to the health and well being of residents, as well as economic impacts from reduced recreation and tourism.

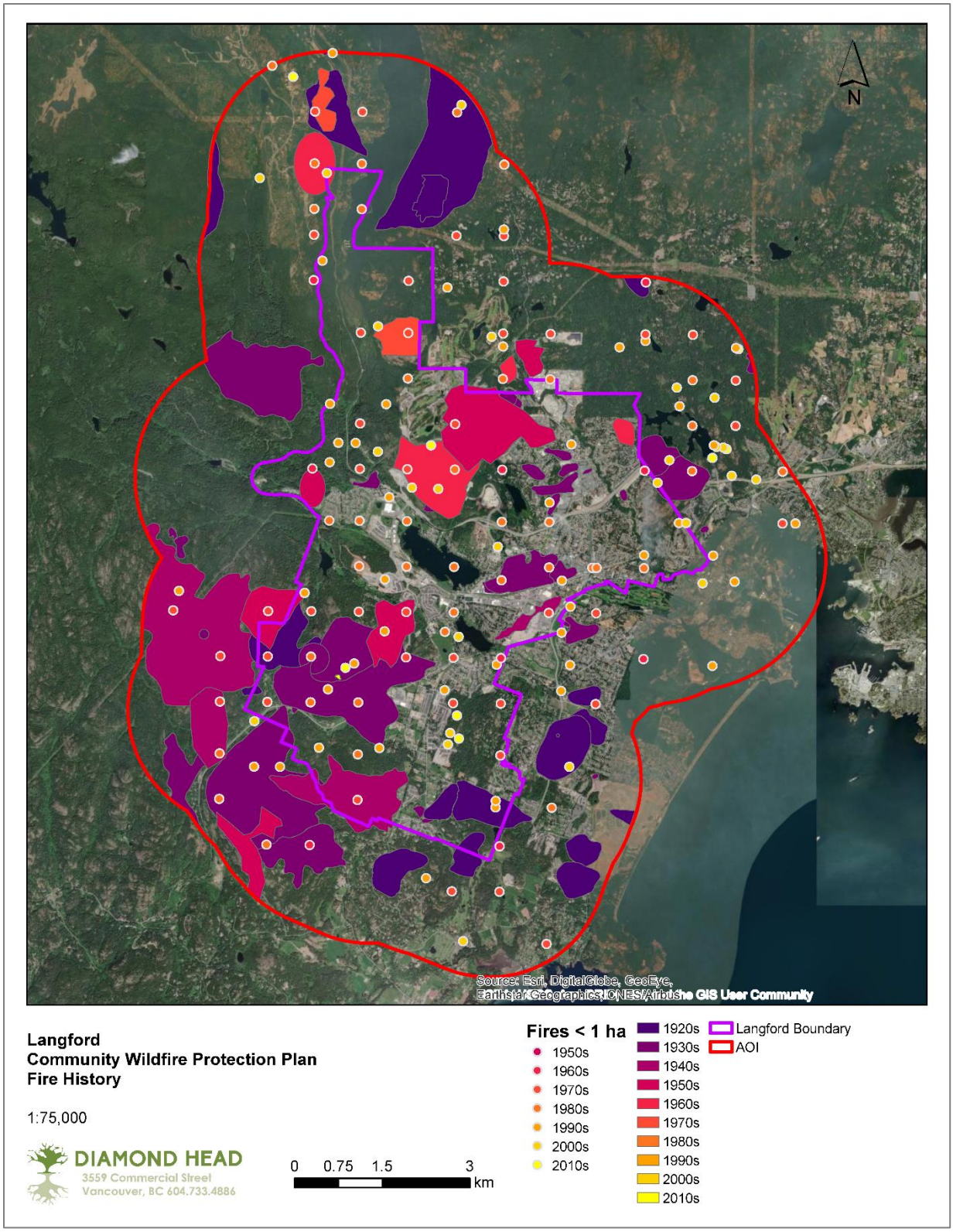


Figure 4 Location of previous wildfire events in the AOI. Polygons represent larger wildfires and points represent smaller fires. Color codes represent fires within different decades.

2.4 Current Community Engagement

The City's pre-existing Fire Hazard Plan was created in 2002, and was one of the first wildland-urban interface fire projects completed in BC. The creation of this plan included the establishment of a Langford Interface Fire Committee, made up of representatives from a variety of organizations and groups. This included a member from a community considered to be at risk from interface fire. A public open house was held to increase community engagement and education and to gather feedback to inform the plan. A key recommendation was the inclusion of key interest groups including residents in high risk areas during examination of wildfire hazard.

Photo 3: The interface is where forest cover abuts urban development and could potentially introduce a wildfire into urban neighbourhoods.

2.5 Linkages to Other Plans and Polices

Many City plans and policies relate in one way or another to wildfire planning. The most relevant are summarized below.

2.5.1 Local Authority Emergency Plan

The City has emergency plans in the event of a large-scale emergency, including earthquake, fire, and flood. West Shore Alert is used to deliver notifications to registered residents in the event of an emergency, using phone and email to deliver messages to residents.

The City is currently developing an evacuation plan, however this was unavailable for review at the time of production of this CWPP.

2.5.2 Affiliated CWPPs

Community Wildfire Protection Plans exist for the neighbouring municipalities of View Royal, Colwood, Metchosin, Highlands, and Sooke. By renewing its Community Wildfire Protection Plan, the City is contributing to a collective effort to manage wildfire risk in West Shore communities.

2.5.3 Local Government and First Nation Plans and Policies

Fire Hazard Plan

An interface Fire Hazard Planning Model was produced for Langford in 2002. This was prepared to address the wildland-urban interface fire hazard and describe the range of tools available to reduce wildfire hazard. This was one of the first comprehensive wildfire-interface fire project undertaken by a municipality in BC. One of the results of this planning model was the mapping and designation of high and extreme risk interface areas, which was subsequently used to guide the discussion of wildfire hazard in the Official Community Plan and to develop Development Permit Areas Guidelines.

Official Community Plan

The Official Community Plan (OCP) for the City of Langford was adopted in 2008 and provides a framework for land use in the City. This plan was updated in 2019. The OCP explicitly acknowledges an increased risk of wildfire from climate change, and the need for this to be addressed in the planning process. The OCP includes a map of interface hazard area (Figure 5), which maps out the interface fire hazard throughout the City. Development in areas of “High and Extreme interface fire hazard must occur in a way that minimizes the risk to person or property associated with these hazards.” The specific requirements for development in these areas are described in the City of Langford Design and Guidelines and Development Permit Areas document.

Designated Development Permit Area and Design Guidelines

The Lands identified on Map 19 of the Official Community Plan as "high" or "extreme" interface fire hazard have been designated as a Development Permit Area pursuant to Sec. 488(1)(b) of the Local Government Act. Prior to any subdivision or alteration of land, a property owner must first obtain a Development Permit (DP) from the City of Langford. The DP will be informed by a report prepared by a qualified professional (QP) to assess the interface fire hazard. Recommendations of the QP may form part of the DP and requirements with respect to building use, design or materials may also be stipulated in the DP. Conditions relating to the construction of the building are met through the building permit and building inspections. The DP may also control non-construction related activities, such as open burning and landscape maintenance and impose a rent charge against the property if these conditions are not met. The City of Langford maintains a pro-forma interface fire hazard Development Permit and covenants to simplify the process for individual property owners seeking to develop only one house on one lot.

City of Langford Burning and Fire Regulation Bylaw No. 1532

The City of Langford Burning and Fire Regulation Bylaw No. 1532 regulates the use of open burning, recreational fires, and wood burning appliances. Open burning is permitted between March 15 through April 15 and November 1 through November 30. This prohibits the burning of garbage, organic waste, plastic, rubber, asphalt shingles, or any similar materials, as well as the burning of debris from logging, land clearing, construction, demolition and/or business. Burning is also limited during periods of high wind. There are several areas, such as Ravens View, where no burning is permitted through the use of restrictive covenants. Campfires are exempt from the burning bylaw, however campfire bans do occur during hot and dry summers. Campfire bans are enacted whenever local BC wildfire service enact a fire ban on the adjacent lands outside the City.

Climate Action & Energy Plan

Climate change policy is embedded in the OCP and outlined in City reports and plans. The City signed the BC Climate Action Charter in 2007. The OCP incorporates the city's commitment to addressing issues related to climate change and sets out actions including the development and maintenance of the Community Energy and Emissions Reduction Strategy (CEERS). The CEERS sets out series of goals to achieve the overarching goal of becoming a national model of a sustainable, resilient, and energy-secure community by 2050.

First Nation Plans and Policies

The adjacent Goldstream IR 13 is not within the boundaries of an existing Community Wildfire Protection Plan. Some of the Nations with shared claim to the Reserve have in the past trained staff in fire protection and recognition of fire hazards. No emergency planning or wildfire protection planning has been undertaken by a First Nation for IR 13.

Capital Regional District Regional Growth Strategy Bylaw No. 1, 2016

The Regional Growth Strategy sets out high-level land-use designations for communities of the Capital Regional District, including Langford. Growth projections within the Strategy indicate Langford is expected to continue growing rapidly, with an additional 18,000 people (almost two-thirds of the city's current population) by 2038.

Wildfire Risk Analysis for the CRD Greater Victoria Water Supply Area

The CRD has completed a landscape level wildfire analysis for the water supply area for the Greater Victoria Area. This document was provided for review as part of this CWPP. Burn probability was modelled for the water supply area to assess the relative risk across the region in and around the area. This identified several areas of higher wildfire risk, with potentially high impacts. This document concludes that while the water supply area is in a coastal rainforest not known for high wildfire threat, large fires are possible and have serious threat to local water supply (Perrakis, Stohmann, & Taylor, n.d.). Fuel treatment and other management decisions are recommended as options to reduce risk.

Photo 4 Langford lake walkway (credit: John Newcomb)

Map 19: Interface Fire Hazard Areas
(Replaced by Bylaw 1674)

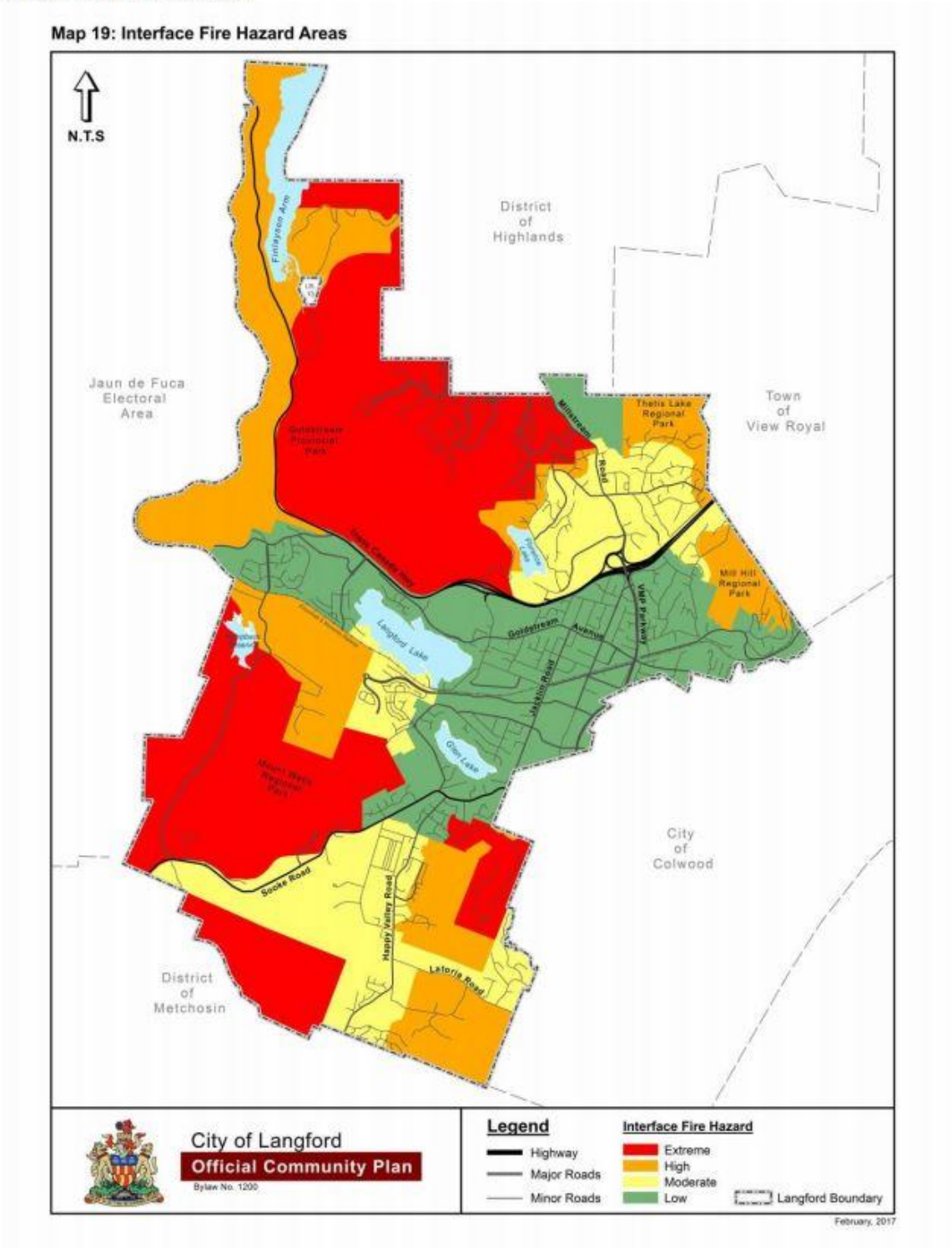


Figure 5 Interface Fire Hazard Map from City of Langford OCP.

2.5.4 Higher-Level Plans and Relevant Legislation

Vancouver Island Summary Land Use Plan (2000)

The plan provides high-level direction to crown land management on Vancouver Island. None of the special management zones or orders continued under the plan's legal authority apply to areas within the limits of the City of Langford.

2.5.5 Ministry or Industry Plans

There are no additional relevant ministry or industry plans for the AOI.

Section 3 Values at Risk

Wildfires can impact our community in many ways. They can cause direct impacts to structures, facilities, and infrastructure, and in rare cases can result in the loss of life. Smoke from nearby wildfires causes direct impacts to human health. Economic impacts can include reduced tourism activity and agriculture production. Wildfires can also disrupt economic activity through evacuations of residents, who often must take leave from their employment. Evacuations and area closures disrupt the movement of goods and services via roads, railways, and utility corridors that is critical to the wider regional economy. These direct and indirect impacts can be difficult to quantify but cause significant cumulative impacts on local livelihoods. This section of the report provides an overview of the types of values that are at risk from wildfire within the AOI.

3.1 Human Life and Safety

Protection of human life is the top priority in the event of wildfire in the urban interface. Structure locations have been used to provide a measure of the density of population. Areas with an average density of more than 6 structures per square kilometer are defined as the Wildland Urban Interface (WUI) (Figure 6).

Table 5 provides a summary of the total area within the AOI by structure density class. Highly urbanized areas of more than 100 structures per square kilometer make up a high percentage (38%) of the total AOI and development is typically dense with limited inclusion of urban forested areas. Development around the outskirts of the City is intermixed within natural forested areas. Around half of the area contains structures at densities lower than 100 structures per square kilometer. These types of developments present the most difficulty for suppression response and evacuation access as they tend to be spread out with trees embedded closely in and around the structures.

Table 5 Summary of density

Density Structures/km^2	Area (km^2)	% of total area
1-6	2012	16%
6-24	1803	14%
25-100	2436	19%
100-250	1,411	11%
250+	3350	26%
No buildings	1687	13%

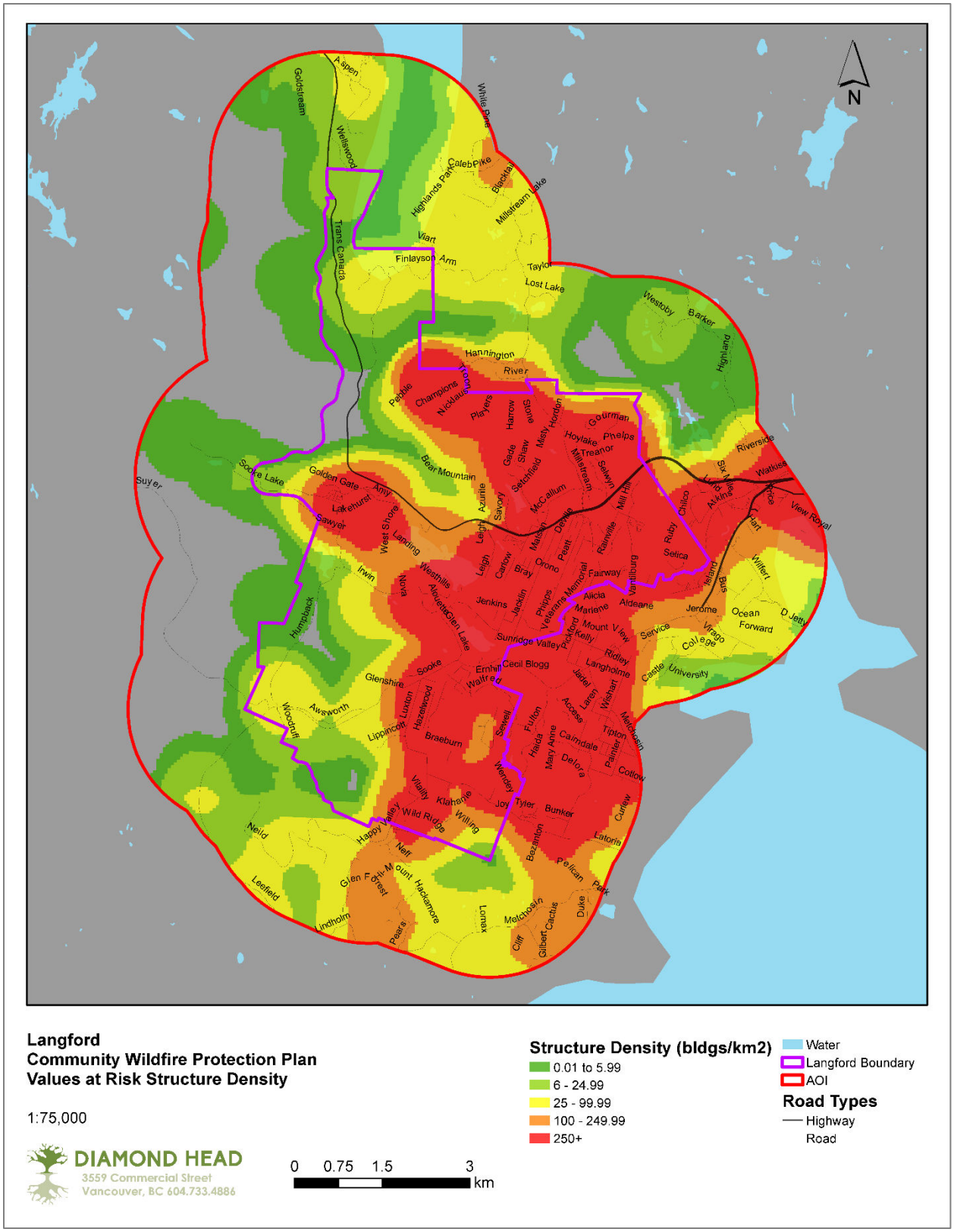


Figure 6 Density of structures

3.2 Critical Infrastructure

The features and utilities that are considered critical infrastructure were identified through consultation with stakeholders. These are features that, if disrupted or destroyed, would cause serious impacts on the functioning of the government and important facilities that the public relies on. These include BC Hydro transmission lines and substations, municipal water supply, waste treatment, hospitals, schools, municipal buildings, police and fire stations (Figure 7).

3.2.1 Electrical Power

BC Hydro services the City of Langford through an electrical grid of above- and below-ground transmission lines, with 54 kilometers of above-ground transmission lines in the AOI. BC Hydro has policies and mitigation activities in place to mitigate the risk from wildfire. These include fuel management in the interface area surrounding sites, wildfire assessments prior to work in the interface, and risk evaluations during periods of high or elevated wildfire danger. Hydro power lines and their substations are also a source of ignition, particularly if trees fall on the lines. BC Hydro is responsible for reducing the risk from trees adjacent to its power lines.

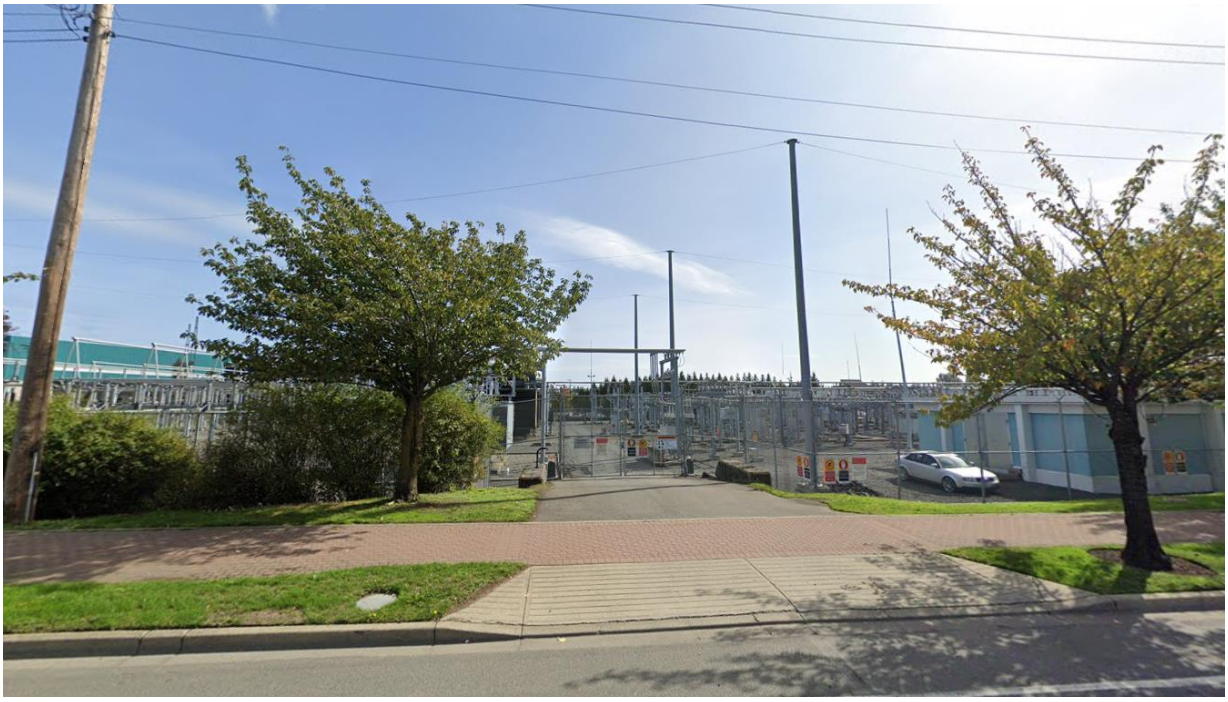


Photo 5: BC Hydro substation on Jacklin Road (Google Earth)

3.2.2 Communications, Pipelines, and Publicly Owned Buildings

Natural Gas

Fortis BC maintains a network of underground gas pipelines for the region. A major distrubtion centre and support office is in Langford adjacent to the BC hydro facility. This distrubtion centre is a critical junction for supplying gas to the entire south island. This facility is in the urban area of Langford and is not in the wildland urban interface.

Municipal Buildings

There are many community facilities that could be identified for protection in the case of a wildfire. Critical infrastructure are those facilities that are important to protect to ensure the City can continue functioning in the case of a catastrophic wildfire event. For the purposes of this CWPP the following municipal and public buildings were identified as critical infrastructure:

- Langford City Hall
- Langford Fire Stations
- RCMP West Shore Detachment
- All public and private schools and school board offices.
- BC Vancouver Island Emergency Dispatch Centre (Ambulance)
- BC Hydro Substation (Jacklin Rd)
- Capital Regional District Supply Disinfection Facility (Japan Gulch)
- Mount Macdonald Communications Infrastructure (inside CRD Parks)

Most of the Critical Infrastructure is in the main urban area of the City. A major exception is the CRD water supply facilities, all of which are in the WUI. These facilities are Critical Infrastructure for not only the City, but the entire CRD.

Photo 6 City of Langford Fire Rescue Station 3.

Transportation

During a wildfire event, transportation is critical for evacuations and to support suppression efforts. Infrastructure to be protected includes Highways 1 and 14, and additionally Veterans Memorial and Langford Parkways. Highways 1 and 14 provide the primary evacuation routes to the north, east, and southwest. While a wildfire event may result in the closure of one of these routes, it is highly unlikely that these routes would be closed in all directions, isolating the City.

3.2.3 Water and Sewage

The City of Langford water and sewer system relies on supply from the CRD watersheds. The AOI hosts the main treatment facilities for the CRD system at Japan Gulch, which is the primary source for water throughout the CRD and the location of disinfection facilities and watershed administration. The CRD employs full-time wildfire protection and emergency response personnel in its watershed to manage the threat from wildfire to the regional water supply. Because of the wildfire threat to the facilities, building design at Japan Gulch generally includes the use of fire-resistant building materials and occupy a fuel-free compound. Backup generators can supply power in the event of an outage. The proactive wildfire risk mitigation by the CRD has decreased the likelihood of the facilities themselves being involved in an interface wildfire. A more likely scenario is a wildfire in the watershed itself.

Photo 7 CRD water disinfection facilities at Japan Gulch.

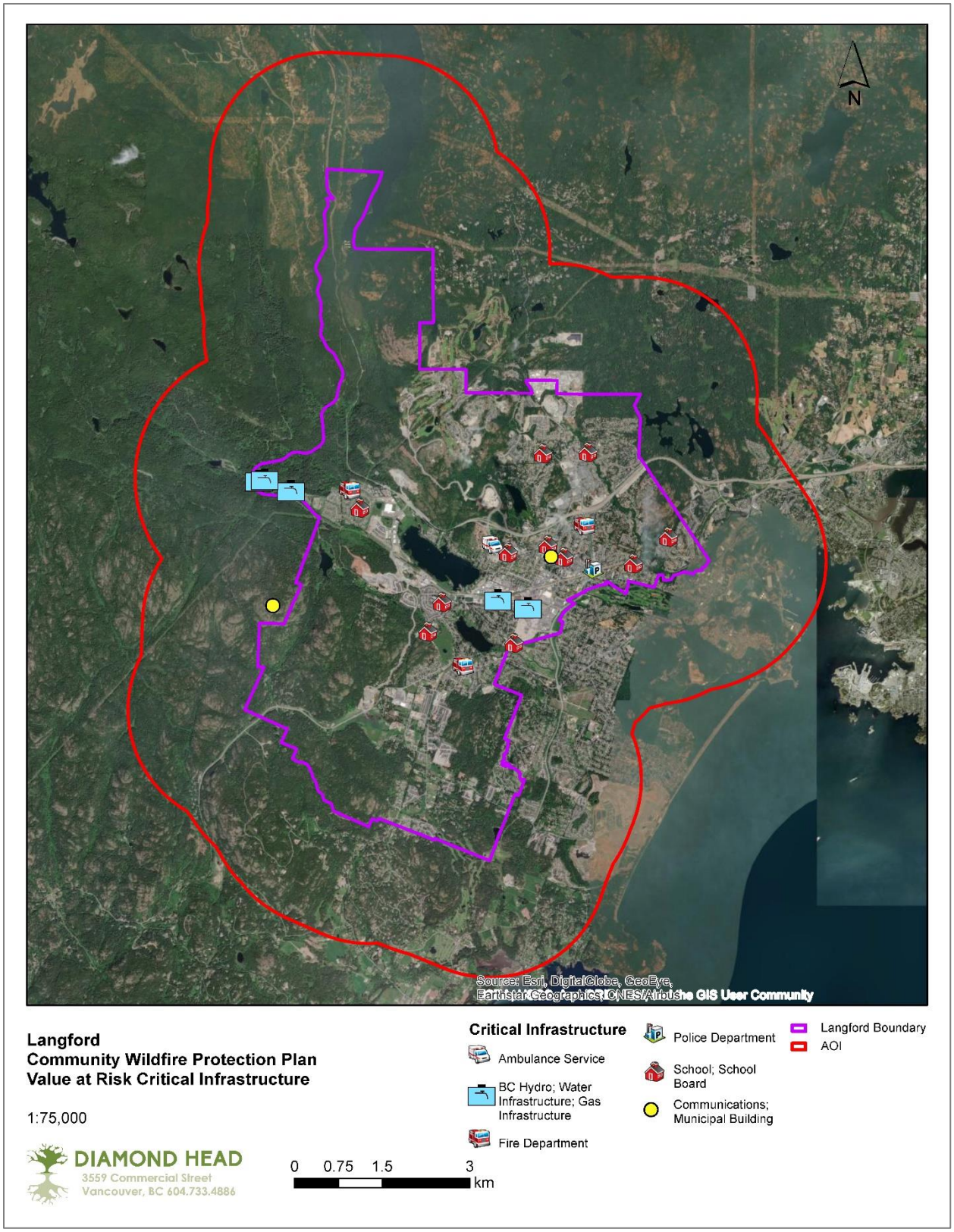


Figure 7 Critical infrastructure Map

3.3 High Environmental and Cultural Values

3.3.1 Drinking Water Supply Areas and Community Watersheds

Two provincially designated community watersheds overlap the AOI: the Goldstream and Waugh Community Watersheds. The Goldstream watershed is largely within the controlled area for the CRD water supply. The Waugh community watershed is managed as a CRD park and contributes surface flow to Goldstream River downstream of the Japan Gulch treatment facility. Wildfires can cause shifts in landscape processes that can decrease water quality by increasing sedimentation and nutrients downstream, and increasing erosion adjacent to watersheds (Emelko & Sham, 2018). There have also been cases where homes and infrastructure have been destroyed or damaged during debris flows that can be attributed to wildfires (Jordan, Turner, Nicol, & Boyer, 2006). The likelihood of debris flow is increased after wildfire to communities downstream, particularly areas of development on alluvial fans.

3.3.2 Cultural Values

The Archaeology Branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development maintains a spatial database of archaeological and historical sites. These include locations where there is evidence of past human activity. Within the AOI there are 35 recorded sites of which 34 are archaeological sites related to aboriginal life during the 14,000 years prior to European contact. These sites occur throughout the municipality. They include caches, trails, fishing sites, cooking features, lithics, grave sites and human remains. Due to the sensitive nature of these sites their exact locations cannot be published.

There is one location which includes sites of historic importance from the past 200 years. These historic sites are protected under federal, provincial, or local acts and include recognized heritage buildings as well as some heritage trees.

3.3.3 High Environmental Values

The BC Conservation Data Centre (CDC) records BC's most vulnerable vertebrate animals and vascular plants, each of which is assigned to a provincial Red or Blue list according to their provincial conservation status rank. Species or populations at high risk of extinction are placed on the Red list and are candidates for formal endangered species status. Blue-listed species are considered vulnerable to human activity and natural events.

The impacts of fuel treatments to these plants, animals and ecosystems should be taken into consideration when prescribing fuel treatments across the study area. Details regarding the management requirements of these entities can be found on the Conservation Data Centre Website (https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre). Red- and blue-listed wildlife species at risk that are known to inhabit the AOI or the adjacent natural areas are listed in Table 6 and illustrated in Figure 8.

Table 6 Recorded known occurrences of Red and Blue listed species and ecological communities that inhabit the AOI (Conservation Data Centre).

CDC Occurrence ID#	Name	B.C. Status
1303	Common Ringlet, *insulana* subspecies (*Coenonympha tullia* ssp. *insulana*)	Red
4750	Contorted-pod Evening Primrose (*Camissonia contorta)*	Red
1546, 4347, 5697, 6639	Deltoid Balsamroot (*Balsamorhiza deltoidea*)	Red
1301, 5409	Douglas-fir – Alaska Oniongrass	Red
1230, 1381, 5195	Douglas-fir – Arbutus	Red
8634, 8642, 8644, 8645, 8646, 8647	Douglas-fir – Dull Oregon-grape	Red
9553, 11714, 12140, 14384	Fern-leaved Desert-parsley (*Lomatium dissectum*)	Red
4921	Garry Oak – Arbutus	Red
5929	Garry Oak – California brome	Red
251, 1547, 4888	Garry Oak – Oceanspray	Red
2116, 14123, 14124, 14125, 14126	Grand fir – dull Oregon-grape	Red
1384	Grand-fir – Three-leaved Foamflower	Red
5750, 13908	Howell's Triteleia (*Triteleia howellii*)	Red
267, 1666, 7579	Macoun's Meadow-foam (*Limnanthes macounii*)	Red
7674	Painted Turtle, Pacific coast population (*Chrysemys picta*)	Red
6523	Phantom Orchid (*Cephalanthera austiniae*)	Red
6532, 6560, 7493, 15941, 15942	Prairie Lupine (*Lupinus lepidus*)	Red
3829	Propertius Duskywing (*Erynnis propertius*)	Red
250, 1428, 5279, 7639	Purple Sanicle (*Sanicula bipinnatifida*)	Red
2025	Red alder – skunk cabbage	Red
10869	Rough-leaved Aster (*Eurybia radulina*)	Red
6956, 9962	Sharp-tailed Snake (*Contia tenuis*)	Red
13913	Trembling Aspen – Pacific Crabapple – Slough sedge	Red
8956	Western Branded Skipper, *oregonia* subspecies (*Hesperia colorado* ssp. *oregonia*)	Red
10784	Western redcedar – common snowberry	Red
15725	Western redcedar – salmonberry	Red
3732, 6322	White Meconella (*Meconella oregana*)	Red
6908	Banded Cord-moss (*Entosthodon fascicularis*)	Blue
12924	Black knotweed (*Polygonum paronychia*)	Blue
7093, 7921, 8917	Blue-grey Taildropper (*Prophysaon coeruleum*)	Blue
2677, 5384, 9558, 9568, 10685	Common bluecup (*Githopsis specularioides*)	Blue
5281	Moss' Elfin, *mossii* subspecies (*Callophrys mossii* ssp. *mossii*)	Blue
5878	Near Navarretia (*Navarretia propinqua*)	Blue
8675, 8676, 12857	Northern Red-legged frog (*Rana aurora*)	Blue
8880, 12074, 12116	Poverty Clover (*Trifolium depauperatum*)	Blue
148	Purple Martin (*Progne subis*)	Blue
10760	Red Alder – Salmonberry – Common Horsetail	Blue

CDC Occurrence ID#	Name	B.C. Status
2824, 9538, 9569, 10674, 11713, 11985	Slimleaf Onion (*Allium amplectens*)	Blue
382	Surf Scoter (*Melanitta perspecillata*)	Blue
12888	Threaded vertigo (*Nearctula* sp. 1)	Blue
7413, 7414	Twisted Oak Moss (*Syntrichia laevipila*)	Blue
4218, 6515, 10139	Vancouver Island Beggarticks (*Bidens amplissima*)	Blue
12874	Wandering Salamander (*Aneides vagrans*)	Blue
1591, 3471	Western Screech-owl, *kennicottii* subspecies (*Megascops kennicottii* ssp. *kennicottii*)	Blue
3167	Western Water Shrew, *brooksi* subspecies (*Sorex navigator* ssp. *brooksi*)	Blue
754, 6779, 7352	White-top Aster (*Sericocarpus rigidus*)	Blue
8062	Yellow Sand-verbena (*Abronia latifolia*)	Blue

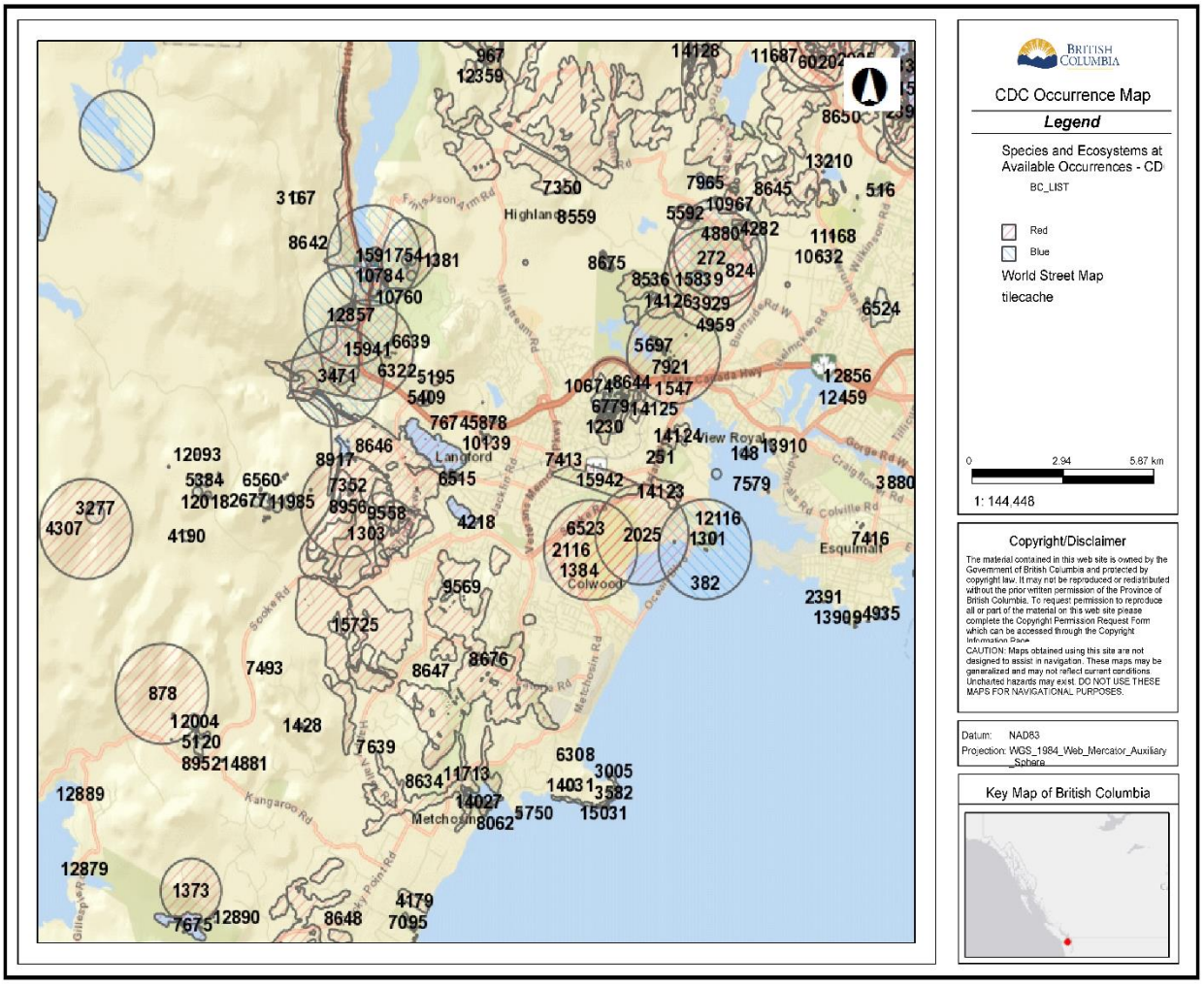


Figure 8 Known occurrences of red and blue listed species (Conservation Data Centre).

3.4 Other Resource Values

Recreation Features

Langford is a centre for outdoor recreation within the area. Regional and provincial parks provide well-used hiking and biking trails. In addition to hosting a golf course in the interface, Bear Mountain Resort is home to the Canadian National Mountain Bike Team, whose local facilities include a terrain park and forested trails. City-maintained trails provide access between Langford Lake and the larger regional park properties on Mt Wells and Mount MacDonald, where rock climbing occurs on unsanctioned but well-established routes.

Photo 8: Trail in Mt Wells Regional Park.

Natural Resource Extraction

Within the City Limits, there is little to no direct activity in natural resource extraction. Forested land within the City is generally held privately or by the City or the CRD for Park uses. Within the AOI, forests

are generally held on private lands within residential subdivisions or within areas protected from timber harvesting, such as the regional watersheds and parks.

3.5 Hazardous Values

The intent of this sub-section is to recognize hazardous values that pose a safety hazard to emergency responders. During a wildfire, stores of hazardous materials can ignite, explode, or support such reaction; or they may pose other safety hazards to emergency workers seeking to control a location or activity. Hazardous values can include stores of fuels like gasoline and diesel, fertilizers or fertilizer components, and other industrial chemicals. Industrial and commercial facilities across the city may have stores of hazardous materials, while residences may also have smaller stores. All gas stations inside the study area are potentially hazardous due to the large quantities of volatile fuel stored on-site. These are concentrated along Highways 1, 14, and Langford Parkway. Some are within 100m of the forest interface.

A unique store of hazardous values exists at the CRD's Japan Gulch water treatment facility. Water treatment at the facility uses chlorination and ammonization processes and may involve chemicals that can support ignition or explode when heated under pressure. The CRD has emergency procedures and personnel to prevent and mitigate fire ignition and spread at its facilities, including Emergency Response Teams.

Section 4 Wildfire Threat and Risk

The following sections provide a summary of the factors that contribute to wildfire threat and risk. Wildfire threat is a term that reflects the potential fire behaviour that a natural area could support. This considers fuel loading, slope, aspect, weather conditions, fire regime and the impacts from pests and diseases. The term wildfire risk accounts for the likelihood of a wildfire occurring and its potential behavior, or threat, and the consequences of it impacting human lives, structures, and infrastructure.

4.1 Fire Regime, Fire Danger Days and Climate Change

4.1.1 Fire Regime

The Biogeoclimatic Ecosystem Classification (BEC) is used to describe ecosystems by vegetation, soil, and climate. Ecosystems are classified at the largest scale into BEC zones. Most of the AOI is in the Coastal Douglas-fir (CDF) BEC zone, with smaller areas at higher elevations in the Coastal Western Hemlock (CWH) BEC zone. The CDF is highly unique within British Columbia and Canada, representing BC's warmest climate and supporting a unique community of plants.

All ecosystems are influenced by periodic disturbances that vary in size, severity, and occurrence. Examples of common disturbances include wildfire, windthrow, ice and freeze damage, water, landslides, insect, and disease outbreaks as well as human-caused events such as logging or land clearing. Historically, agents of disturbance were viewed as unhealthy and a threat to the integrity of the forest as a timber resource. Standard forest protection policy was to suppress all wildfires. A century of forest management practices has led fire-dependent ecosystems to express biological and physical instabilities such as hazardous fuel accumulations and pest outbreaks. This has caused land managers to reassess the integral role that disturbance agents play in maintaining spatial and temporal diversity in our ecosystems.

Wildfire can significantly alter the physical and biological characteristics of an ecosystem. It can change the structure and species composition of a forest, remove some or the entire forest floor organic layer, and alter the chemical properties of the soil. In ecosystems where natural wildfires are frequent, wildfires help to prepare seed beds, recycle nutrients, alter plant succession, maintain a diversity of age classes (seral stages) across the landscape, control insect and disease outbreaks as well as reduce fuel accumulations. Many of the native plant species in fire-dominated ecosystems depend on wildfire during some part of their lifecycle.

The BEC zones within the study area are further broken down into subzones, which reflect more specific climates (Table 8). These subzones are associated with different natural disturbance regimes. Most of the study area is located in the CDFmm (moist maritime) subzone, which is an ecosystem with warm, dry summers and very mild winters with little snow. This transitions to the wetter climate of the CWHxm (very dry, maritime), found at higher elevations in the west of the AOI.

All biogeoclimatic subzones have been separated into natural disturbance types (NDT) according to the Forest Practices Code Biodiversity Guidebook. These NDT are classified based on the size and frequency of natural disturbances that occur in those ecosystems as per the following:

- NDT 1 Ecosystems with rare stand-initiating events
- NDT 2 Ecosystems with infrequent stand-initiating events
- NDT 3 Ecosystems with frequent stand-initiating events
- NDT 4 Ecosystems with frequent stand-maintaining fires
- NDT 5 Alpine Tundra and Sub-alpine Parkland ecosystems

Table 7 Summary of the biogeoclimatic zones within the City of Langford.

Biogeoclimatic Zone	Natural Disturbance type	Area (ha)	Percent of total
Coastal Douglas-fir – Moist, Maritime (CDFmm)	NDT 2	8829	69.6
Coastal Western Hemlock – Very Dry, Maritime eastern variant (CWHxm1)	NDT 2	3862	30.4

All forests within the AOI are classified as Natural Disturbance Type 2: Ecosystems with infrequent stand-initiating wildfires. These ecosystems were historically characterized by major fires of moderate size creating a mosaic of even-aged forests 20 to 1000 hectares in size across the landscape. Larger fires occurred following extreme drought conditions and reset forest succession across entire landscapes. In some areas of the CDFmm fires were also intentionally set by indigenous people to promote forage and game habitat (McDadi & Hebda, 2006). These fires were lower-intensity events promoting the maintenance of open canopy Garry oak meadows, though some may have intensified depending on weather and fuel conditions.

Wildfire suppression efforts has effectively suppressed most of the wildfires that would have naturally occured in this ecosystem. This has led to higher fuel accumulations, and a higher likelihood of increased fire intensity. This is reflected by the historic count and area burned of wildfires in the AOI. Wildfire activity has generally decreased as wildfire suppression techniques and equipment became more sophisticated and as Cities have become more urbanized.

Fire Weather Rating

Table 8 Climatic characteristics of the biogeoclimatic zones within the City of Langford (Green & Klinka, 1994)

Biogeoclimatic Zone	Range	Annual Precipitation (mm)	Summer Precipitation (mm)	Annual Snowfall (cm)	Avg. Annual Temperature (°C)
Coastal Douglas-fir, Moist Maritime (CDF)	Max	1263	272	92	10.5
	Min	636	105	17	8.8
Coastal Western Hemlock Very Dry Maritime (CWH)	Max	2721	565	234	10.7
	Min	1100	160	26	7.8

Table 9 summarizes summer temperature and rainfall statistics from the nearest Ministry of Environment weather station (Victoria Airport). The daily high temperatures were higher in 2018 compared with the 30-year average. Rainfall was also lower in 2018 with very little rainfall in July and August. This demonstrates the weather statistics associated with an extreme wildfire season.

Table 9 Weather statistics for the months of May to Sept

Weather Attribute	May	Jun	Jul	Aug	Sep
30 year Daily Average High (°C)	16.9	19.9	22.4	22.4	19.6
2018 Max Daily High (°C)	25	31	30.4	32.4	24.6
30 year Average Rainfall (mm)	37.5	30.6	17.9	23.8	31.1
Rainfall in 2018 (mm)	3.4	23.6	2.2	1.6	63.2

Table 10 provides a summary of the average number of moderate, high, and extreme rated fire danger days in the fire season (May to Sept) at nearby fire weather stations. This has been calculated from data over the past ten years. The average number of high- and extreme-rated days from the closest station, Victoria Airport, is about 76.6 or 50% of fire season (May to September).

Table 10 Average number of moderate, high and extreme rated fire danger days over the past ten years (May to Sept)

Weather Station	Average # of Days as Moderate	Average # of Days as High	Average # of days as Extreme
Victoria Airport – 28km NE	37.3	47.0	29.6
Saltspring2 – 29km N	7.7	44.6	29.2
TSSanJuan – 49km W	6.9	28.2	4

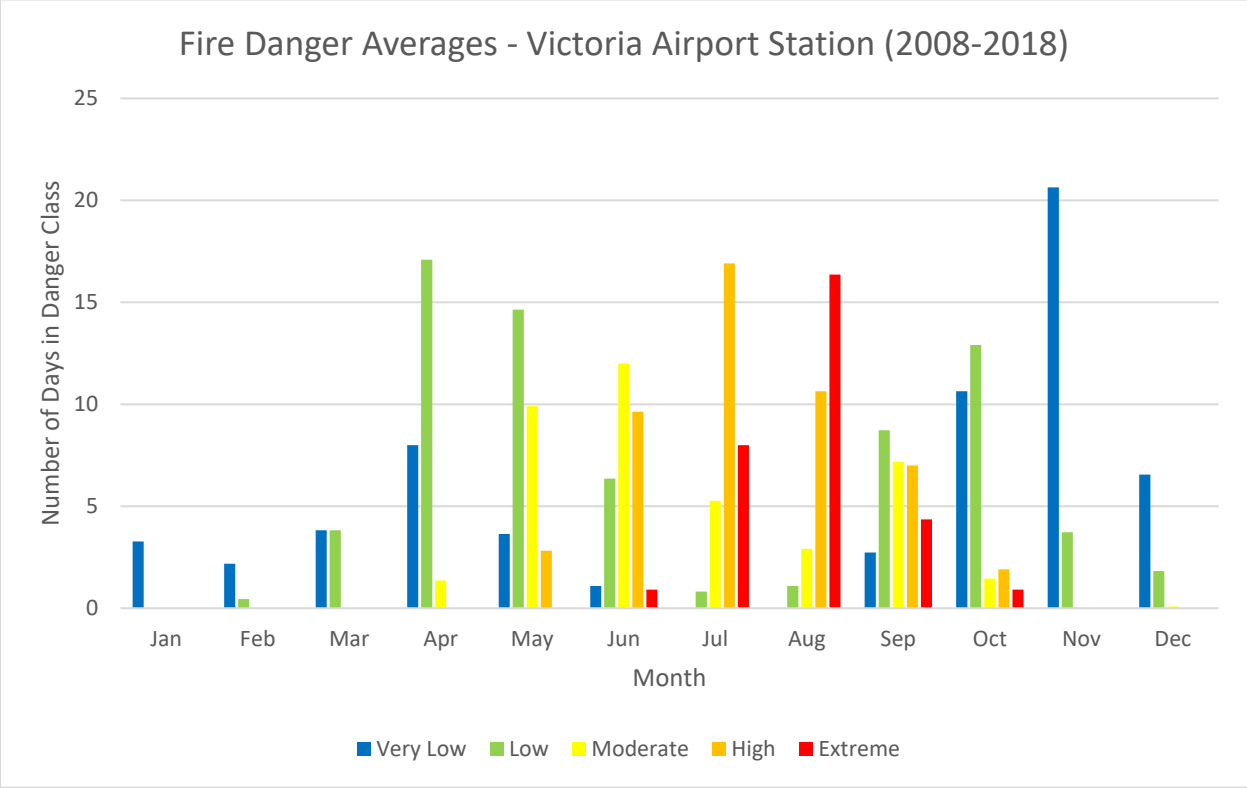


Figure 9 Average number of danger days in each fire danger class over the past ten years (2008-2018)

4.1.2 Climate Change

Climate change will result in changes to temperature and precipitation, with impacts to both forest health and wildfire risk. Estimates of future climate for the CRD were prepared by regional government in 2017. They indicate that temperatures will increase and precipitation will decrease in summer months. Summer daytime high temperatures are expected to increase by 3.7 to 7.0 °C by the 2080s, while summertime precipitation is expected to decrease by 6 to 50% (Capital Regional District, 2017). Patterns observed in other parts of BC and North America suggest that hotter, drier conditions are likely to result in an overall increase in wildfire frequency in the study area (Kirchmeier-Young, Gillett, Zwiers, Cannon, & Anslow, 2019; Taylor, Régnière, St-Amant, Spears, & Thandi, 2010). Warmer temperatures in spring and fall will extend the duration of the fire season, placing values at risk throughout more of the year (Abatzoglou & Williams, 2016).

Climate change is expected to have negative impacts for forest health (Spittlehouse, 2008). Climate change affects forest health by creating maladaptation between trees and sites and supporting secondary health factors like populations of insect pests. More frequent or prolonged droughts are likely to reduce tree health and vigor, increasing susceptibility to pathogens and pests (Woods, Heppner, Kope, Burleigh, & Maclauchlan, 2010; Sturrock, et al., 2011).

4.2 Provincial Strategic Threat Analysis (PSTA)

The PSTA is a high-level analysis conducted by the Province and is intended to be used as a starting point for an assessment of local wildfire threat. It is an interpretation of fuel type mapping, historical fire data and weather, and topography. The PSTA includes information and maps that describe fuel types, historical fire density, and the potential for embers to land in an area (spotting impact), head fire intensity (HFI), and a final calculated wildfire threat score (Figure 10).

Provincial Strategic Threat Analysis and metadata from the BC Wildfire Service (BCWS) was clipped to the AOI. The PSTA head fire intensity and subsequent wildfire threat classes were ultimately updated based on the fuel typing changes for the local threat assessment as described in Section 4.3. For each updated fuel polygon, similar fuel types nearby were referenced to update the HFI rating. Fire density and spotting impact numbers did not change due to any input at a local level.

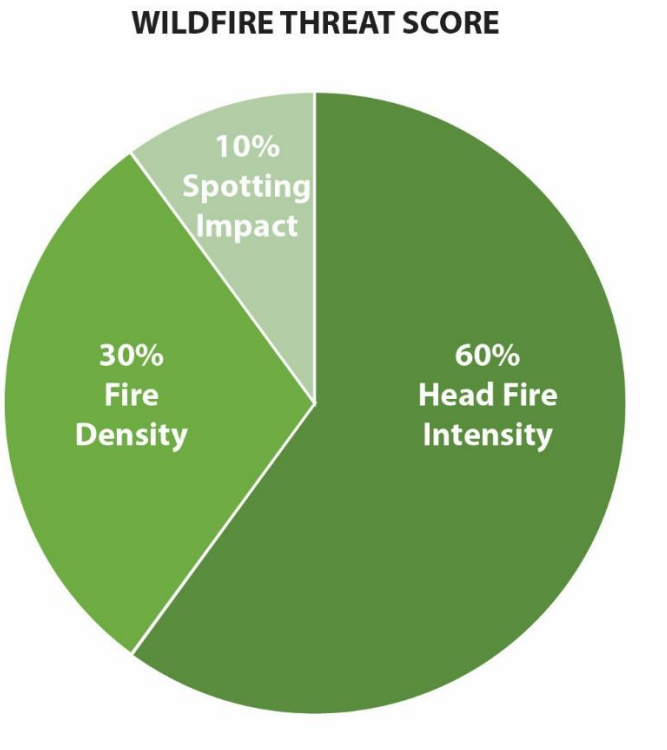


Figure 10 Input factors and contributing weights to the final Wildfire Threat score.

The 10 Fire Threat Classes represent increasing levels of overall fire threat (i.e. the higher the number, the higher the threat). The most severe overall threat classes are Class 7 and higher. Areas of the province that fall into these higher classes are most in need of mitigation. Areas rated as Class 7 or higher are locations where the fire intensity, frequency and spotting can be severe enough to potentially cause catastrophic losses in any given wildfire season, where those threat ratings overlap with or are adjacent to significant values at risk. Areas rated as Class 6, while below the class 7 threshold, are also prone to escaped wildfires. These areas also have crown fire potential (head fire intensity greater than 10,000 kW/m) and are most likely to be affected by spotting impacts.

The PSTA mapping for the AOI (Figure 11) appears highly fragmented because PSTA scores cannot be published for private land. Approximately half of the AOI is private land. The PSTA identified the majority of the public land area assessed as a Moderate to High threat (Table 11). These areas include the forests that are dominated by or have a high component of conifer tree species. The highest risk areas are also closely correlated with the steepness of the slopes. The areas with forests classified as extreme risk include the slopes in the periphery of the AOI. Land within the City (where data was available) were mostly moderate to high threat. None of the AOI was low threat.

Table 11 Summary of wildfire threat on public owned lands

PSTA Threat Rating (class)	Area (ha)	% of area
Extreme	46	0.4%
High	4167	33%
Moderate	2127	17%
Low	0	0%
No Data (Private Land)	5785	46%
Water	576	5%

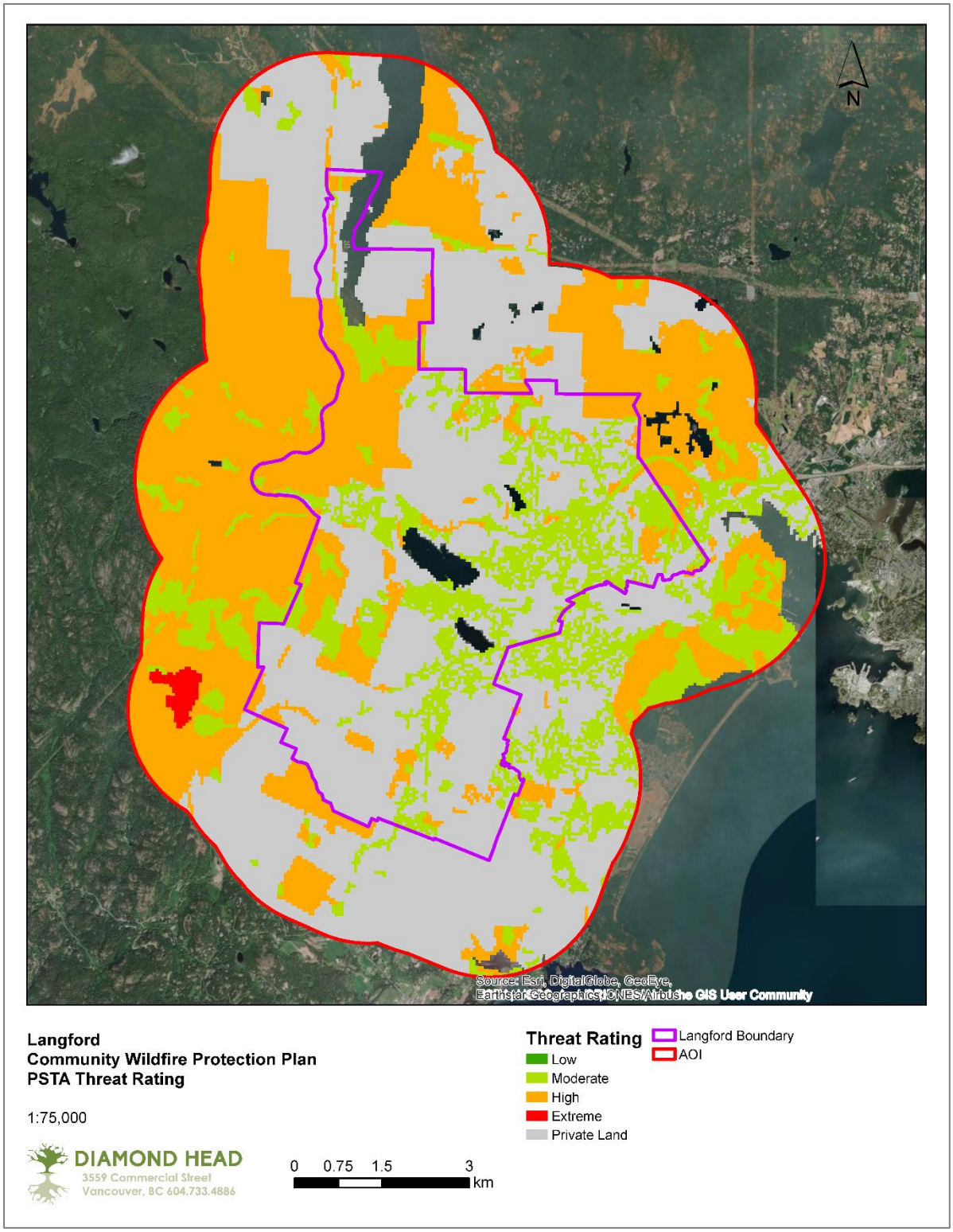


Figure 11 PSTA threat rating on public lands

PSTA - Limitations

The PSTA is a generalized and coarse analysis completed at a province wide layer with a 50m pixel size. This tool is useful for higher level wildfire analysis, however lacks detail that is required for a localized analysis of wildfire risk. In the case of the City of Langford, recently completed VRI data was used to create a more detailed fuel typing layer and to recalculate the fire behavior modeling. This process and methodology is detailed in section 4.2 and Appendix 1.

4.2.1 Fire History

Charcoal studies indicate that indigenous burning within the CDFmm occurred regularly on some sites during the pre-settlement period (Banman, 2010; Bjorkman & Vellend, 2010). Fire activity peaked at the time of settlement (1860s-80s) as Europeans used broadcast burning to clear land for agriculture. Large fires occurred in the early twentieth century within the AOI, many resulting from escaped ignitions of the logging industry. After 1950, fires decreased in size and number as urbanization became a more important part of the landscape and fire suppression improved. In the ten years before 2018 (the most recent available data), the annual number of fires has been well below historic averages, reflecting this long-term success in fire suppression and the reduction of forest extent within the AOI.

Table 12 Summary of wildfires in the AOI since 1950.

AOI Fires Summary	# of Fires	Area Burned (ha)
Total 1950 – 2018	769	1473
Total 2009 – 2018	9	3.4
Average #/year (1950 – 2018)	11	21.7
Modified Average #/year (10 largest fires excluded)	11	7.15

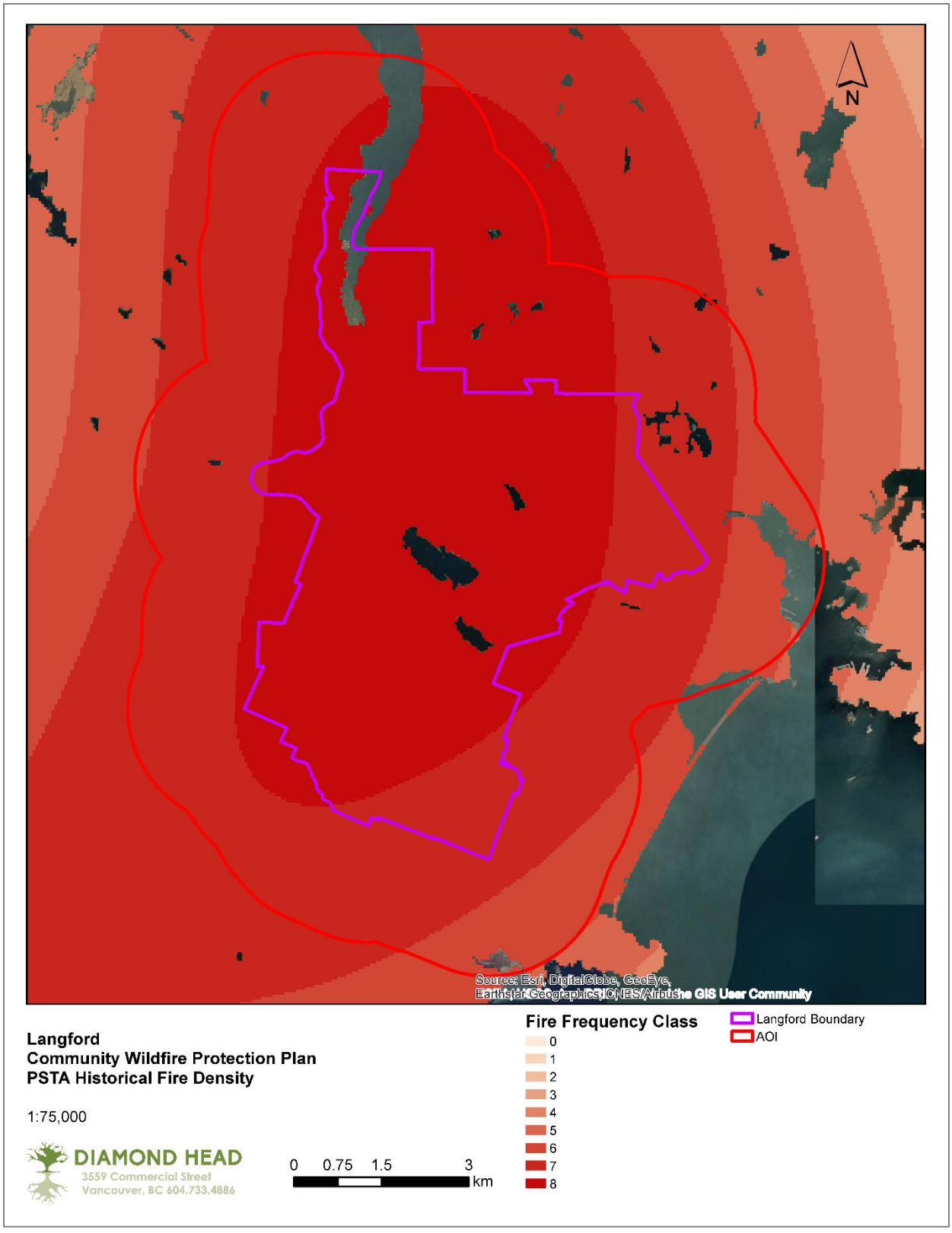


Figure 12 Historical Fire Density.

4.3 Local Wildfire Threat Assessment

This section provides a detailed assessment of the local wildfire threat, including field reviewed fuel characteristics, proximity of fuel to the community, local fire spread patterns, topographical considerations, and local factors.

The local wildfire threat assessment process involved:

1. Verification of local fuel types to develop a fuel type map.
2. Assessment of the proximity of fuels to the community.
3. Assessment of fire spread patterns.
4. Consideration of topography.
5. Stratification of the WUI based on relative wildfire threat.
6. Classification of wildfire risk areas.

Fuel Typing

Fuel typing falls into sixteen national benchmark fuel types that are used by the Canadian Fire Behaviour Prediction System (Canada, 2018). This system divides fuels into 5 major groups and 16 more specific fuel types. These groups are used to describe fuels according to stand structure, species composition, surface, and ladder fuels and the organic (duff) layer. The current Canadian Forest Fire Behavior Prediction (FBP) System does not include coastal forests in their fuel type descriptions (Perrakis & Eade, British Columbia Wildfire Fuel Typing and Fuel Type Layer Description, 2015), therefore the fuel type that most closely represents forest stand structure was identified. Fuel types by area in the AOI are summarised in Table 13.

A recent vegetation resource inventory (VRI) was recently completed for the area surrounding the City. To produce the most accurate assessment of fire behavior potential for this area, new fuel typing was developed from this VRI inventory. This was done using a series of queries of forest attributes to best match the coastal forest conditions associated with each fuel type. This updated typing was confirmed through air photo interpretation and ground truthing. For complete details on this analysis see Section A1.1.

The majority of fuels within the AOI were coniferous fuel types, which accounted for 60% of the AOI. The conifer fuel types are mostly C5, which is a common coastal conifer fuel type. There is a high component of C3 in the area, mostly on higher elevation forests with higher density.

Table 13 The fuel types and representative areas found within the Langford AOI.

Fuel Type Classification	Total Area (ha)	% of area
C-3 - Mature Conifer	2347	18.5
C-4 – Semi-Mature Conifer	111	0.9
C-5 – Mature Conifer	4084	32.2
C-7 – Open, Mature Conifer	953	7.5
M-1/2 - Mixed stands	1034	8.1
D-1/2 - Deciduous/swamp/shrub	469	3.7
O-1 a/b - Open grass	310	2.5
S- 1/2/3 - Slash	0	0
Non-Fuel Areas	2819	22.2
Water	573	4.5

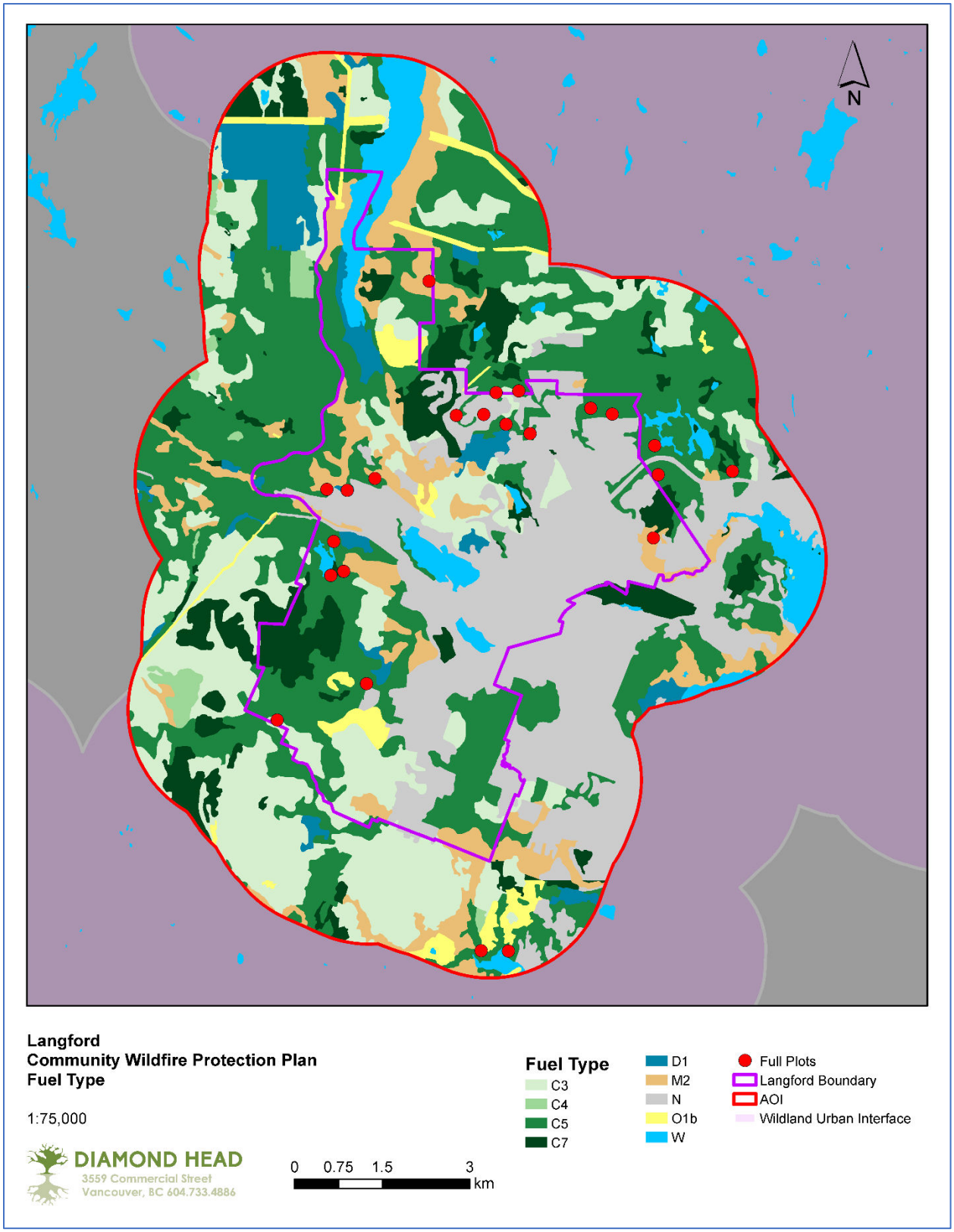


Figure 13 Updated Local Fuel Type Map and Field Verification Plots. Full plots indicate that a Wildfire Threat Assessment plot was completed at this location.

Fire Weather Inputs

Weather conditions used to calculate fire behaviour were derived from the nearest provincial weather data, Victoria Airport. This was the nearest station with complete weather data that could be used. This weather station is located approximately 7 km east of the study area. Data from the Saltspring 2 station was also reviewed, as this station is located in the CDF BEC zone, and therefore has similar weather conditions to the City.

Table 14 Ministry of Forests, Lands, Natural Resource Opeations weather stations

Station #	Station Name	LATITUDE	LONGITUDE	ELEVATION (m)	Years
49	Victoria A/P	48.7	-123.4	19	1992-2015
45	Saltspring 2	48.7	-123.47	34	1989-2018

Historical weather data was statistically analyzed for the months of May to September. The 90th percentile indices were used to represent the worst-case scenario for fire weather conditions. This information, in addition to ground fuel plot data, was used to model fire behaviour characteristics.

Table 15 Fire weather indices between the months of May to September

	Fine Fuel Moisture Code	Duff Moisture Code	Drought Code	Initial Spread Index	Build Up Index	Fire Weather Index	Relative Humidity	Precip. (mm)	Temp.
Victoria A/P									
90th Percentile	93.1	89.5	431.8	11.7	113.5	32.2	25.0	6.8	25.8
Average	73.9	37.6	217.3	4.9	48.9	12.6	49.7	1.9	17.5
Maximum	97.2	227.5	727.9	26.3	232.4	69.9	100	44.5	47.9*
Saltspring 2									
90th Percentile	88.89	86.3	653.1	6.5	124.6	22.9	86	3.0	24.8
Average	76.2	43.0	378.4	3.2	63.5	10.2	64.6	1.1	19.2
Maximum	96.9	171.1	849.6	16.2	222.4	43.4	100	57.2	35

***The max temperature for this station is likely an error in the datatset.**

Fire Behavior Modeling

The updated fuel typing and weather data from the Victoria A/P weather station were used to model fire behavior potential. The objective of this modeling exercise is to predict how wildfire will behave under extreme weather conditions. It is based on the Canadian Fire Behaviour Prediction System (FPB) which provides quantitative outputs of selected fire behaviour characteristics for the major Canadian fuel types (Hirsch 1996).

Topographical attributes required to predict fire behaviour include slope and aspect. The study area was delineated into polygons based on slope breaks of 10% intervals and aspects of 45 degrees. Cardinal

wind direction was calculated from the aspect so that it was blowing upslope and the elapsed time was set at 24 hours. Wind speed was set at 20 knots.

All the data pertaining to fuel types, topographical attributes, and fire weather was compiled for the entire study area. This information was then run through the modelling software (Remsoft FPB97) to create output fire behaviour layers.

The output that provides a simple measure of fire behavior potential and is comparable between areas is fire intensity. This is a measure of the rate of heat energy released per unit time per unit length of fire front and is based on the rate of spread and the predicted fuel consumption. Units for this layer are kilowatts per meter. The categories used for fire intensity class are summarised in Table 16.

Table 16 Fire intensity units and weighting

Layer	Units	Unit Value	Wildfire Behavior Threat
Fire Intensity	Kilowatts per meter (kW/m)	>0-500 501-1000 1001-2000 2001-4000 4001-10000 10001-30000 >30000	Very Low Low Low Medium Medium High Extreme

High risk fire behaviour potential in the AOI is closely related to the conifer density of the fuel type and the slope. The fuel typing identified a majority of the area in the AOI is dominated by conifer fuel types. In addition, most of the land in the AOI is mountainous with steep slopes throughout. These two factors have resulted in a majority of land included in the wildfire risk analysis has a High or Extreme wildfire behaviour potential.

Table 17 Wildfire threat category based on fire intensity

Wildfire Behavior Threat	Total Area (ha)	% of area
Very Low	1456	11.5
Low	0	0
Moderate	937	7.38
High	2479	19.52
Extreme	1580	12.44
Private	6247	49.19

Wildfire behaviour on public lands is illustrated in Figure 144

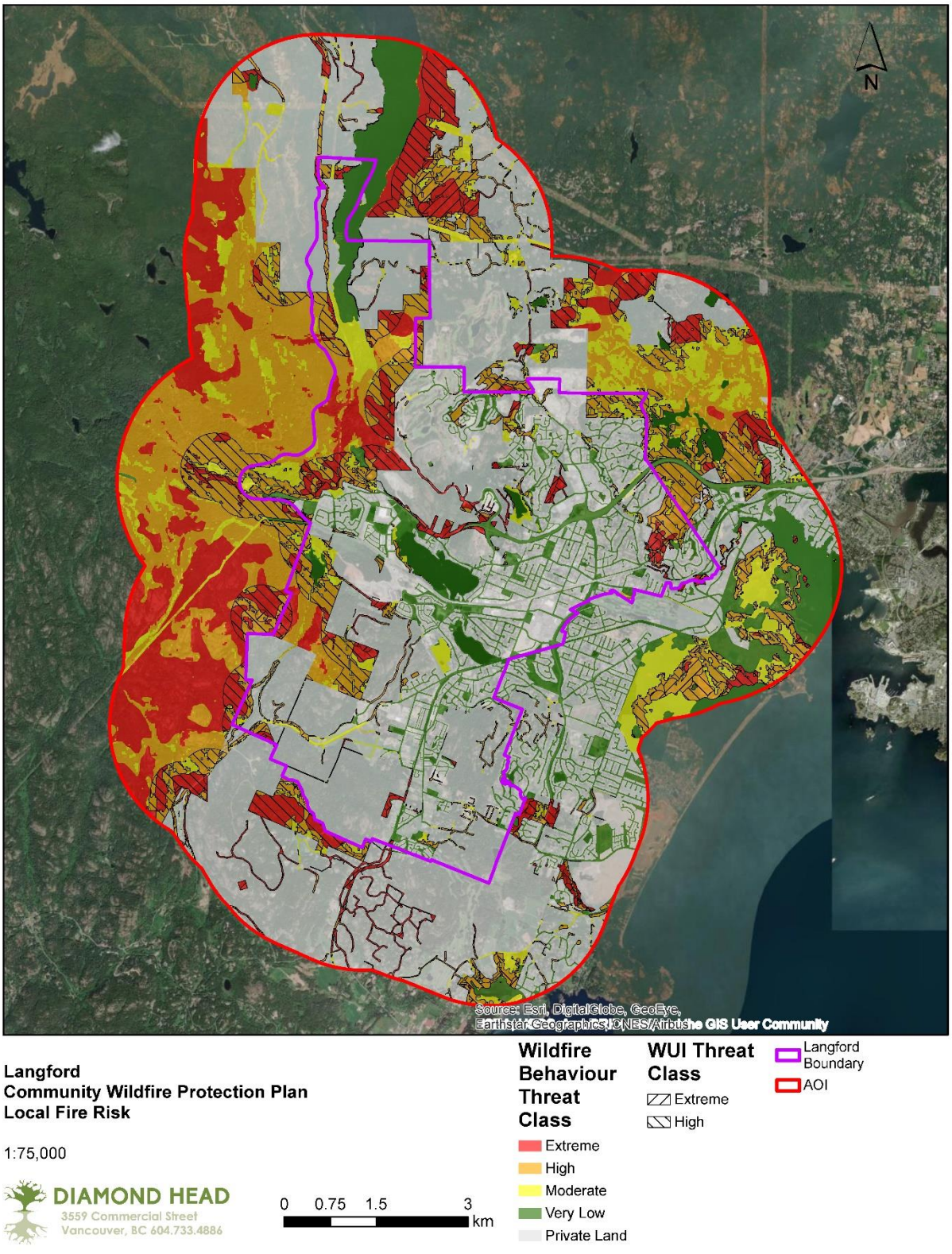


Figure 14 Local Wildfire Risk

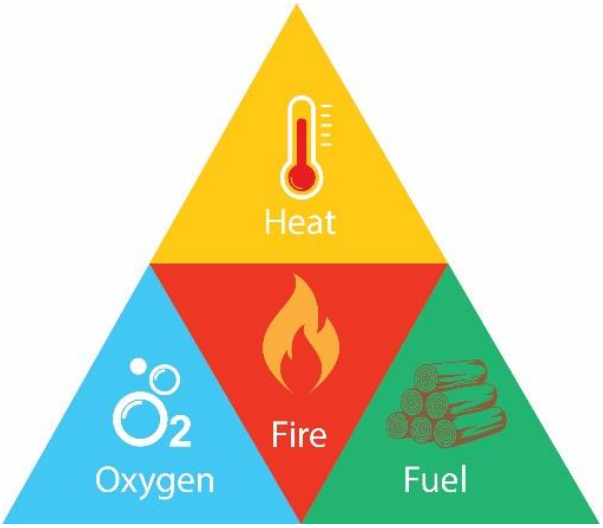
Section 5 Risk Management and Mitigation Factors

This section identifies strategies that can be implemented to reduce the risk of wildfire to the communities and values within the AOI. These strategies have been identified through the analysis of wildfire threat and risk, stakeholder consultation, and review of best management practices. The recommendations vary in scope, implementation cost, timeline, and the party(s) responsible.

1. Fuel Management
2. Planning and Preparedness
3. Communication and Education

5.1 Fuel Management

Fire requires three contributing factors including a fuel source, oxygen, and heat. The only factor that we can feasibly alter is fuel characteristics. The determination of wildfire threat and risk in this CWPP has identified areas that have high fire behaviour potential and threaten human lives and values at risk. The highest risk areas were visited in the field. The areas that were confirmed to pose a high risk have been identified as priority areas where future prescriptions should be developed for operational fuel treatments. In addition to treating fuels within high risk interface areas, larger scale fuel breaks have been recommended. For all prioritized treatment areas, options have been explored to partner and cooperate with other interest groups for initial treatment, maintenance and improving access.



Interface Fuel Treatments

Areas on public lands that were identified as high risk and are located within 100 metres of moderately dense interface communities were visited in the field. Fuel plots were established in representative areas. Assessments of the fuel condition were completed following the provincial assessment system, 2019 Wildfire Threat Assessment Guide and Worksheets (MFLNRO, 2019). This is the provincial standard for field assessments of fuel hazard in the WUI and is used to plan fuel hazard mitigation works. Fuel types are scored under this system which is used to help prioritize the areas for fuel hazard mitigation funding under the Community Resilience Investment Program (CRI).

Photo 9 Example of a stand posing a high wildfire hazard.

Table 18 provides a summary of interface treatment areas that should be considered for subsequent detailed prescriptions and operational treatment. These are areas with fuel conditions that could support a high-risk wildfire and are adjacent to critical values and/or dense communities. The threat and priority scores are from the findings of the ground assessment plots. Additional considerations included the size of the area, adjacent previous treatments that can be enhanced, and existing fuel breaks that can be expanded upon.

The overall objective of all the fuel treatment prescriptions is to change the fire behavior potential of these stands from a crown fire to a surface fire under 90th percentile weather conditions. This allows suppression resources to act on the wildfire and defend the adjacent values. The detailed strategies for reducing fire behavior potential are detailed in a fuel management prescription, which is developed by a Registered Professional Forester with wildfire management experience. Potential strategies include tree thinning, spacing, pruning, surface debris removal, or creating fuel gaps. Treatment areas should be linear adjacent to the values at risk, a target of at least 100m wide and located up against man made and natural fuel breaks when possible.

Photo 10 Examples of a stand condition before (left) and after (right) fuel mitigation treatment

Photo 11 Example of a stand crown density before (left) and after (right) fuel mitigation treatment. The goal of crown density reduction is to make the main canopy of trees separated and discontinuous.

Treatment Prioritization

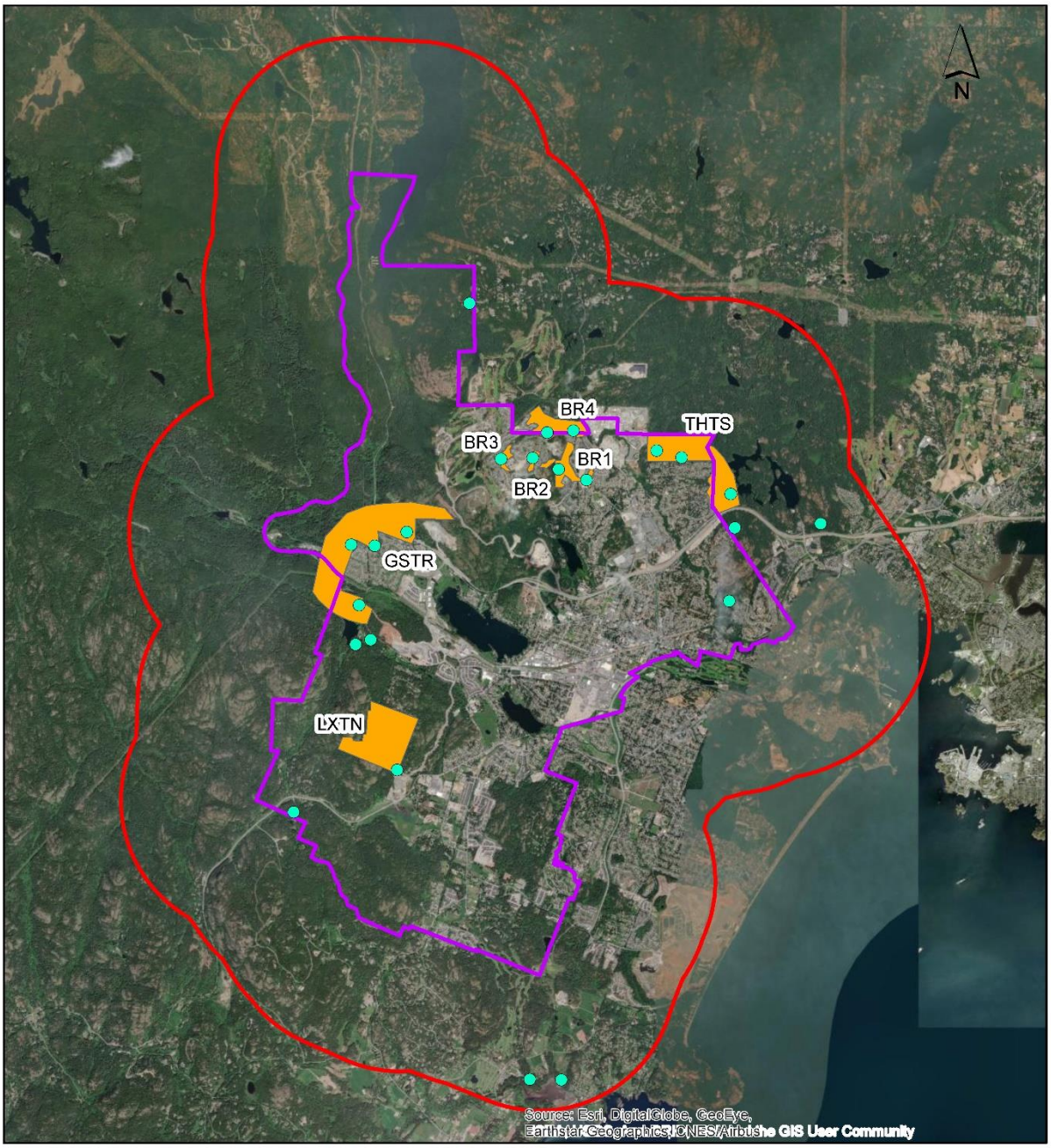
Prioritizing treatment units depends on several factors, including the priority score, the threat score, funding opportunities, and administrative burden of developing treatments. The table below is arranged base on an assessment of the impacts the treatment will have on reducing wildfire risk to the community at a landscape level. In many cases, this may not correspond with the Priority Score, which assesses the site level non-fuel characteristics to provide a coarse prioritization of treatment areas.

Fuel threat was assessed using the 2019 Wildfire Threat Assessment Guide and Worksheets (MFLNRO, 2019). This method assessed the fuel characteristics of a stand for wildfire threat. This does not include other biophysical characteristics such as slope, aspect, and proximity to community. The fuel threat ratings provided below may therefore be slightly misleading, specifically as many of the areas that have been assessed are near dense communities and on steep slopes. We have provided the PSTA threat rating for all polygons in the below table to provide additional detail and rationale to treat these areas.

Table 18 Fuel Treatment Summary Table

Treatment Polygon ID	Threat Score	Fuel Threat Score	PSTA Threat	Priority Score	Fuel Type	Area (ha)	Comments
GSTR (Goldstream Meadows)	52	Moderate	High	55	C5, M1/2	124.0	Approximate area mapped, will form a large fuel break in area with a discrete interface between broader landscape and developed property. Will reduce risk to critical infrastructure at Langford Fire Hall, with potential to expand treatment area to adjacent protect CRD water supply and/or to form a fuel break for reducing risk to City of Langford. Expansion of treatment area will require consultation with CRD, as they own and control access. A variety of ownership inside Treatment area will require collaboration with BC Parks and Regional District. Wide variety of fuel conditions, with mortality in Fd. Some C3 patches. Steep terrain in areas will require manual treatment. Intensity of treatment will likely vary within polygon.
LXTN (Mt Wells)	47	Moderate	High	44	C5	63.8	Polygon within City limits but inside Mt Wells Regional Park. Collaboration with CRD required. C5/C3 fuel type on steeper terrain. Poor access would potentially require an agreement with adjacent private landowners to gain access.
THTS	57	Moderate	High	38	C5	67.1	Variable composition, dense patches with openings on poor soil. High ladder fuel continuity aside from openings. Trails throughout. Treatment will require collaboration with regional district and regional parks.
BR4 (Bear)	49	Moderate	High	53	C5	21.3	Large natural area between subdivisions. C5 fuel type with dense patches of C3. Thin scattered soils, with higher component of dead and declining Fd possibly due to forest health issue. Trails throughout, but are rough and appear informal. Treatment will require collaboration with regional district, as ownership is shared.

Treatment Polygon ID	Threat Score	Fuel Threat Score	PSTA Threat	Priority Score	Fuel Type	Area (ha)	Comments
BR1 (Bear)	42	Low	High	50	C5	15.2	BR1, BR3, and BR2 have similar attributes and are located near each other. They have been divided into individual treatment areas as they are separated by urban development. Park on steep terrain between subdivision. Park trails throughout. Dead wood and fuel scattered throughout. Forest health issues with Fd declining/dead. Likely a low intensity treatment to reduce standing and down dead fuels, and reduce loading adjacent trail. All parcels city owned, may be efficiencies in combining all treatment areas into one prescription with separate treatment units.
BR3 (Bear)	52	Moderate	High	62	C5	4.6	See BR1 comments.
BR2 (Bear)	43	Low	Moderate	56	M1/2	2.2	See BR1 comments.



Langford
Community Wildfire Protection Plan
Fuel Treatment

1:75,000

DIAMOND HEAD
3559 Commercial Street
Vancouver, BC 604.733.4886

0 0.75 1.5 3 km

Threat Plots
Proposed Treatment
Langford Boundary
AOI

Figure 15 Proposed fuel treatment areas.

Other fuel treatment recommendations

Many the identified values at risk do not have a suitable defensible space from the adjacent forest areas. Many of these are within natural forested areas and do not have adequate fuel free zones around them. The City should assess the condition of fuels and wildfire risk around all their facilities and develop fuel treatment prescriptions with the target of establishing a 30m defensible spaces around them.

Summary of recommendations

Number	Action Item
Rec 2	Develop fuel treatment prescriptions for high priority interface fuel treatment areas. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #9 Fuel and Vegetation Management).
Rec 3	Consult and coordinate with BC Hydro to create defensible spaces and reduce risk around all substations.
Rec 4	The City should assess the condition of fuels and wildfire risk around their facilities and develop fuel treatment prescriptions with the target of establishing a 30m defensible space around them. (CRI Activity #9 Fuel and Vegetation Management).

Fuel treatment implementation and funding opportunities

Mitigation of fuels for the purpose of altering fire behaviour potential can be costly as merchantable timber is not necessarily targeted for removal. The following are options for funding to help implement the recommended treatment areas.

Regional Partnerships

Wildfire risk is analyzed at a landscape scale that crosses jurisdictions. Most of the risk to the city is found on land outside the City's boundaries. The are treatment areas that are candidates for fuel modification to reduce that risk, but many of the treatment areas are located partially in other jurisdictions. Therefore, partnerships and collaboration with other jurisdictions are key for reducing the wildfire risk to the City of Langford and neighbouring communities. The City is important for wildfire risk management in the broader regional area as the critical drinking water infrastructure for the CRD is located within and directly adjacent to the City boundary.

While the CRD has comprehensive wildfire management planning and staffing, there are opportunities to increase wildfire prevention and risk management by working with other groups. It is recommended that a Wildfire Risk Management regional committee be established to coordinate wildfire risk management and risk reduction initiatives in the region. Key stakeholders for this committee would be the City of Langford, the CRD, BC Provincial Parks, BCWS, as well representatives from the adjacent district municipalities of Highlands and Metchosin. CRI funding is available for participation in multi-agency fuel management groups.

Community Resilience Investment Program (CRI)

This CWPP update was funded through the UBCM Community Resiliency Investment program. CRI contains a variety of funding categories, including Education, Planning, Training, and Fuel Management activities. The available funding ranges from $25,000 annually for low-risk communities, to $150,000 annually for higher-risk communities. The City of Langford will be eligible as a high-risk community for up to $150,000 annually for wildfire related projects. Applications for 2020 funding grants will be due in late 2020.

Langford is eligible to apply for funding through this program for several the initiatives and recommendations within this CWPP. Some of the eligible activities include:

- Development of detailed fuel treatment prescriptions for priority interface fuel treatment areas by a professional forester.
- Operational fuel management treatments in the priority interface fuel treatment areas.
- Hosting of neighbourhood level FireSmart education initiatives and workshops.
- Development of a new development permit area and supporting resources.
- Interagency co-operation including meeting with the Regional District and Langford Fire Rescue for training exercises.
- S100 training for staff.
- Establishing a rebate program to support treatment on private lands and fund off site debris disposal.

Wildfire Risk Reduction Program

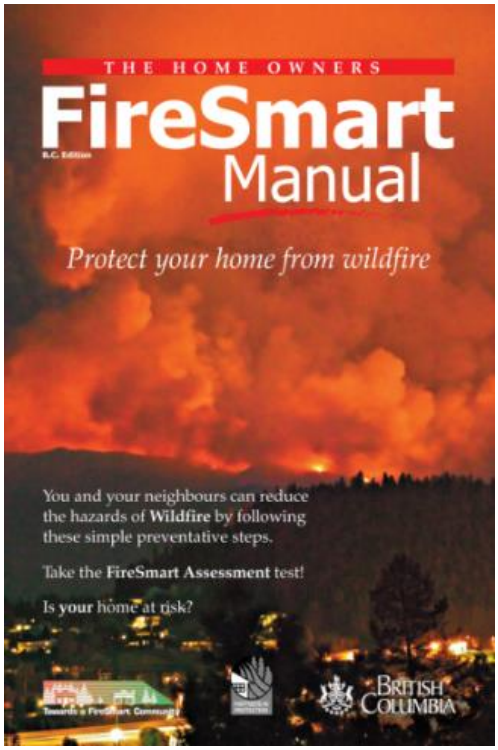
The Provincial government is transitioning to a new program for wildfire mitigation on crown land, the Wildfire Risk Reduction (WRR) program. Previously, public-owned lands that did not qualify for funding through CRI could apply through the Forest Enhancement Society of BC (FES). The WRR will replace this, however at the time of writing this program was still being developed.

Summary of recommendations

Number	Action Item
Rec 5	Develop a partnership with the CRD to pursue treatment of CRD lands adjacent to the City (CRI Activity #9 Fuel and Vegetation Management).

5.2 FireSmart Planning & Activities

During a large-scale wildfire event the weather and topography cannot be controlled. For a private landowner, the factors that can be managed include the fire resilience of the structures and fuel conditions within the interface. This section provides recommendations to mitigate the risk of wildfire to existing and planned developments within the prioritized zones defined in the FireSmart Homeowners Manual (Partners in Protection and Province of BC, 2016).



During a wildfire homes are ignited as a result of:

- Sparks or embers landing and accumulating on vulnerable surfaces such as roofs, verandas, eaves, and openings. Embers can also land on or in nearby flammable materials such as bushes, trees or woodpiles causing a fire close to a structure.
- Extreme radiant heat from flames within 30 m of a structure that melts or ignites siding or breaks windows.
- Direct flame from nearby flammable materials such as bushes, trees, or woodpiles.

Figure 16 Wildfire Risk to homes. During a wildfire, homes are ignited as a result of radiant heat as well as embers carried by wind or convection.

The fire resistance of homes in the interface can be improved by achieving FireSmart standards for building materials, ignition sources and combustible fuels within each of the three FireSmart Priority Zones. If a wildfire does threaten the area, suppression capability is improved with good access to the interface area, defensible spaces around values, and a good water supply.

Zone 1 is the area directly surround a structure out to 10m. In this area people and structures are at risk from radiant heat associated with a wildfire. It has been shown through analysis of recent large-scale wildfire events such as the 2017 Fort McMurray that the most important factors in protecting structures is the exterior construction materials and immediate landscaping next to homes (Westhaver, 2017). The structure itself is sometimes considered on its own as the Home Ignition Zone (1A).

Zone 2 includes the area from 10 m to 30 m from a structure. In this area there is still a risk from radiant heat but also even earlier on from ember transport associated with a wildfire. Fuels are generally treated aggressively in this area to prevent a crown fire from establishing. Treatments include removal of ground fuel, thinning of trees and lift pruning of those retained.

Zone 3 includes the area from 30m out to around 100m. People and structures are at risk from ember transport associated with a wildfire in this area. Treatment of fuels in this area generally includes stand thinning and aims to prevent a crown fire but is generally not as aggressive as treatments in zone 2.

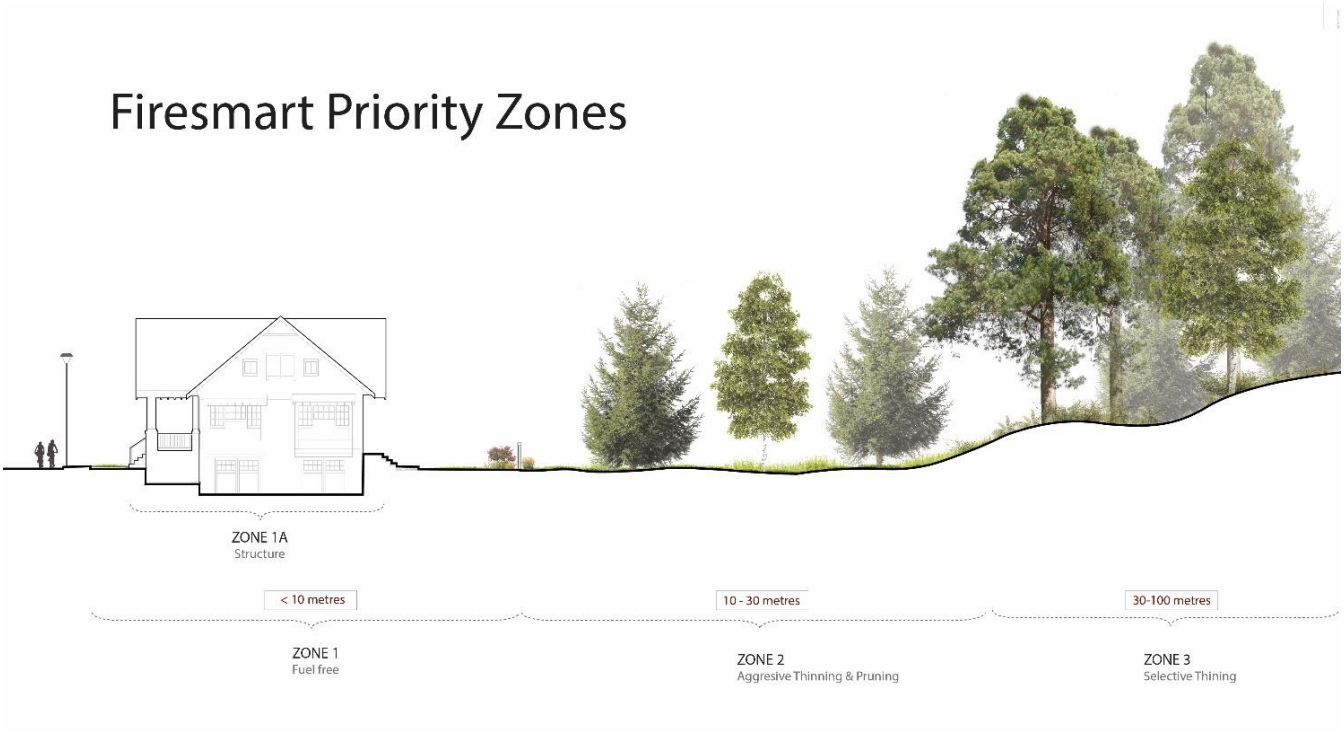


Figure 17 FireSmart Management Zones

Photo 12 Example of a structure in the interface

5.2.1 FireSmart Goals & Objectives

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

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

FireSmart Assessment

Local FireSmart Representatives (LFR) are key facilitators for FireSmart programs and initiatives within a community. These representatives engage and motivate private landowners to mitigate wildfire risk on their property, and thereby reduce risk to the community. By participating in a Local FireSmart Representative workshop, participants become designated as an LFR. Typically these workshops are attended by fire department staff, wildfire staff, emergency management staff, planners, and foresters.

5.2.2 Key Aspects of FireSmart for Local Governments

The City is able to manage risks on public lands. However, most structures at risk as well as interface fuels are located on private lands under which the City has limited influence. Neighbourhood level community-based engagement can be effective in promoting FireSmart initiatives. This encourages residents to cooperate with each other for the mutual benefit of reducing risk to the neighbourhood.

Communities can apply for FireSmart Community Recognition status through FireSmart Canada. The City should encourage high risk neighbourhoods to establish wildfire awareness committees and apply for this status. This program includes resources for communities to establish a FireSmart Board and to designate Community Champions. Funding is available through FireSmart Canada to support activities that can reduce wildfire risk within communities.

New construction and landscaping can be addressed through the wildfire hazard development permit area (discussed below). However voluntary changes to existing structures and landscapes are required by private landowners. Education and outreach can provide some success on private lands. The City should distribute information on where residents can access wildfire awareness resources. These should include:

- http://www.bcwildfire.ca/Prevention/FireSmart.htm
- https://www.FireSmartCanada.ca/

- https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/wildfire-status/prevention/prevention-home-community/bcws_homeowner_FireSmart_manual.pdf

Materials to distribute should include the FireSmart Homeowner's manual which includes a questionnaire to help understand wildfire risk around private residences.

5.2.3 Priority Areas of Interest for FireSmart

FireSmart planning and outreach to communities should focus in neighborhoods at greatest risk. A number of these neighborhoods are built adjacent to large tracts of forest having moderate to high fire behavior potential. Some general neighborhoods to consider focusing on for FireSmart initiatives and educational outreach include:

- Bear Mountain
- Goldstream
- Westhills
- Luxton

Table 19 Summary of FireSmart priority areas.

Area ID	Wildfire Risk Rating (E/H/M/L)	FireSmart Y/N	FireSmart Canada Recognition Received Y/N	Recommended FireSmart Activities
Bear Mountain	H	N	N	A comprehensive FireSmart plan is recommended for all areas. This should include communications and engagement goals, educational outreach, coordination with the BCWS, and FireSmart assessments. A committee made up of representatives from the City, Fire Department, BCWS, First Nations, and homeowners should guide the development of this plan.
Goldstream Meadows	H	N	N	
Westhills	H	N	N	
Mt Wells	H	N	N	

Summary of recommendations

Number	Action Item
Rec 6	Train a staff member from the City of Langford as a Local FireSmart Representative through the Local FireSmart Representative workshop. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #6 Cross Training)
Rec 7	Develop neighbourhood level FireSmart plans for the above priority neighbourhoods. This should include neighbourhood level FireSmart committees with the District, Fire Department, BCWS, and First Nations representatives. This should also include a variety of strategies with the objective of increasing private land resilience to wildfire. Participating communities should apply for FireSmart Community Recognition status and funding for mitigation projects through FireSmart Canada. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #1 Education and #8 FireSmart Activities for Residential Areas).
Rec 8	Use recommended interface fuel treatment areas to promote similar projects on private lands. Showcase these treatments though a “FireSmart Day” with neighbourhood FireSmart committees. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #1 Education).
Rec 9	Develop and distribute FireSmart brochures to all houses within higher risk interface areas. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #1 Education).
Rec 10	Develop and distribute a list of ecologically suitable fire-resistant landscape plants (Appendix 4) to residents by mail and through local nurseries. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #1 Education).
Rec 11	Establish community chipping days in the spring to encourage residents to reduce vegetation fuel loads on private land. Provide a location where woody debris can be dropped off for chipping and request tree companies volunteer as a promotional event, similar to Christmas tree chipping events. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #8 FireSmart Activities for Private Land).

Wildfire Development Permit Area

Under the *Local Government Act*, municipalities in British Columbia can designate Development Permit Areas (DPAs) within their Official Community Plans. As one of the earliest Wildfire DPAs in BC, the City has had several years to evaluate and refine the DPA process. Interviews with city staff and field assessments confirmed that the wildfire interface risk is being reduced through this process. This is also influenced by the large development pressure in the city, where many developments are subdivisions on greenfield sites with major regrading and most of the vegetation removed. The only major consideration is a revision of the Wildfire DPA to account for the changes in wildfire risk that have occurred due to development and urban growth since the original adoption of the DPA. This CWPP will provide more refined and detailed maps that are accurate to the current wildfire risk profile and urban development pattern, which can be used to update the Wildfire DPA and revise boundaries.

Summary of recommendations

Number	Action Item
Rec 12	Review the Interface Fire Hazard DPA to ensure implementation meets the City's goals. Update mapping for areas of High and Extreme wildfire risk, and update the wildfire DPA accordingly. Funding for this review can be accessed through the UBCM Community Resiliency Investment Program (CRI #3 Development Considerations).
Rec 13	Ensure that Wildfire DPA applications are reviewed by City or Fire Department staff to ensure the objectives of the DPA are achieved. This will require coordination between City staff and Fire Department staff.

5.3 Community Communication and Education

Community Engagement

Most hazardous fuel areas within the urban interface are located on privately owned lands. Therefore, building public awareness and promoting stewardship of the City's natural areas and its many values is a key component of this wildfire program. Following are general recommendations to be considered for development of a public education program. Chapter 6 of the FireSmart Planner provides detailed recommendations for developing a public communications plan. There are two main goals of a comprehensive public education and awareness strategy:

1. Raising knowledge and awareness of wildfire risk and prevention; and
2. Developing and encouraging stewardship opportunities for individuals and community-based volunteer organizations.

This can be achieved through a variety of strategies:

- Establish neighbourhood specific interest groups as discussed in section 5.3. Including a City or Fire Service liaison in these groups will facilitate engagement and education on FireSmart initiatives.
- During large public events or festivals, have a City and/or Fire Service staff member present to provide educational material and promote awareness.
- When a fuel treatment is planned, and open house should be organized and used as a forum to inform and educate local residents.
- A summary of this CWPP, the wildfire risk maps and the Homeowners FireSmart Manual should be distributed to residents within 100m of moderate to high risk natural areas. Materials should be also made available at public locations including City Hall, fire stations, community centres and libraries. The wildfire risk maps should also be printed and posted at some of these locations.
- Wildfire awareness signs should be placed in and around the City to raise awareness of the risks of wildfire. These should indicate the current Fire Danger level, restrictions during the fire season and the emergency number to call when a fire is detected (1-800-663-5555 or *5555 from a cellular phone). Signs should be bold and placed in clear view, particularly at all major through routes into the City and all recreation sites in natural areas. The City should coordinate with the BC Wildfire Service to erect and maintain these signs.
- Educational and interactive self-walking tours can be established in interface fuel treatment areas.

Youth Engagement

Youth engagement is sometimes overlooked as a public education strategy. By actively engaging youth, the City can encourage the next generation of citizens to be educated and active in wildfire planning and management. In addition, educated youth will often effectively pass on this information to older generations in their family that are more difficult to directly engage.

Opportunities to engage younger residents of the City include:

- Within the school system. The Fire Service can conduct events at schools with wildfire-specific programming. Field trips with school groups can be organized to raise awareness of wildfire risk and strategies for its mitigation.
- A “Young Wardens” program can be initiated to connect younger children with FireSmart information. FireSmartBC publishes curricula and activities for children as young as four years old.

Digital Engagement Tools

Technology is an important avenue to communicate ideas and information. This is particularly true of on-line and electronic media. The City can use technology to promote wildfire awareness by:

- Continuing to provide online media releases on wildfire and FireSmart programming, typically near the beginning of fire season.
- Creating a website to contain comprehensive wildfire information for Langford. The City's webpage should be updated regularly to include notices of wildfire risk, planned interface fuel treatments and education events. The webpage should also promote the FireSmart assessment service. It should also provide links to the Regional, Provincial and Federal websites on wildfire awareness and the FireSmart program. Webpages can function as a virtual open house giving residents information, and the flexibility to participate on their timeline. This is also an effective means of communicating with individuals who do not have time or cannot physically participate in open house and local events.
- On-line sources of education that should be considered include videos that can be linked to the webpage. YouTube is a free and effective means to distribute educational material. A variety of videos can be posted to update the public of upcoming events and to showcase successes in the City.

Summary of recommendations

Number	Action Item
Rec 14	During large events have City and/or Fire Service staff on hand to provide educational material.
Rec 15	Include Open House component to fuel treatments to allow public input and education.
Rec 16	Conduct visits by Fire Service personnel into local schools to discuss wildfire prevention and preparedness.
Rec 17	Update the City's digital media, including video and web content, to reflect this CWPP update. Provide print material at public locations including City Hall, Fire Departments, Community Centres, and Libraries. Risk maps should be presented at some of these locations.

5.4 Other Prevention Measures

Reducing Ignitions

Sources of ignition can be human, or lightning-caused. Lightning-caused ignition is difficult to predict or manage. Human-caused ignitions, however, can be prevented and are the source of about one half of all wildfires in BC. The most common sources of human caused fires include:

- Campfires
- Industrial activity
- Discarded cigarettes and matches
- Vehicles
- Railways
- House-related fires
- Power lines
- Vandalism

Predicting and preventing human-caused ignitions is a critical component of a wildfire prevention program. This is best achieved through public education campaigns. Roadside ditches and medians that contain grasses should be mowed periodically throughout the fire season. This will reduce fuel loading (standing cured grass) and reduce the ignition potential associated with vehicles, heavy machinery, and cigarettes during the fire season. Signs should be posted at camp sites, recreation areas and high use trail heads during the summer showing the fire danger rating and emphasizing the need to fully extinguish campfires and not discard cigarettes.

There is also ignition potential from the numerous residences that back up against the interface. Private residents adjacent to wildland (grass or forested) should be reminded (e.g. through public bulletins or media notices) of common risks of ignition in these forested landscapes. A social media campaign in the late spring and early summer should be considered to enforce awareness of wildfire risk and the publics responsibility to prevent ignitions.

Trees can potentially fall on power lines, which can pose a fire risk. Risk is managed primarily by utility companies with regular assessments and tree hazard mitigation programs. The City should continue dialogue with BC Hydro to ensure they are removing hazardous trees from forested natural areas that could strike the power lines.

Photo 13: Power lines adjacent to forests are sources of ignition as trees or branches fail onto the lines.

Summary of recommendations

Number	Action Item
Rec 18	Ensure all road edges are mowed frequently during the summer months.
Rec 19	Post wildfire danger signage along major transportation corridors, at campsites, parks and recreation, and at high use trail heads areas. Signages should address current fire danger, how to report a wildfire and, when relevant, emphasize the need to fully extinguish campfires and properly dispose of cigarettes.
Rec 20	Develop an annual fire season social media campaign to raise awareness of individual responsibility to prevent ignitions and of the enforcement of fire bans.
Rec 21	Work with BC Hydro to ensure that distribution lines, transmission corridors and substations are assessed regularly for tree risk and that the associated fuel hazards are abated.

5.5 Summary of Recommendations

Below is a summary of all recommendations in Section 5.

Number	Action Item
Rec 2	Develop fuel treatment prescriptions for high priority interface fuel treatment areas. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #9 Fuel and Vegetation Management).
Rec 3	Consult and coordinate with BC Hydro to create defensible spaces and reduce risk around all substations.
Rec 4	The City should assess the condition of fuels and wildfire risk around their facilities and develop fuel treatment prescriptions with the target of establishing a 30m defensible space around them. (CRI Activity #9 Fuel and Vegetation Management).
Rec 5	Develop a partnership with the CRD to pursue treatment of CRD lands adjacent to the City (CRI Activity #9 Fuel and Vegetation Management).
Rec 6	Train a staff member from the City of Langford as a Local FireSmart Representative through the Local FireSmart Representative workshop. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #6 Cross Training)
Rec 7	Develop neighbourhood level FireSmart plans for the above priority neighbourhoods. This should include neighbourhood level FireSmart committees with the District, Fire Department, BCWS, and First Nations representatives. This should also include a variety of strategies with the objective of increasing private land resilience to wildfire. Participating communities should apply for FireSmart Community Recognition status and funding for mitigation projects through FireSmart Canada. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #1 Education and #8 FireSmart Activities for Residential Areas).
Rec 8	Use recommended interface fuel treatment areas to promote similar projects on private lands. Showcase these treatments though a “FireSmart Day” with neighbourhood FireSmart committees. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #1 Education).
Rec 9	Develop and distribute FireSmart brochures to all houses within higher risk interface areas. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #1 Education).
Rec 10	Develop and distribute a list of ecologically suitable fire-resistant landscape plants (Appendix 4) to residents by mail and through local nurseries. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #1 Education).
Rec 11	Establish community chipping days in the spring to encourage residents to reduce vegetation fuel loads on private land. Provide a location where woody debris can be dropped off for chipping and request tree companies volunteer as a promotional event, similar to Christmas tree chipping events. Apply for funding for this initiative

	through the UBCM Community Resiliency Investment Program (CRI Activity #8 FireSmart Activities for Private Land).
Rec 12	Review the Interface Fire Hazard DPA to ensure implementation meets the City's goals. Update mapping for areas of High and Extreme wildfire risk, and update the wildfire DPA accordingly. Funding for this review can be accessed through the UBCM Community Resiliency Investment Program (CRI #3 Development Considerations).
Rec 13	Ensure that Wildfire DPA applications are reviewed by City or Fire Department staff to ensure the objectives of the DPA are achieved. This will require coordination between City staff and Fire Department staff.
Rec 14	During large events have City and/or Fire Service staff on hand to provide educational material.
Rec 15	Include Open House component to fuel treatments to allow public input and education.
Rec 16	Conduct visits by Fire Service personnel into local schools to discuss wildfire prevention and preparedness.
Rec 17	Update the City's digital media, including video and web content, to reflect this CWPP update. Provide print material at public locations including City Hall, Fire Departments, Community Centres, and Libraries. Risk maps should be presented at some of these locations.
Rec 18	Ensure all road edges are mowed frequently during the summer months.
Rec 19	Post wildfire danger signage along major transportation corridors, at campsites, parks and recreation, and at high use trail heads areas. Signages should address current fire danger, how to report a wildfire and, when relevant, emphasize the need to fully extinguish campfires and properly dispose of cigarettes.
Rec 20	Develop an annual fire season social media campaign to raise awareness of individual responsibility to prevent ignitions and of the enforcement of fire bans.
Rec 21	Work with BC Hydro to ensure that distribution lines, transmission corridors and substations are assessed regularly for tree risk and that the associated fuel hazards are abated.

Section 6 Wildfire Response Resources

This section provides a summary of the suppression response protocol and resources available to the communities as well as recommendations for improvement.

Wildfire Detection and Reporting

The BC Wildfire Service is responsible for wildfire detection. Fires are located using a lightning locator system, aerial patrols, and public observation. The BCWS performs flyovers the CRD watershed during periods of elevated wildfire risk, which allows for early detection in areas adjacent to the City of Langford. In urban centers a wildfire is most likely to be detected and reported quickly by the public. Wildfire awareness signs should be posted at strategic locations (major transportation corridors, recreation areas and high use trail heads) that specify how to report a wildfire in the City.

All wildfires should be reported to the Provincial Forest Fire Reporting Center in Victoria through their toll free number 1-800-663-5555 or *5555 on a cellular phone. The agent will then collect as much information as possible regarding the fire and its characteristics including:

- The exact location of the fire;
- Its estimated size;
- The type of fuel burning;
- How fast the fire is spreading and in what direction;
- The colour of the smoke; and
- The location of any structures or lives at risk from the fire.

Contact details as well as the requirement for this information should be included in any public education campaigns. 911 can also be used to report wildfires, however this will require an operator redirect to the reporting centre in Victoria.

6.1 Local Government and First Nation Firefighting Resources

6.1.1 Fire Departments and Equipment

The City is serviced by the Langford Fire Service. Communities within the AOI with their own fire departments include View Royal, Colwood, Metchosin, and Highlands. The CRD coordinates fire protection within the protected watershed lands. Within Langford and adjacent communities, there is a large quantity and variety of fire suppression resources. Mutual Aid agreements are in place between Langford and each of its neighbour municipalities to increase the available response. City resources for suppression in that are currently available are provided in Table 20.

Table 20 Summary of Fire Suppression Resources

Agency	Full-time Staff, Level of certification	Volunteer staff, minimum certifications	Equipment
Langford Fire Rescue	• 17 career firefighters. • All firefighters trained to NFPA 1001 level 2 or NFPA 1021 level 2 or higher. • 14 members are trained to be command officers.	• 56 paid on-call firefighters. • All firefighters trained to NFPA 1001 level 2 or higher. • 30 members trained to the S100 and/or NFPA WSPP-115	• Station 1: 2 engines, 1500/1050 GPM pumps, 750/900 gallon tanks. 1 Ladder w/ 1250 GPM pump and 250 gallon tank. 1 heavy rescue truck. 1 Wildland truck w/ 200 GPM pump and 300 gallon tank. Various command and utility vehicles and one technical rescue trailer. • Station 2: 1 engine w/ 1250 GPM pump and 750 gallon tank. 1 ATV and wildfire response trailer. Mobile command unit. • Station 3: 1 engine w/ 1250 GPM pump and 750 gallon tank. 1 Zodiac with pump.

BC Wildfire Services Resources

The BCWS South Island Fire Centre is located in Cobble Hill, approximately 50 km north of Langford. This Fire Centre manages wildfire throughout the South Island. This includes 3 Initial Attack Crews (9 firefighters) and several wildfire officers.

Summary of recommendations

Number	Action Item
Rec 22	Maintain the mutual aid agreements between the City and the surrounding Fire Protection Areas to enable sharing of suppression resources when responding to a wildfire.

6.1.2 Water Availability for Wildfire Suppression

Water is the single-most important resource for suppression activities. Fire Hydrants are the main source of water delivery for fire suppression inside the City, with most of the community serviced by hydrants. It is critical that all new subdivisions and developments are serviced as well, which is a typical requirement of developments in the City.

Summary of recommendations

Number	Action Item
Rec 23	Continue to require that all new fire hydrants systems for new development areas can serve adjacent high-risk interface areas.

6.1.3 Access and Evacuation

The primary concern when dealing with a wildfire is public safety and if necessary, their evacuation. The City currently is developing a new evacuation plan to address various evacuation scenarios. The City does not maintain a digital alert or mass texting program for emergency notifications.

After a wildfire is detected, the threat that it poses to the public should be quickly evaluated. The location, direction, and rate of spread of the fire will indicate where the greatest risk is to public safety. The Wildfire Service and the Office of the Fire Commissioner, in communication with the City and RCMP, will decide at what point during the wildfire event an evacuation is justified. RCMP and the local fire department are then responsible for implementing the evacuation.

The City should be aware of those populations that may require special assistance to evacuate. These include primary schools and day care, assisted living and care homes, and hospitals. All departments within the District should be aware of their responsibilities during an evacuation. This includes, but is not limited to: the police department, fire department, public works, utilities, and parks and recreation.

Critical infrastructure is in the interface between forests and the community, mostly in the western portion of the City. This includes various CRD drinking water infrastructure and a city fire hall. This infrastructure is critical to supporting wildfire response in the event of a wildfire, and evacuation of these areas may compromise wildfire response. It is recommended that the evacuation plan include separate evacuation provisions for these facilities in the event of a threatening wildfire.

Summary of recommendations

Number	Action Item
Rec 24	Incorporate wildfire scenarios into the development of the evacuation plan.
Rec 25	Work with the CRD to maintain a coordinated evacuation plan in case of wildfire or other large disaster.

6.1.4 Training

Early response time to an ignition is critical to controlling its spread. Langford Fire Rescue will likely be the first responders to a wildfire within City boundaries. Langford Fire Rescue currently has several initiatives that promote wildfire response. All firefighters are ICS-100 (Incident Command System) trained. Most firefighters receive S100 Basic Fire Suppression and Safety training as well as additional training for wildland urban interface wildfires (S-185 Fire Entrapment Avoidance and Safety). This training is conducted in conjunction with the CRD, and creates a cross training opportunity for both agencies. The overall goal of the fire service is to have as many firefighters as possible receive S100 and S185 training.

Summary of recommendations

Number	Action Item
Rec 26	Train all City firefighters in S100 Basic Fire Suppression and Safety training and S185 Fire entrapment avoidance and safety training. Funding is available for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #6 Cross training).
Rec 27	Conduct annual training exercises with the CRD to enhance response in the event of wildland urban interface fire. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #6 Cross training).

6.2 Structure Protection

Langford Station # 2 is equipped with a wildfire trailer containing equipment specific to responding to wildfires. As the population grows, adding structure protection units to halls 1 and 3 could improve the City's response capacity to a major interface fire event. The most effective structure protection is adequate fire prevention and deployment of FireSmart building and landscaping standards.

6.3 Summary of Recommendations

Below is a summary of all recommendations in Section 6.

Number	Action Item
Rec 22	Maintain the mutual aid agreements between the City and the surrounding Fire Protection Areas to enable sharing of suppression resources when responding to a wildfire.
Rec 23	Continue to require that all new fire hydrants systems for new development areas can serve adjacent high-risk interface areas.
Rec 24	Incorporate wildfire scenarios into the development of the evacuation plan.
Rec 25	Work with the CRD to maintain a coordinated evacuation plan in case of wildfire or other large disaster.
Rec 26	Train all City firefighters in S100 Basic Fire Suppression and Safety training and S185 Fire entrapment avoidance and safety training. Funding is available for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #6 Cross training).
Rec 27	Conduct annual training exercises with the CRD to enhance response in the event of wildland urban interface fire. Apply for funding for this initiative through the UBCM Community Resiliency Investment Program (CRI Activity #6 Cross training).

Appendix 1 Local Wildfire Threat Process

A1.1 Fuel Type Attribute Assessment

The fuel typing layer is the primary geospatial data input used to estimate Wildfire Risk in a community. The fuel type layer is provided by the province through the Provincial Strategic Threat Analysis (PSTA) to inform the development of CWPPs. This layer is created on a broad scale province-wide to classify fuels according to the Canadian Forest Service Fire Behavior Prediction System (FBP). This layer is generated from multiple data sources including forest inventory mapping and silvicultural submissions to RESULTS.

The PSTA fuel typing layer is not shown on private lands. It can also be inaccurate in areas that are not inventoried for forest activities. The AOI is heavily fragmented by private land. The PSTA Fuel Type layer provided by the province was coarse and highly pixelated and did not accurately represent the forest conditions to a level that could be used in the CWPP. Figure 18 illustrates the level of detail within the PSTA fuel layer.

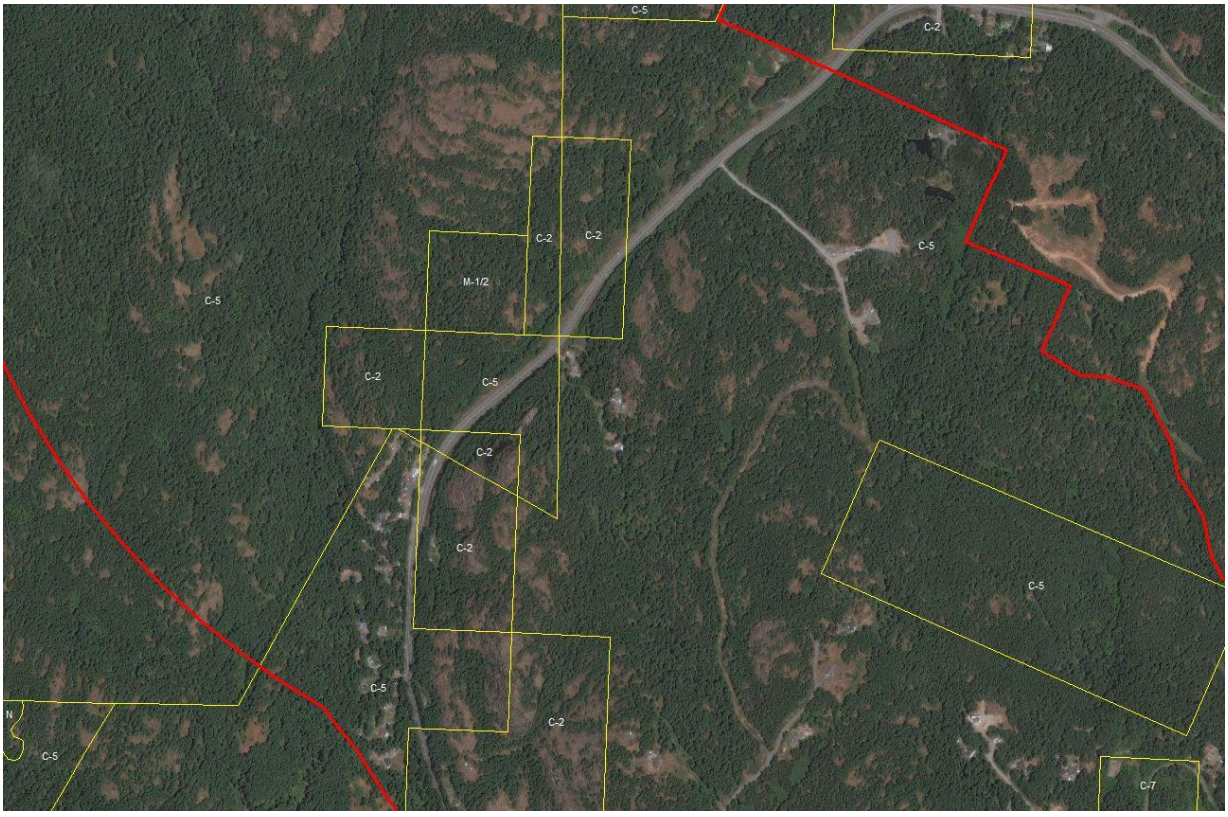


Figure 18 Example of PSTA fuels layer illustrating the low level of accuracy

The fuel typing layers and subsequent fire behavior modeling provide critical analysis for assessing the risk from wildfire and to identify mitigation options within a CWPP. Vegetation Resource Inventory (VRI) mapping was referenced for updating fuels. This spatial linework and data was analysed to classify fuel types within the AOI. The following is a summary of the process and rationale used for this analysis.

1. Separate polygons into fuel type "groups". Leading species from the VRI attribute table was used to separate tree stand into conifer, mixed, and deciduous stands. Conifer stands were trees with over 75% conifer, mixed were stands with 25-75% conifer, and deciduous were any stands with less than 25% conifer component. Non-tree polygons (ie: recently harvested polygons) were aggregated into another group.

2. Fuel types were stratified based on the provincial fuel type layer overview report (Perrakis & Eade, British Columbia Wildfire Fuel Typing and Fuel Type Layer Description, 2015), and the decisions made for the provincial layer were replicated where possible. These are summarized below:

    a. C-2:Young immature conifer stands. Typically 10 year old plantation of 100% conifer less than 10 m in height. Rare in the assessment area.

    b. C-3: Young stands of mostly Douglas-fir that is 40-80 years old. Heights in this fuel type varied between 18 and 30 m.

    c. C-4: Pole sapling stand of mostly Douglas-fir that is 20-40 years old. Heights in this fuel type varied between 10 and 20 m. Higher density stands with high crown closure. Rare in assessment area.

    d. C-5: Mature stands of mostly Douglas-fir that is older than ~80 years. Heights in this fuel type are generally greater than 30m. These stands have a lower density with large fuel strata gaps.

    e. C-7: 100% conifer stands with a low crown closure. These stands have low densities with canopy gaps separating the crowns of trees.

    f. M-2: These include stands of varying ages that have a mix of deciduous and conifer tree species.

    g. D-1: These include stands of varying ages that are dominated by deciduous trees or shrub communities.

    h. S-3 – Areas recently harvested were classified into slash fuel types.

3. The outputs from the initial fuel type classifications were quality controlled using recent aerial imagery. Obvious errors in fuel typing were identified. Examples included areas types as forest but which had been recently harvested. Recent harvesting not captured by VRI

were generally typed as S-3, given the likely levels of slash post-harvest in this region of the South Coast. In some areas the VRI-derived fuel type was classified as grass or slash, but the polygon in the aerial imagery is clearly treed. These were classified using air photo interpretation and referencing the nearest treed polygons.

4. Field work was conducted to ground truth the fuel layers. Polygons adjacent to values were visited by foresters and the accuracy of the fuels typing layer confirmed.

5. Following field assessments, the spatial fuels layer was finalized.

The algorithm used for fuel typing went through several iterations before it was considered complete and accurate. Ground truthing of the fuel typing confirmed that it was accurate. Below (Figure 19) is an example of the final fuels layer, which is the same location as Figure 18.

Figure 19 Example of updated fuels layer.

Fuel Types in the Study Area

M-2 – Mixed stands

This fuel type is found scattered throughout the study area. These fuel types are characterized by stands comprised of a mix of coniferous and deciduous species. The conifer component in these stands is mostly Douglas-fir with some grand fir and western redcedar. The deciduous component varies and can include red alder, bigleaf maple, Garry oak, and arbutus. In addition to the diverse species composition, stand mixtures exhibit wide variability in stand structure and development. Fire behaviour potential in these stands increases with and is highly dependent on the amount of coniferous trees present.

Photo 14: Example of a stand classified as M2 fuel type

D-1/2 - Deciduous

This fuel type consists of stands that are generally moderately stocked and dominated by deciduous trees. These are comprised of a mixture of Cottonwood, Alder, Bigleaf Maple, and Arbutus. These stands may include a small to very small component of conifers, usually in patches or as single trees. Dead and down round wood fuels are a minor component of this fuel complex. During the summer months, the principal fire-carrying surface fuel consists chiefly of deciduous leaf litter and cured herbaceous material that are directly exposed to wind and solar radiation. Areas dominated by shrubs are also included in this type. These are dense plant communities with few trees and a variety of shrub species. In terms of fire behaviour potential these stands will all have a relatively low spread rate potential.

Photo 15: Example of deciduous fuels in rear. Isolated conifers can be found in deciduous stands.

Conifer Fuel Types C3, C5, and C7 -

These fuel types consist of conifer dominated forests. Three of the seven possible conifer fuel types are found in the AOI due to the wide variety of conifer tree species found in this area. These are C3, C5, and C7. Figure 20 summarizes the general attributes of the conifer fuel types found in the AOI.

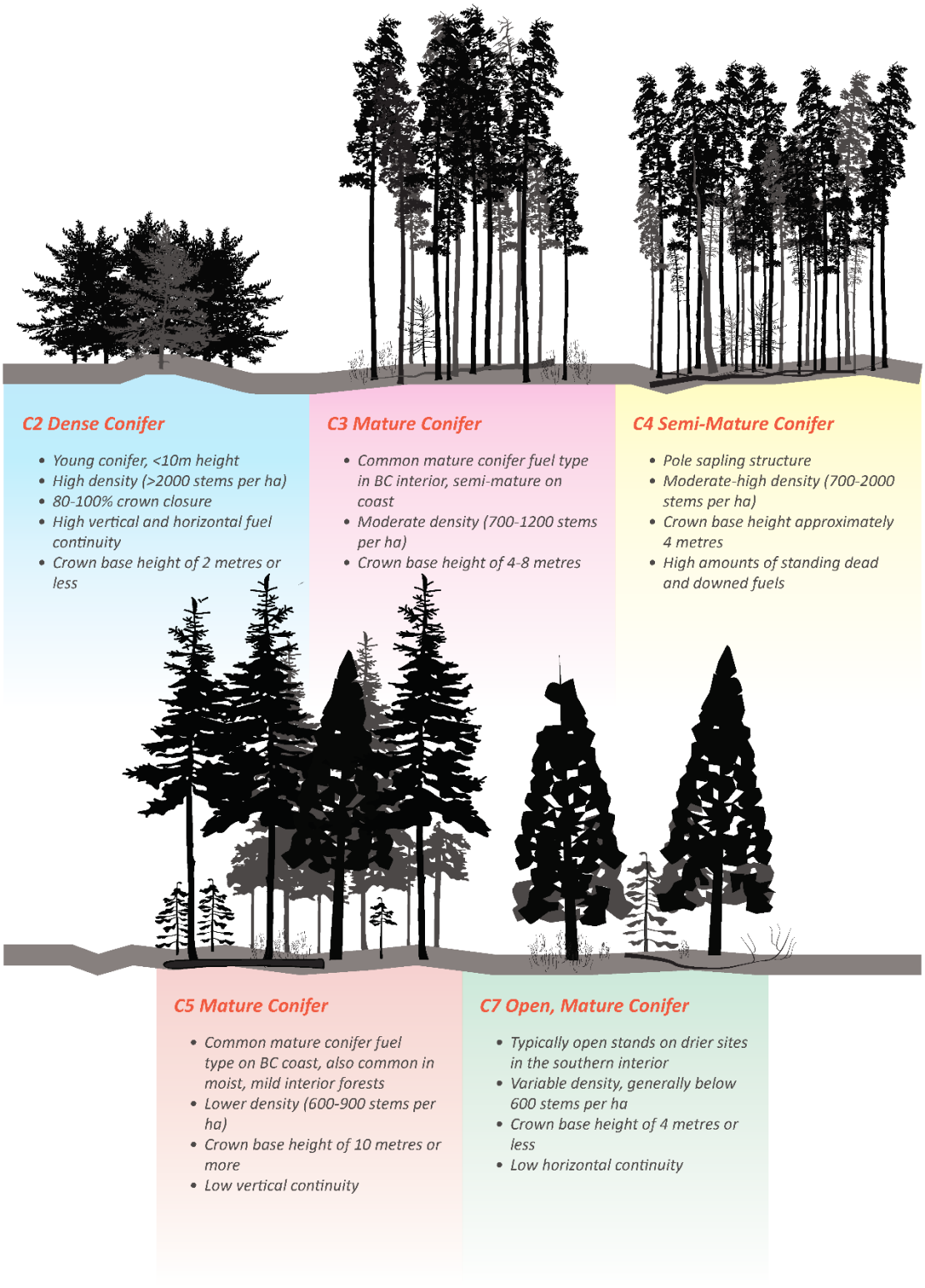


Figure 20 Conifer fuel types

A1.2 Proximity of Fuel to the Community

Fuel closest to the community usually represents the highest hazard. To capture the importance of fuel proximity in the local wildfire threat assessment, the WUI is weighted more heavily from the value or structure outwards. Fuels adjacent to the values and/or structures at risk receive the highest rating followed by progressively lower ratings further from values.

The local wildfire threat assessment process subdivides the Wildland Urban Interface (WUI) into 3 areas (Table 21):

1. Areas within 100 meters of the WUI (WUI 100).
2. Areas from 101 to 500 meters from the WUI (the WUI 500).
3. Areas 501 to 2000 meters from the WUI (the WUI 2000).

Table 21 Proximity of fuels 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.

WUI threat classes of High or Extreme are depicted in Figure 14. These are identified through a combination of both wildfire behaviour and proximity to communities or values. High WUI Threat Class areas are those with High or Extreme wildfire behaviour and are within 500 m of a value or community. Extreme WUI Threat Class areas are those with High or Extreme wildfire behaviour and are directly adjacent a value or community.

A1.3 Fire Spread Patterns

Initial Spread Index (ISI) is a rating of the expected rate of spread of a fire. ISI and wind speed and direction data is recorded at local BCWS weather stations and are used to understand the predominant summer fire spread patterns. This data is illustrated as ISI Wind Roses (Figure 21). Each rose shows the frequency of counts by wind direction with the frequency of the ISI values during that time period.

The nearest BCWS weather station with a windrose is the Saltspring 2 station. However, this windrose is not representative of the local weather conditions, as there are major differences in topography and oceanic influence on wind. Figure 22 shows a publicly available windrose for the City of Langford.

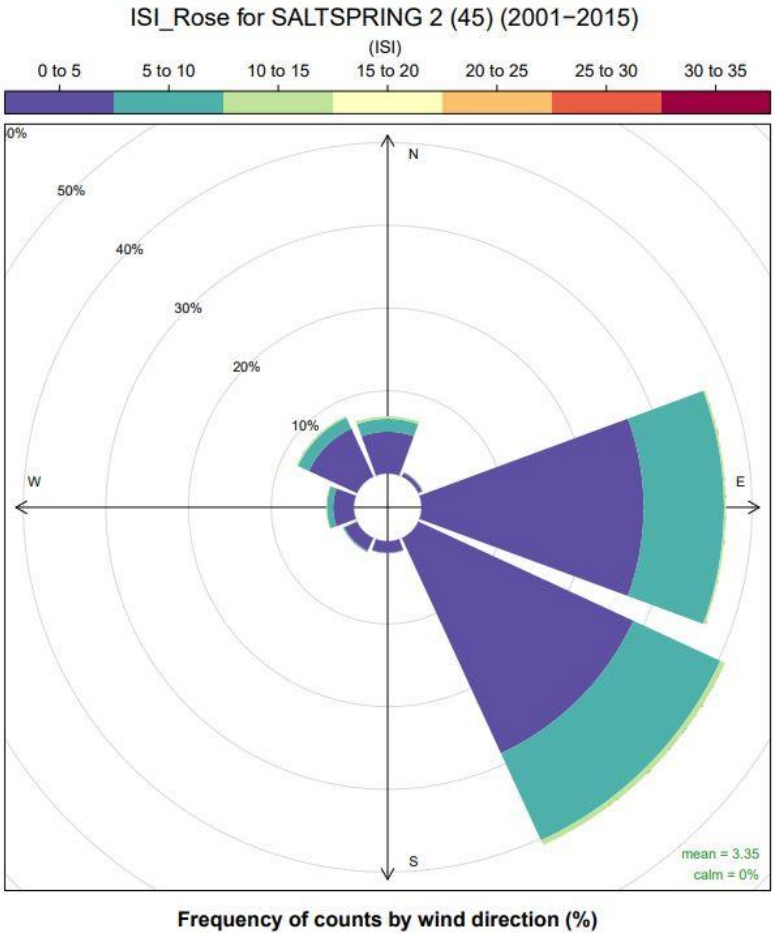


Figure 21 Initial Spread Index (ISI) rose from Saltspring 2 Weather Station. (BC Wildfire Service, 2020).

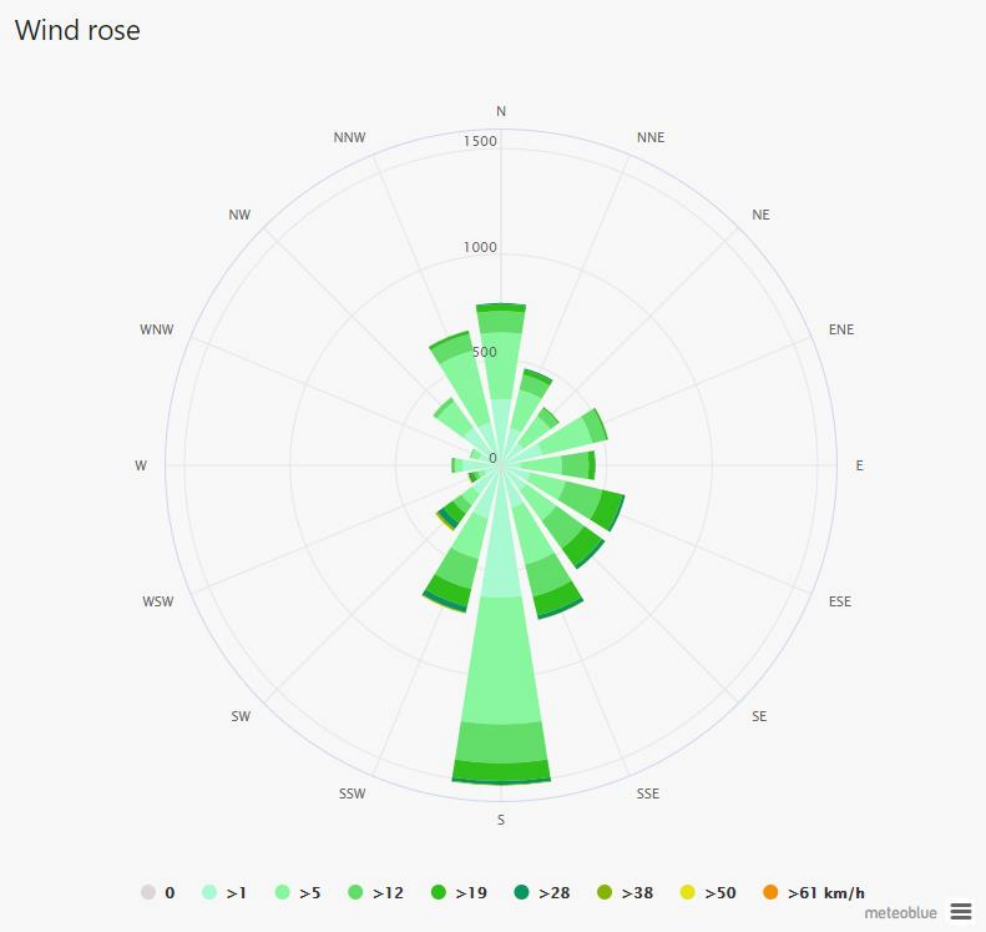


Figure 22 Windrose for City of Langford. (Meteoblue, 2020).

The dominant wind pattern in the AOI is southerly winds from the Strait of Juan de Fuca. Most of the City is located in low-lying and hilly terrain, with steeper mountainous topography surrounding. This contributes to a funnelling effect promoting the southerly winds. In the natural areas in the AOI adjacent the City boundaries, local topography will contribute to more variable winds. The larger fires in the fire history layer appear to spread from south to north. There is major variability in these patterns, and fire spreads in the AOI do not follow any broad common spread patterns.

A1.4 Topography

Steep slopes significantly increase wildfire spread through increasing radiant and convective heat. Aspect on steep slopes will also affect wildfire spread, as south-facing slopes will be much warmer and drier than other aspects. The City includes a mix of low-lying terrain and steeper slopes with urban development. Winds are most frequently out of the south. Langford lies at the west end of the CRD where elevations rise toward the central spine of Vancouver Island. This may affect wind speeds locally by constricting southerly winds as they cross the southeastern point of Vancouver Island. Structures at the edge of continuous forest cover, where a developing crown fire could run, are at higher risk than structures near isolated forest patches.

Photo 16: Langford occupies a mix of low-lying valleys between forested hills.

A1.5 Local Wildfire Threat Classification

The areas that have a high wildfire threat include fuel types that are dominated by conifer tree species and on steep slopes. These areas have high fuel loading that with both winds and the effects of slope will burn at a high intensity. A majority (60%) of the AOI is dominated by coniferous fuels. Most of the high and extreme wildfire threat is located west of the City in the Goldstream area. This overlaps with CRD managed land and continue into the near continuous fuel of the CRD watershed to the west. These areas are mapped in Figure 14.

Table 22 Wildfire behavior category based on fire intensity.

Wildfire Behavior Threat	Total Area (ha)	% of area
Very Low	1,456	11.5%
Low	0	0%
Moderate	937	7.4%
High	2,479	19.5%
Extreme	1,580	12.4%
NA	6,247	49.2%

A1.6 Local Wildfire Risk Classification

The 2012 wildfire risk methodology was used to determine wildfire risk. This method intersects the updated wildfire threat with the proximity to values to determine wildland urban interface threat class, which represents wildfire risk. This highlights areas of High or Extreme wildfire threat, and classifies their risk based on stratified distances. Areas of very low, low, or moderate wildfire threat are dropped from this analysis. Area of High wildfire risk are within 500m of a value and pose a high or extreme wildfire threat. Areas of Extreme risk are directly adjacent a value and pose a high or extreme wildfire threat.

Table 23 Wildfire Urban Interface Threat Class

Wildfire Behavior Threat	Proximity of High or Extreme Threat to Value	Total Area (ha)	% of area
High or Extreme	Within 500m	1,383	11%
High or Extreme	Directly Adjacent	513	4%

A1.7 Summary of Fire Risk Classes

The above table summarizes the total area by WUI threat class. This the total area of high wildfire threat that is adjacent values. This is summarized in Figure 14, which shows the spatial distribution of the areas of highest wildfire risk.

Appendix 2 Wildfire Threat Assessment Worksheets and Photos

Worksheets and photos submitted separately.

Appendix 3 Maps

Maps submitted separately

Appendix 4 Description of Terminology

Term	Definition
Co-dominant Trees	Defines trees with crowns forming the general level of the main canopy in even-aged groups of trees, receiving full light from above and partial light from the sides.
Coarse fuels (coarse woody debris)	Combustible material over 7cm in diameter
Crown base height	The height, above ground, where the live crown of coniferous trees begins. Measured in meters (m).
Crown closure	An assessment of the degree to which the crowns of trees are nearing general contact with one another. Commonly measured as the percentage of the ground surface that would be considered by a downward vertical projection of foliage in the crowns of trees.
Diameter at breast height	The diameter of a tree measured at 1.3m above the point of germination.
Dominant trees	Defines trees with crowns extending above the general level of the main canopy of even-aged groups of trees, receiving full light from above and significant light from the sides.
Fire-resistant materials	These meet the acceptance criteria of CAN/ULC-S101, (Fire Endurance Tests of Building Construction and Materials)
Fuel break	An area of non-combustible materials that inhibits the continuous burning of fuels.
Fuel load	The mass of combustible materials expressed as a weight of fuel per unit area.
Fuel moisture	Percent water content of vegetation. This is an important factor in rate of spread.
Fuel types	Classification of forested stands as described by Canadian Forest Fire Behavior Prediction (FBP) System. There are currently no fuel type classifications specific to coastal fuels.
Fine fuels (fine woody debris)	Combustible woody debris under 7cm in diameter.
Fire behaviour	The manner in which a fire reacts to the influences of fuel, weather, and topography.
Intermediate trees	Defines trees with crowns extending into the lower portion of the main canopy of even-aged groups of trees, but shorter in height than the co-dominants. These

Term	Definition
	receive little direct light from above and none from the sides, and usually have small crowns that are crowded on the sides.
Ladder fuels	Live or dead vegetation that allows a fire to burn into the canopy (crown) of a forested stand.
Lift pruned	The removal of ladder fuels to increase the crown base height.
Litter layer	Surface buildup of leaves and woody material.
Live crown ratio	Is the percentage of the total stem length covered with living branches. It provides a rough but convenient index of the ability of a tree's crown to nourish the remaining part of the tree. Trees with less than 30 percent live crown ratio are typically weak, lack vigor, and have low diameter growth, although this depends very much on the tree's age and species.
Non-combustible materials	Means that a material meets the acceptance criteria of CAN/ULC S114, (Standard Method of test for determination of non-combustibility in Building Materials)
Open-grown	Defines trees with crowns receiving full light from all sides due to the openness of the canopy.
Rated roofing materials	Class A, B or C is a measure of the external spread of flame on a roof surface. Tests are conducted using CAN/ULC S107M methods of fire tests of roof coverings, or equivalent. The best rating achieved is Class A, which may be described as effective against severe fire exposure.
Spotting	Fire producing sparks or embers that are carried by the wind and start new fires.
Stems per hectare	The number or size of a population (trees) in relation to a unit of space (one hectare). Stems per hectare can be used to predict fire behavior in concert with additional forest characteristics and is also important in describing successional stages of forest development.
Suppressed trees	Defines trees with entirely below the general level of the canopy of even-aged groups of trees, receiving no direct light either from above or from the sides.
Wildfire	A wildland fire from natural or human causes. Wildfires may threaten identified values and be subject to control efforts.

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