City of Port Moody Community Wildfire Protection Plan 2019 Update

Approved by Port Moody City Council
May 2023

Submitted by:

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

Submitted to:

Kirk Heaven
Deputy Fire Chief,
Port Moody Fire Rescue
City of Port Moody
100 Newport Drive
Port Moody, BC V3H 5C3
Ph: 604 469 4528
Email: kheaven@portmoody.ca

B.A. Blackwell & Associates Ltd.

PORT MOODY City of the Arts

ACKNOWLEDGEMENTS

The authors would like to thank the following City of Port Moody staff: Kirk Heaven, Deputy Fire Chief and Jason Harper, Deputy Fire Chief, Port Moody Fire Rescue; Jeff Little, Manager of Operations; Julie Pavey Tomlinson, Manager of Parks; Lesley Douglas, General Manager, Environment and Parks; Bryan Moffatt, Urban Forestry Technician; Kurt Frei, Environmental Technician; Jess Daniels, Policy Planner; Kristi Smith, Mapping and GIS Technologist; and Laura Turner, Manager Financial Reporting. These individuals invested substantial time in meetings, answering questions, reviewing, and commenting on the contents of this document.

In addition, the authors would like to thank staff from the BC Wildfire Service, including: Dana Hicks (Fuel Management Specialist), Tony Botica (Wildfire Prevention Officer) and Jordan Struthers (Wildfire Technician); and staff from the Ministry of Forests, Lands, Natural Resource Operations and Rural Development: Maurice DePaoli (First Nations Advisor) as well as staff from Metro Vancouver Parks including Rod Tulett (Emergency Management) and Marcel LaBreche (Parks).

The authors extend their appreciation to Reaman Miller, Referrals Liaison Officer of the Kwikwetlem First Nation.

This report would not be possible without the Community Resiliency Investment (CRI) program and funding from the Union of British Columbia Municipalities (UBCM).

REGISTERED PROFESSIONAL SIGN AND SEAL

RPF PRINTED NAME	
Bruce A. Blackwell	RPF 2073
DATE SIGNED	
February 18, 2020	
I certify that the work described herein fulfills the standards expected of a member of the Association of British Columbia Forest Professionals and that I did personally supervise the work.	
Registered Professional Forester Signature and Seal	

EXECUTIVE SUMMARY/ SUMMARY OF CWPP RECOMMENDATIONS

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

This CWPP Update will provide the City of Port Moody (CPM) with a framework that can be used to review and assess areas of identified high fire risk within the CPM. Additionally, the information contained in this report can guide the development of emergency plans, emergency response, evacuation plans, communication and education programs (including FireSmart), bylaw development in areas of fire risk, and the management of potentially hazardous forest lands adjacent to the community.

Since the development of the last CWPP in 2007, the City of Port Moody has made progress at implementing recommendations from the report. The most notable actions include implementation of the following[1]:

- Partial implementation of ***Recommendation 1***: the development of a communication plan and education through public outreach of fire behaviour, structure protection and vegetation management (see Sections 5.2.2 and 5.3);
- Using the City's website as a platform to communicate information regarding FireSmart, fire risks, and current fire danger **(*Recommendation 4*)**.
- Signage consisting of current fire danger and warnings at all major entrances to the community (***Recommendation 5***). A fire danger sign has been installed at the corner of IOCO and Murray Street. The identification of additional areas (*i.e.* Barnet Highway) still needs to be explored;
- FireSmart assessments in high risk areas of the community (***Recommendation 10***). To this end, Port Moody Fire Rescue (PMFR) has four staff trained as Local FireSmart Representatives (LFR) to conduct FireSmart assessments on individual homes;
- Collaboration between PMFR and the Planning and Development department to better address wildland urban interface protection (***Recommendation 12***). PMFR evaluates compliance with FireSmart for rezoning applications by developing and implementing non-combustible FireSmart requirements. However, to fulfill the intent of this recommendation, the FireSmart compliance during re-development of single-family lots should be included;
- Development by the CPM's City Emergency Program of an *Evacuation Response Plan* and a more detailed *City of Port Moody Interface Fire Immediate Response Plan* (***Recommendation 17***);
- The continued and ongoing skill renewal and training of PMFR staff with regards to wildland fire fighting **(*Recommendation 22*)**; and

[1] A full enumeration of recommendations from the 2007 CWPP can be found in Appendix M – Summary of 2007 CWPP Recommendations.

- CPM has continued to equip PMFR with personal protective and initial attack suppression equipment for wildland firefighting (***Recommendation 23***). See Section 6.1.1 and Table 13 of the CWPP report for a detailed listing of the current inventory of equipment.

A total of 45 strategic recommendations are summarized in Table 1 below and are discussed in appropriate sections throughout the document. The recommendations within this plan should be considered a toolbox of options to help reduce the wildfire threat to the community. There is no one course of action or combination of actions that is the singular answer to the challenge of wildfire risk in communities; the CPM must further prioritize based on resources, strengths, constraints, and availability of funding, regularly updating prioritizations and courses of action as variables and circumstance change through time.

Table 1. Summary of CWPP Recommendations by Document Section.

Document Section 2: Local Area Description (2.5.3: Local Government/First Nations Policies and Recommendations)				
Item	**Page No.**	**Priority**	**Recommendation/Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Review and amend the current City of Port Moody (CPM) regulatory framework to incorporate wildfire mitigation and preparedness considerations.				
1	26	High	Review and amend OCP Chapter 16 to incorporate a Wildfire Development Permit Area with wildfire interface guidelines based on FireSmart principles and consider including single-family lot redevelopments into the scope of the Wildfire DPA:	$25,000-$30,000 consultant cost UBCM Community Resiliency Investment (CRI) program[2] funding
2	27	Low	Address dumping on public land behind residences across the WUI; by assessing and mapping patterns of dumping followed by a joint strategy with Parks and Environment, Operations (Solid Waste), City of Port Moody Fire and Rescue Services (PMFR), and Bylaw Enforcement to increase enforcement with notification to the public.	~130 in-house hours
3	27	Moderate	Review and amend Bylaw No. 2835-C, 2010: Fire Protection and Emergency Response to update the list of combustible materials that are prohibited to accumulate on private property. The City should have authority to require removal/clean-up of combustible materials or to complete removal and recoup costs from the owner.	~30-50 in-house hours (local government funding). May be eligible for CRI program funding.
4	27	Moderate	Align smoking and open burning regulations with with Metro Vancouver. Annually review compliance and enforcement measures for open burning, barbecue, and hot-works construction during periods of extreme fire danger.	~15 in-house hours
5	28	High	Establish a shared decision-making process between Environment and Parks, and PMFR to assess fuel loading, ignition potential and surface fuels for possible fuel treatment opportunities during hazard tree removal.	Negligible in-house cost
6	28	Moderate	Revise Bylaw No. 2961, 2015: Tree Protection Bylaw to include language which allows the issuance of a permit for cutting of trees if it is required to reduce wildfire hazard within the wildland urban interface, as determined by a qualified professional (QP). This bylaw should also be reviewed to ensure that it does not limit the ability of homeowners to address wildfire hazards associated with trees on private property immediately adjacent to homes.	~20-30 in-house hours (local government funding or CRI program funding).

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

Document Section 2: Local Area Description (2.5.4: Higher Level Plans and Relevant Legislation)				
Item	**Page No.**	**Priority**	**Recommendation/Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Acquire parkland with a low level of hazardous fuels.				
7	30	Moderate	Review the Park Acquisition Strategy to consider parks acquisition and maintenance through a wildfire risk lens to require: 1) the use of a Qualified Professional (QP) in review, assessment, and siting of parks and park access prior to acceptance; and 2) ensure that bylaws provide the CPM authority to request modification prior to acceptance to ensure that parks are received in, and able to be maintained in, an acceptable range of risk.	~25-30 in-house hours (local government funding or CRI program funding).
Document Section 3: Values at Risk Recommendations				
Objective: Protect critical infrastructure and mitigate post-wildfire impacts				
8	33	Moderate	Develop an emergency management plan for fire suppression in consultation with Metro Vancouver Parks and private industrial owners Imperial Oil Corporation (IOCO), BC Hydro, and FortisBC where currently no city utilities exist.	Negligible in-house cost
9	33	Moderate	Consider using fire-resistant building construction materials for all critical infrastructure (CI) when completing upgrades, establishing new infrastructure or as part of routine maintenance. Landscaping and vegetation setbacks should be compliant with FireSmart guidelines, or guidelines from a wildfire hazard development permit area if Port Moody implements one.	~20-30 in-house hours (local government funding or CRI program funding).
Objective: Enhance secondary power capacity.				
10	35	High	Complete a vulnerability assessment of all critical infrastructure, secondary power sources, and fuel availability. Review current capability of secondary power sources, identify vulnerabilities, and prioritize needs, in the case of prolonged or extensive power outages. Upgrade or realign resources, as prioritized.	~$1,500-$5,000 per location (consultant cost) or ~80 in-house hours or CRI program funding.

Document Section 3: Values at Risk Recommendations				
Item	**Page No.**	**Priority**	**Recommendation/Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Undertake and maintain proposed fuel treatments to reduce risk from wildfire				
11	36	Moderate	Conduct formal FireSmart assessments (completed by a Qualified Professional) of critical infrastructure such as the fire halls, water infrastructure, and others as identified in this CWPP (Table 3).	~$1,000-$1,500 per location (consultant cost).
Objective: Protect existing critical infrastructure assets.				
12	38	High	Identify areas where upgrades to systems, flows, hydrant number or location, and water storage, power can be completed to enhance wildfire response. Prioritize and rank projects and complete or require upgrades as resources allow.	~$1,000-$1,500 per location (consultant cost) or ~25 in-house hours).
13	38	High	Identify components of the water distribution system that can be reinforced through improvements or repairs that enhance resiliency to ensure the City's system can function independently.	CRI program funding / local government funding
Objective: Protecting areas with high environmental values: forest health				
14	47	Low	Formalize the invasive plant management program into a Strategy document in order to prioritize and target treatments and monitoring in areas with known invasive species occurrences in the WUI. Coordinate invasive species management with fuel management	In-house cost (~60 hours)
Document Section 5: Risk Management and Mitigation Factors Recommendations				
Objective: Reduce wildfire threat through fuel management				
15	63	High	Proceed with detailed assessment, prescription development and treatment of proposed treatment units identified and prioritized in this CWPP Update. Prescriptions must be developed within the context of the Environmentally Sensitive Area (ESA) Strategy and Metro Vancouver's Sensitive Ecosystem Inventory (SEI). Consult with a qualified biologist during prescription development to ensure all concerns are addressed.	CRI program funding; prescription development and operational costs to vary due to consultant bids. (~$300-$500/ha and $15,000-$25,000/ha to implement).
Objective: Maintain acceptable levels of wildfire threat through fuel management				
16	71	Low	As/if treatments are implemented; treatment monitoring to be completed by a qualified professional to schedule next set of maintenance activities (10 -15 years out).	CRI program funding. Costs will vary due to site specifics and consultant bid.

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation/Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Reduce wildfire hazard on private land				
17	78	Moderate	Continue PMFR's input into development permit and building permit applications prior to approval. If a Wildfire DP is implemented (see recommendation #1) and more applications are received, the importance of communication and integration between the fire department and the Development Services department will increase.	~20-30 in-house hours (local government funding or CRI program funding).
18	78	Moderate	Develop a landscaping standard which lists flammable vegetation and landscaping materials, non-flammable drought and pest resistant alternatives, and tips on landscape design to reduce maintenance, watering requirements, avoid wildlife attractants and reduce wildfire hazard.	$2,000-$3,000 or negligible cost if FireSmart information used
19	79	Moderate	Engage the development/building community (include developers, builders, landscapers, and architects) in DPA development process through a series of workshops/ information sessions to: 1) increase awareness of wildfire risk, 2) demonstrate that there are a variety of actions which can be undertaken to immediately and measurably reduce the risk to the homeowner and community, 3) discuss various strategies and actions which could be implemented to meet DP objectives, and 4) educate and inform regarding the DP process and expectations.	CRI program funding. Costs will vary due to site specifics and consultant bid.
20	80	Moderate	The City should consider enhancing the capability of the existing sprinkler protection program from 20 homes to 50 homes and is particularly applicable to FireSmart priority neighbourhoods identified in Section 5.2.3.	~20 in-house hours (local government funding).
21	80	High	The City should apply for a FireSmart demonstration grant through the CRI program. This fuel treatment can display the practices and principles of FireSmart activities to the public in the form of demonstration treatments. These small projects are not necessarily completed to reduce fire behaviour or increase stand resiliency in any measurable way, but are prioritized more by their visibility to the public and combining the treatment with elements of public education (signage, community work days, public tours, and active demonstrations of operations).	~20-25 in-house hours for CRI program funding application for demonstration project. Prescription and implementation costs similar to #16 above.

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation/Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Reduce wildfire hazard on private land				
22	81	High	Develop and implement a community chipper program with the help of neighbourhood representatives. This program can begin twice per year in two separate neighbourhoods. This program can also be implemented in conjunction with community clean up days. Apply for CRI funding to establish the Community Local Rebate program.	Eligible for CRI program funding (in-house or contractor service). ~20-30 in-house hours for advertisement.
Objective: Increase public wildfire awareness				
23	85	Low	Engage Port Moody media (The Now, Tri-City News) on the issue of interface wildfire risk to capture a wider segment of the population. Regular contact with the media can improve the transfer of information to the public.	5-10 CPM staff hours
24	85	High	This CWPP Update report and associated maps should be made publicly available through webpages and social media. Re-visit the CPM's social media strategy to ensure communication of fire bans, high or extreme Fire Danger days and wildfire prevention initiatives and programs.	~3-6 in-house hours depending on method of distribution.
25	85	Moderate	Continue to promote FireSmart approaches for wildfire risk reduction to CPM residents through various engagement and education events. Conduct these campaigns prior to and during the fire season. Continue supplying FireSmart materials to homeowners in the interface at this time.	Dependent on the number of DP applications
26	86	Moderate	Continue to hold the annual wildfire presentation evening every spring prior to the start of the fire season, and consider organizing a wildland specific Fire Prevention Day or Week, or similarly formatted event as well. Incorporate sessions to include high school students and rotate presentations to other venues such as community hall or community centre locations.	~20 in-house hours (local government funding).
27	86	Low	Complete or schedule periodic updates of the CWPP to gauge progress and update the threat assessment for changes in fuels, forest health, land planning, stand structure or changes to infrastructure in the interface.	CRI program funding. ~20-40 in-house hours to coordinate.
28	86	Moderate	Facilitate uptake into the FireSmart Canada Community Recognition Program (FSCCRP) within the CPM and enhance its applications by including the following: 1) participation with BCWS crews for annual FireSmart events; 2) Encourage individual homeowners to complete the self-administered FireSmart home assessment tool.	$5,000 per neighbourhood and ~40 in-house hours (CRI program funding).

Document Section 5: Fuel Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation/Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Increase public wildfire awareness				
29	86	High	Promote the use of the FireSmart Home Partners Program offered by the Partners in Protection Association, for voluntary FireSmart assessments on private property. Educate homeowners about hazards on their property and provide easy improvements to reduce their risk.	~3 hours/assessment
30	86	High	Develop a school fire education program to include an element of wildfire preparedness education to elementary, middle, and high schools. Programming could include volunteer work from professional foresters, wildland firefighters or prevention officers, and CPM staff.	~30-40 in-house hours (local government funding).
Objective: Promote fuel management and joint initiatives.				
31	87	Moderate	Amend the Unsightly Premise Bylaw No.1488, and insert a clause that states PMFR can conduct an inspection to determine fuel sources, ignition potential, or to determine if a FireSmart assessment is warranted.	~10-15 CPM staff in-house hours
32	87	Moderate	Work with industrial operators such as BC Hydro and FortisBC to ensure that high risk activities, such as grubbing/brushing and right-of-way mowing work do not occur during high to extreme fire danger times to reduce chance of ignitions as per the *Wildfire Act*.	~ 20 hours to initiate. CRI program/local government funding
33	87	Moderate	Work with industrial operators (i.e., BC Hydro) to ensure that rights-of-way do not contain fine fuel accumulations (< 7.5 cm, easily cured) and significant regeneration of conifer vegetation prior to and during the fire season.	~ 20 hours to initiate. CRI program/local government funding
Document Section 6: Wildfire Response Resources Recommendations				
Objective: Improve Water Availability for Emergency Response				
34	90	Moderate	Identify interface areas with hazardous fuels that have limited water distribution system access, including where hydrant distances exceed current bylaw and best practice requirements. Investigate feasibility of installing appropriate water infrastructure to suit fire suppression needs.	~120 CPM staff in-house hours and $20,000 consultant costs
35	90	Moderate	Wherever possible, ensure City fleet equipment, including tankers, sewer cleaning trucks, or other equipment, is configured to allow for use as water tenders to supplement water availability in areas not currently serviced by the water distribution system	~$3,000-$5,000 per equipment

Document Section 5: Fuel Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation/Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Improve Water Availability for Emergency Response				
36	90	Moderate	Review improvements to ensure the City's water distribution system has redundant, resilient features deliver uninterrupted water supply in the event of an emergency.	240 CPM staff in-house hours and ~$50,000 consultant costs
Objective: Improve Access/Egress to Enhance Emergency Preparedness				
37	92	High	Participate in regular testing of, and updates to, and mock exercises for an interface fire event as outlined in the City of Port Moody Evacuation Response Plan and Interface Fire Immediate Response Plan. Target areas with potential entrapment issues (Heritage Woods, White Pine Beach Rd, Belcarra Regional Park, Bedwell Bay Rd, Thermal Plant Rd) with signage and fuel treatments.	~40-50 hours to plan and test (local government funding).
38	92	Moderate	Consider developing a community wildfire pre-planning brochure that addresses the following: 1) locations of staging areas; 2) communications requirements (i.e., radio frequencies); 3) minimum resource requirements for structure protection in the event of an interface fire, and values at risk; and 4) maps of the area of interest. This brochure is intended for internal distribution and use only.	~30-40 hours to plan and stage; 8 hours to complete testing
39	92	Low	Develop an Emergency Access Classification Plan (EACP) to map and inventory trail and road networks in natural areas for suppression planning. This plan should also identify and map evacuation routes (*i.e.* White Pine Beach Rd, Bedwell Bay Rd), and may inform future access improvements and should include identification of the location, widths, and weight limits of roads and bridges. Georeferenced maps with ground-truthed locations of potential optimal firebreaks should also be developed as part of the EACP and shared with fire suppression personnel and BCWS to support emergency response in the event of a wildfire. The plan should be updated every five years, or more regularly, as needed to incorporate additions and/or changes.	~$8,000-$10,000 (estimated contractor costs).
40	93	Moderate	Include a qualified professional (QP) with experience in operational wildland/interface fire suppression in the planning and strategic siting of future trails and parks.	40 hours (estimated contractor costs).

Document Section 6: Wildfire Response Resources Recommendations				
Item	**Page No.**	**Priority**	**Recommendation/Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Increase and continually develop PMFR staff training				
41	93	High	PMFR should work with BCWS to initiate and maintain an annual structural and interface training program to include annual reviews to ensure PPE and wildland equipment resources are complete and in working order and that crews can operate. PMFR should engage in yearly practical wildland fire training with BCWS and Metro Vancouver and review: pump, hose, hydrant, air tanker awareness, and deployment of SPUs. The training program should include safety training specific to wildland fire and risks inherent with natural areas (completion of a joint wildfire simulation exercise is recommended).	~16-20 hrs to initiate and/or maintain a training program. ~8 hrs to conduct annual reviews. ~16 hrs/ PMFR to complete annual wildfire exercise and safety course.
42	94	Moderate	PMFR should engage in regular communication with the BCWS Fraser Fire Zone, Cultus/Haig Fire Base to identify potential cooperative wildfire risk reduction opportunities.	~4 hours per year.
43	94	High	Ensure that PMFR maintains the capability to effectively suppress wildland fires, through wildfire-specific training sessions. Ensure all PMFR members have SPP-WFF 1 (or S-100 and S-185 combined) at a minimum as well as WSPP-115 (for the development of structural protection units).	Current PMFR training budget.
44	94	Moderate	Train CPM parks and utilities staff in S-100, particularly those who undertake a considerable amount of work in forested areas within the City. The nature of their jobs may allow these staff members to have an opportunity to provide immediate initial response and suppression before PMFR or BCWS are able to respond.	~8 hours of training per staff member (local government funding) and annual refresher (on-line, in-house, or external).
Objective: Structure Protection				
45	95	Moderate	Expand on existing programs which serve to remove barriers to action for homeowners by providing methods for them to cheaply and easily dispose of wood waste removed from their property. This could include scheduled community chipping opportunities, and/or yard waste dumpsters available by month in neighbourhood. Programs should be available during times of greatest resident activity (likely spring and fall).	May be eligible for CRI program funding (in-house or contractor funding). Extra time for advertisement. ~$400 per neighbourhood to implement a community chipping day.

TABLE OF CONTENTS

Acknowledgements i
Registered Professional Sign and Seal ii
Executive Summary/ Summary of CWPP Recommendations iii
Commonly Used Acronyms xvii
SECTION 1: Introduction 18
1.1 Purpose 18
1.2 CWPP Update Planning Process 19
1.2.1 Consultation 19
1.2.2 Identification of Values at Risk and Local Wildfire Threat Assessment 19
1.2.3 Development of a Risk Management Strategy 20
1.2.4 Building Community Engagement and Education Strategy 20
SECTION 2: Local Area Description 21
2.1 CWPP Area of Interest 21
2.2 Community Description 23
2.3 Past Wildfires, Evacuations and Impacts 24
2.4 Current Community Engagement 24
2.5 Linkages to Other Plans and Policies 25
2.5.1 Local Authority Emergency Plan 25
2.5.2 Affiliated CWPPs 25
2.5.3 Local Government/First Nation Policies and Recommendations 25
2.5.4 Higher Level Plans and Relevant Legislation 29
2.5.5 Ministry or Industry Plans 30
SECTION 3: Values At Risk 31
3.1 Human Life and Safety 32
3.2 Critical Infrastructure 33
3.2.1 Electrical Power 34
3.2.2 Communications, Pipelines and Municipal Buildings 35
3.2.3 Water and Sewage 37
3.3 High Environmental and Cultural Values 38
3.3.1 Drinking Water Supply Area and Community Watersheds 38
3.3.2 Cultural Values 39
3.3.3 High Environmental Values 40
3.4 Other Resource Values 41
3.5 Hazardous Values 41
SECTION 4: Wildfire Threat and Risk 43
4.1 Fire Regime, Fire Weather and Climate Change 43
4.1.1 Fire Regime and Fire Weather 43
4.1.2 Climate Change 49

4.2 Provincial Strategic Threat Analysis 52
4.2.1 Fire History 54
4.3 Local Wildfire Threat Assessment 55
SECTION 5: Risk Management and Mitigation Factors 59
5.1 Fuel Management 59
5.1.1 Proposed Treatment Units 61
5.1.2 Maintenance of Previously Treated Areas 69
5.2 FireSmart Planning and Activities 70
5.2.1 FireSmart Goals and Objectives 70
5.2.2 Key Aspects of FireSmart for Local Governments 74
5.2.3 Priority Areas within the AOI for FireSmart 81
5.3 Communication and Education 83
5.4 Other Prevention Measures 85
SECTION 6: Wildfire Response Resources 86
6.1 Local Government Firefighting Resources 86
6.1.1 Fire Department and Equipment 87
6.1.2 Water Availability for Wildfire Suppression 88
6.1.3 Access and Evacuation 89
6.1.4 Training 92
6.2 Structure Protection 93
Reference 95
Appendix A – Local Wildfire Threat Process 97
A-1 Fuel Type Attribute Assessment 98
A-2 Proximity of Fuel to the Community 101
A-3 Fire Spread Patterns 102
A-4 Topography 104
Appendix B – Wildfire Threat Assessment – FBP Fuel Type Change Rationale 106
Appendix C – Wildfire Threat Assessment Worksheets and Photos 107
Appendix D – Maps 108
Appendix E – Wildland Urban Interface Defined 109
Appendix F – WUI Threat Plot Locations 111
Appendix G – Fuel Typing Methodology and Limitations 113
Appendix H – WUI Threat Assessment Methodology 114
Appendix I – Principles of Fuel Management 118
Appendix J – FireSmart Fuel Treatments 123
Appendix K – FireSmart Construction and Landscaping 125
Appendix L – Communication and Education 128
Appendix M – Summary of 2007 CWPP Recommendations 129

List of Tables

Table 1. Summary of CWPP Recommendations by Document Section. v
Table 2. Summary of AOI by land ownership. 21
Table 3: Municipal critical infrastructure identified in 2019 field visits. 35
Table 4. Energy provider critical infrastructure 36
Table 5. Critical Infrastructure Identified in 2019 CWPP field visits. 37
Table 6. Publicly available occurrences of Red-listed species recorded within the AOI. 40
Table 7. Hazardous Infrastructure identified in 2019 CWPP field visits. 41
Table 8. BEC zones and natural disturbance types found within the AOI. 44
Table 9. Overall PSTA Wildfire Threat Analysis for the AOI (rounded to the nearest hectare). 53
Table 10. Fire behaviour threat summary for the AOI. 57
Table 11. Proposed Treatment Area Summary Table. 64
Table 12. Summary of FireSmart Priority Areas. 82
Table 13. Fire department capacity and equipment within the AOI. 87
Table 14. Fuel Type Categories and Crown Fire Spot Potential. Only summaries of fuel types encountered within the AOI are provided. 99
Table 15. Proximity to the Interface. 101
Table 16. Slope Percentage and Fire Behaviour Implications. 104
Table 17. Slope Position of Value and Fire Behaviour Implications. 105
Table 18. Summary of WUI Threat Assessment Worksheets. 111
Table 19. Description of variables used in spatial analysis for WUI wildfire threat assessment. 115

List of Maps

Map 1. Area of Interest (AOI). 22
Map 2. Values at Risk within the AOI. 31
Map 3. Biogeoclimatic Zones and natural disturbance regimes within the AOI. 45
Map 4. Fire Regime, Ecology and Climate Change. 51
Map 5. Provincial Strategic Threat Rating. 54
Map 6. Local Fire Behaviour Threat Rating and WUI Threat Rating. 58
Map 7. Proposed Fuel Treatments. 69
Map 8. Updated Fuel Type. 100

List of Figures

Figure 1. Average number of danger class days for the Seymour QD2 fire weather station. Summary of fire weather data for the years 2009 - 2018. 49
Figure 2. The various coordinated levels of the FireSmart program. 71
Figure 3. Wildland/urban interface disaster sequence. 74

Figure 4. Wind rose for Seymour QD2 weather station based on hourly wind speed data during the fire season (April 1 – October 31) 2009-2018. The length of each bar represents the frequency of readings in percent and bar colour indicates the windspeed range. 103
Figure 5. Illustration of intermix and interface situations. 109
Figure 6. Firebrand caused ignitions: burning embers are carried ahead of the fire front and alight on vulnerable building surfaces. 110
Figure 7. Radiant heat and flame contact allow fire to spread from vegetation to structure or from structure to structure. 110
Figure 8. Comparison of stand level differences in height-to-live crown in an interior forest, where low height to live crown is more hazardous than high height to live crown. 120
Figure 9. Comparison of stand level differences in crown closure, where high crown closure/continuity contributes to crown fire spread, while low crown closure reduces crown fire potential. 120
Figure 10. Comparison of stand level differences in density and mortality, and the distribution of live and dead fuels in these types of stands. 121
Figure 11. Illustration of the principles of thinning to reduce the stand level wildfire hazard. 122
Figure 12. Illustration of FireSmart zones. 124

COMMONLY USED ACRONYMS

AOI	Area of Interest
BCWS	British Columbia Wildfire Service
BEC	Biogeoclimatic Ecosystem Classification
CDC	B.C. Conservation Data Centre
CFFDRS	Canadian Forest Fire Danger Rating System
CI	Critical Infrastructure
CPM	City of Port Moody
CRI	Community Resiliency Investment Program
CWPP	Community Wildfire Protection Plan
DPA	Development Permit Area
EOC	Emergency Operations Centre
ESA	Environmentally Sensitive Area
FBP	Fire Behaviour Prediction System
FESBC	Forest Enhancement Society of British Columbia
FMP	Fire Management Plan
FRS	Fire Rescue Services
FSCCRP	FireSmart Canada Community Recognition Program
HCA	Heritage Conservation Act
HIZ	Home Ignition Zone
IOCO	Imperial Oil Corporation
MFLNRORD	Ministry of Forests, Lands, Natural Resource Operations, and Rural Development
NFPA	National Fire Protection Agency
OCP	Official Community Plan
OFC	Office of the Fire Commissioner
PMFR	Port Moody Fire and Rescue Services
PMPD	Port Moody Police Department
PSTA	Provincial Strategic Threat Analysis
PTU	Proposed Treatment Unit
QP	Qualified Professional
RMZ	Riparian Management Zone
SEI	Sensitive Ecosystem Inventory
SPU	Structural Protection Unit
UBCM	Union of British Columbian Municipalities
VAR	Values at Risk
VFD	Volunteer Fire Department
WUI	Wildland Urban Interface

SECTION 1: INTRODUCTION

City of Port Moody ('CPM', 'the City') staff have recognized wildfire mitigation and planning to be an integral component of their emergency planning and preparedness. In 2019, B.A. Blackwell and Associates Ltd. were retained to assist the CPM in developing an update to the previous 2007 Community Wildfire Protection Plan *City of Port Moody Community Wildfire Protection Plan*, hereinafter referred to as the 2007 CWPP. This CWPP Update document revisits the 2007 CWPP with a focus on integrating the updated Provincial Strategic Threat Analysis (PSTA), BC Wildfire Service (BCWS) Fuel Type mapping, and the updated and improved wildfire threat analysis methodology. Some significant changes since 2007 which have impacted the wildfire risk include: subdivision development, implementation of building regulation bylaws, and changes in fuels surrounding the community.

The 2003, 2004, 2009, 2010, 2015, 2017 and 2018 wildfire seasons resulted in significant economic, social and environmental losses in BC. The 2018 fire season was the most extensive in terms of area burned, surpassing the 2017 fire season. Other recent wildfire disasters—like those experienced in Slave Lake, Alberta (2011), Washington State (2014 and 2015), Fort McMurray, Alberta (2016) and California (2017 and 2018) demonstrate the vulnerability of communities and the potential toll of wildfires on families, neighbourhoods and the economy of entire regions. These events, have spurred the need for greater consideration and due diligence with respect to fire risk in the wildland urban interface (WUI).[3] Climate change is another serious and complex aspect to consider in wildfire management planning (see Section 4.1.2).

1.1 PURPOSE

The purpose of this CWPP Update is to identify the wildfire risks within the administrative boundary and to describe the potential consequences if a wildfire was to impact the area. The goal of this CWPP Update, in addition to defining the threats to human life, property and critical infrastructure from wildfires, is to identify measures necessary to mitigate these threats and outline a plan of action for implementing these measures. It is intended to serve as a framework to inform actions and strategies that will serve to: 1) reduce the likelihood of wildfire entering the community, 2) reduce the impacts and losses to property and critical infrastructure if a wildfire were to occur; 3) reduce the negative economic and social impacts of wildfire to the community; and develop wildfire management planning and mitigation strategies with projected climate change impacts specific to Port Moody and the Metro Vancouver region.

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

1.2 CWPP UPDATE PLANNING PROCESS

This CWPP Update is a review and synthesis of the background information and current data related to the Area of Interest (AOI) which represents the municipal boundary of the City of Port Moody. The CWPP consists of four general phases outlined in Sections 1.2.1 to 1.2.4 as described below.

1.2.1 Consultation

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

The first step in the consultation process was to assemble key players in the 'Wildfire Working Group'. This group comprised key internal City of Port Moody staff from Emergency Services (Port Moody Fire Rescue); Planning; Operations; GIS/Mapping; Recreation, Environment and Parks; and Finance.

BCWS representatives from the Coastal Fire Centre and Fraser Fire Zone - Cultus/Haig (Wildfire Prevention Officer and Forest Protection Specialist) were consulted as follows: 1) at the onset of the project planning phase; 2) throughout the CWPP update development process, both via the submission of Fuel Type Change Rationales and questionnaire regarding concerns and priorities of BCWS with respect to wildfire and emergency planning in the City of Port Moody; and 3) to provide review and revision of the draft document upon plan completion.

Information sharing took place with fifteen First Nations, as identified through the Consultative Areas Database, and in consultation with MFLNRORD for locations of existing or potential cultural values at risk requiring protection consideration. Information sharing consisted of an initial phone call, and subsequent distribution of a referral letter and information package (i.e., maps, draft CWPP document). Fifteen First Nations were provided the Plan for review and feedback.

Additional stakeholders were consulted to identify synergies, opportunities for collaboration, and ensure linkages with adjacent and overlapping planning. These stakeholders included the BCWS, FortisBC, BC Hydro, Imperial Oil Corporation (IOCO), Burrard Thermal Plant, and Metro Vancouver (Emergency Management and Parks). Consultation has generated a shared understanding of the CWPP objectives and expected outcomes.

1.2.2 Identification of Values at Risk and Local Wildfire Threat Assessment

The risks associated with wildfire must be clearly identified and understood before a CWPP can define strategies or actions to mitigate risks. The identified values at risk are described in Section 3 and concepts of wildfire threat and risk are elaborated on in 0. The wildfire threat in the City of Port Moody was assessed through a combination of the following approaches:

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

1.2.3 Development of a Risk Management Strategy

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

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

1.2.4 Building Community Engagement and Education Strategy

Engaging the community from local government staff and officials, to key stakeholders and residents in wildfire protection planning activities is key to ensuring successful implementation. Community engagement and education strategies are described in Section 5.3. A presentation to the City of Port Moody Council will aim to ensure high level approval and support for this CWPP.

SECTION 2: LOCAL AREA DESCRIPTION

This section defines the Area of Interest (AOI) and describes the City of Port Moody AOI. It also summarizes the current community engagement in wildfire prevention and mitigation and identifies linkages to other plans and policies with relevance to wildfire planning.

2.1 CWPP AREA OF INTEREST

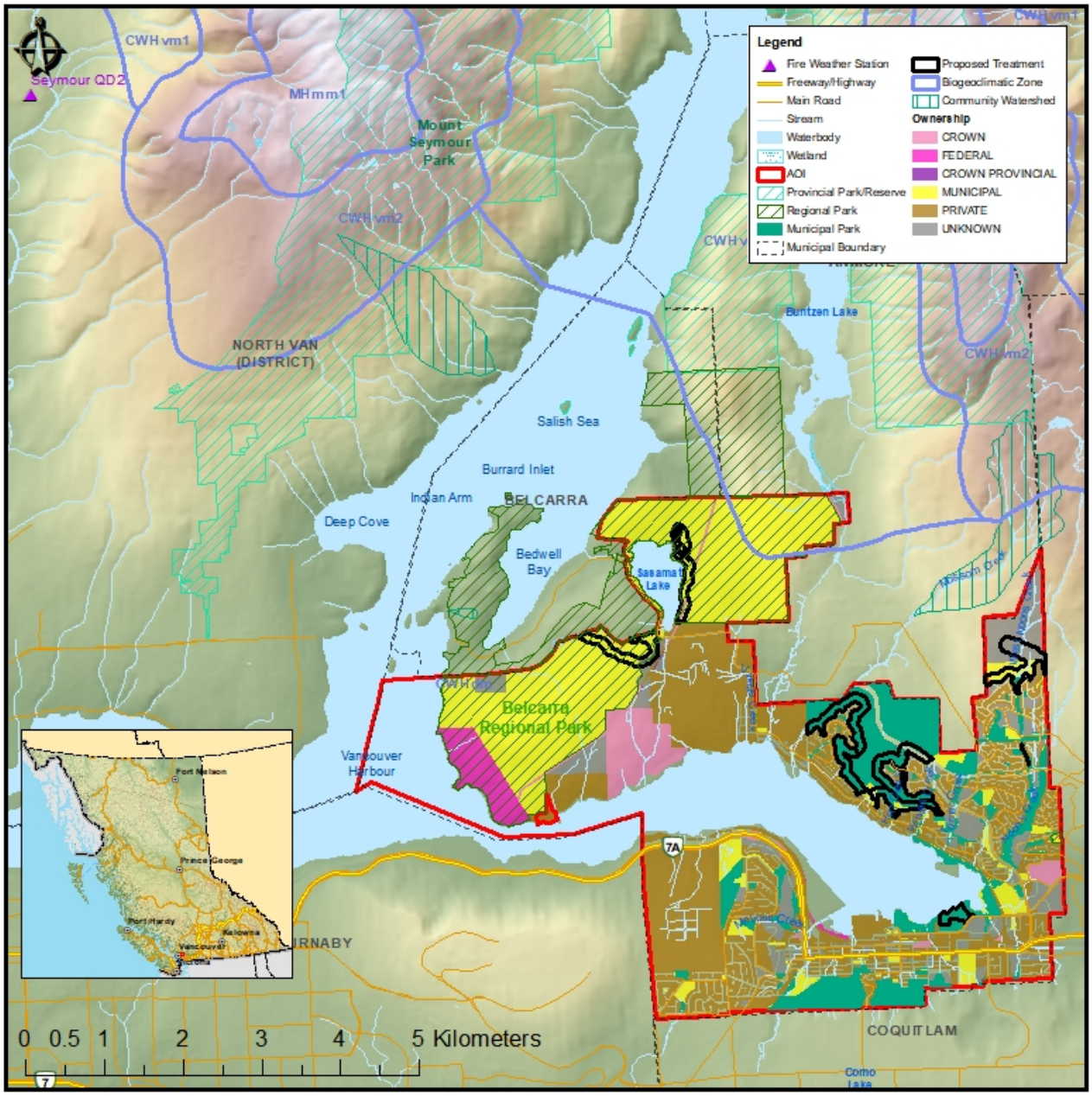
The City of Port Moody is situated at the eastern end of Vancouver Harbour, and surrounds the eastern end of Burrard Inlet. Port Moody is one of three suburban cities considered the Tri-Cities, which includes Port Moody, Coquitlam and Port Coquitlam, and is bordered by Burnaby in the West and Coquitlam in the east and south.

The City has a total land area of 32.82 square km. Within its boundaries there is a mix of residential, commercial, heavy industrial, and waterfront properties. Park land, natural areas, steams and riparian zone are prominent features throughout the City, including such features as Belcarra Regional Park, Admiralty Point Park, and a number of municipal parks including: Mossom Creek, Bert Flinn, Noons Creek, Chines, Shoreline, and Rocky Point. The 2016 Census reported the population of the City of Port Moody at 33,551; resulting in a 1.6% increase from the previous Census in 2011.

The AOI for the CWPP is illustrated below in Map 1 and represents the City of Port Moody municipal boundary. The current AOI is bounded in the west by Indian Arm and the Village of Belcarra, to the south-west by Burnaby and in the south-east by Coquitlam and in the north by the Village of Anmore. The AOI is approximately 3,282 ha in size. A breakdown of the AOI's land ownership is provided in Table 2.

Table 2. Summary of AOI by land ownership.

Land Ownership	Hectares
Crown Agency	103
Crown Provincial	0
Federal	62
Municipal	1,040
Municipal/Crown Provincial	935
Private	861
Unknown	281
Total	**3,282**



Map 1. Area of Interest (AOI).

2.2 COMMUNITY DESCRIPTION

The City of Port Moody is one of 21-member municipalities that make up Metro Vancouver. The City of Port Moody, along with Coquitlam, Port Coquitlam and the two villages of Belcarra and Anmore make up the Tri-Cities region. In addition to the 21 municipalities, Metro Vancouver contains one Treaty Nation (Tsawwassen First Nation) and one unincorporated electoral area. As members of Metro Vancouver, the Tri-Cities are provided shared services such as drinking water, regional park management, solid waste management and wastewater treatment. Partnerships also exist for recreation, environment, and parks. At the city level, services provided include city hall services, business and development planning, fire protection services, garbage and recycling services, roads and sidewalk maintenance, and bylaw development and enforcement. As of the 2016 census, the City in its entirety has a population of approximately 33,551 people.[4]

Prior to colonial settlement, Metro Vancouver was inhabited by the Coast Salish Aboriginal Peoples including the Kwikwetlem, Tsleil-Waututh, and Sto:lo First Nations, some of whom continue to live within the AOI today.

The City's economy was historically driven by forestry, petroleum product distribution, and a deep-sea bulk loading terminal and other water way transportation services. Although these industries remain of importance to the local economy, in recent years the economic focus has shifted towards real estate development, health and related services, light industry, home-based business and arts and culture.

Fire protection within the AOI is the responsibility of the City of Port Moody Fire and Rescue Services (PMFR). A services agreement (mutual aid) exists between this department and neighbouring jurisdictions. The PMFR also has a memorandum of understanding in place with the BCWS, and firefighters are trained with S-100 and WSPP-115. In the event of an interface fire or wildfire, BCWS aid may be requested.

Highway 7A (also known as Barnet Highway) is the primary access/egress route within the City, which is a connected highway route that runs east-west through the City. Ioco Road, Bedwell Bay Road, and Heritage Mountain Boulevard provide access to interfaces areas across the north side of the City, while Clarke Road, Murray Street, Barnet Highway and St. Johns Street provide access to southern interface areas. In the event of a wildfire, the western and northern portion of the City, specifically Metro Vancouver's Belcarra Regional Park and Admiralty Point Park, have limited emergency egress routes. These narrow and forested corridors are an area of particular concern with respect to limited emergency egress and lack of an alternate evacuation route. This not only presents a challenge for emergency egress, but also limits the ability of fire crews to respond to fires and to safely evacuate residents.

[4] Statistics Canada. 2016 Census. Port Moody [Census Subdivision], British Columbia. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CSD&Code1=5915043&Geo2=PR&Code2=12&Data=Count&SearchText=Port%20Moody&SearchType=Begins&SearchPR=01&B1=All

2.3 PAST WILDFIRES, EVACUATIONS AND IMPACTS

BCWS Coastal Fire Zone staff communicated that the majority of past wildfire activity within the AOI was human caused and ignitions have occurred during the fire season (usually May – September / October).

Based on the BCWS historical wildfire dataset, wildfire activity in Port Moody has been generally low. Over the last 10-year period there was one small fire in 2013, and three small fires in 2015 (one fire measured $9m^2$) that burned within the City of Port Moody. All fires were actioned, resourced, and controlled by PMFR; the assistance of BCWS was not required. Five larger fires adjacent to Port Moody occurred between 1922 – 1941. To the north, three fires on the lower slopes of Eagle Mountain ranged in size between 62 – 224 ha; and to the south, two fires proximal to the Chineside neighbourhood were both approximately 850 ha and both burned in 1922.

The BCWS historical ignition dataset shows that the proportion of human-caused fires within and adjacent to the City of Port Moody is similar to other municipalities in the Metro Vancouver region.[5] More than 90% of ignitions have been human caused, versus the 40% BC provincial average[6]. However, Port Moody and adjacent municipalities (Maple Ridge, Coquitlam, Pitt Meadows) that possess interface areas next to extant tracts of forested park and/or Crown land are noted by BCWS as regions where large or catastrophic wildfires can occur, with resulting impacts to densely settled communities (pers. comm. Jordan Struthers, December 17, 2019).

The City of Port Moody allowed back-yard burning up until 2017 when bylaw 2835-C (2010) Fire Protection and Emergency Response was amended to ban all back-yard burning. While this bylaw amendment is effective at reducing nuisance fires, alternative debris disposal methods must be presented to residents in the form of community chipping and yard waste pick-up programs (Section 5.2.2); and to reduce the incidence of illegal dumping of fuels onto public land.

2.4 CURRENT COMMUNITY ENGAGEMENT

Within recent years, there has been significant community engagement in FireSmart initiatives within the City. FireSmart presentations and workshops are provided by the City of Port Moody and on average four City sponsored events are held each year. In recent years, the City has been active in implementing the following FireSmart initiatives: 1) training staff to become local FireSmart Representatives; 2) creating and maintaining new fire rating signage; 3) posting on Port Moody Fire Rescue (PMFR) and City of Port Moody social media accounts (FireSmart information and events and Fire Danger Rating); 4) distributing FireSmart educational materials door to door in selected neighbourhoods; 5) attending City-sponsored community events to provide FireSmart education; and 6) conducting FireSmart presentations for the citizens of Port Moody with a panel of local experts.

Overall FireSmart initiatives have been well received by the public and feedback is generally positive. The PMFR website has a wildfire safety page, which communicates important information to the public

[5] BC Wildfire Service: Fire Incident Locations - Historical
[6] BCWS, 2018

such as the current Fire Danger Rating, a link to a current version of the City of Port Moody emergency preparedness page, and links to FireSmart Canada which provides resources, such as a "how-to" video on FireSmarting your home, and purchasing information for Wildfire Automated Sprinkler Protection (WASP) systems. CPM staff have expressed that public uptake for FireSmart initiatives in the City is much higher during and following an active fire season in BC, but dwindles considerably in low fire years. Future initiatives should focus efforts during times of high public uptake in order to maximize the resources available for community engagement.

2.5 LINKAGES TO OTHER PLANS AND POLICIES

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

2.5.1 Local Authority Emergency Plan

Emergency preparedness is documented in the City of Port Moody's *Evacuation Response Plan*. The plan utilizes a practical methodology that can be applied to any evacuation event, regardless of size, scope and impact severity and is similar to Emergency Management British Columbia's (EMBC) *Evacuation Operational Guide*.[7] The centralized command, control, coordination and communication hub is the Emergency Operations Centre (EOC) located at Inlet Centre Fire Hall (Fire Hall #1). An interface wildfire event is considered a Planned Evacuation due to early warning and preparation time. The plan outlines the resources required and a systematic three-phased evacuation process to communicate with and move affected people from high-risk areas during a wildfire emergency.

2.5.2 Affiliated CWPPs

A CWPP was developed for the City of Port Moody in 2007. This document has been reviewed for synergistic project opportunities, as well as to confirm that there are no contradicting recommendations.

2.5.3 Local Government/First Nation Policies and Recommendations

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

Port Moody Official Community Plan, 2015

The Port Moody Official Community Plan (OCP) provides the City with a long-range framework to guide, monitor and evaluate future land uses and development throughout the area. The following sections

[7] Province of BC Evacuation Operational Guide. Accessed September 13, 2019 https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/local-government/evacuation_operational_guidelines.pdf

contain objectives and policies which are directly relevant to wildfire risk reduction, emergency response, and community resilience post-disaster as described below.

- Port Moody OCP, 2015, Chapter 6, The Natural Environment
  This chapter covers objectives surrounding natural areas and their linkages within the municipality. *Policy 47:* The City will continue to involve Port Moody Fire and Emergency Services in planning and development for projects that may pose a wildland interface threat.
- Port Moody OCP, 2015, Chapter 7, Parks, Open Spaces and Recreation
  Much of City's parkland occurs in stream ravines and forested areas. Planning objectives include maintaining forest health and Environmentally Sensitive Areas (ESA) in all parkland; and linking shoreline parks and forested areas along Burrard Inlet which are important considerations when recommending fuel treatments. Reforestation and removal of hazard trees are discussed.
- Port Moody OCP, 2015, Chapter 11, Heritage Conservation
  Archeological heritage is included in this chapter. Archeological sites are noted as protected under the Provincial Heritage Conservation Act and identified sites require consultation with local First Nations prior to implementing fuel treatments.
- Port Moody OCP, 2015, Chapter 12, Community Well-Being
  The provision of fire services and the establishment of a second Firehall (Firehall #2) is discussed. PMFR staff are involved in reviewing development proposals in areas adjacent to parks and forested areas to reduce the fire risk. The Disaster Response Plan includes emergency pre-event planning, emergency event response training and disaster recovery requirements.
- Port Moody OCP, 2015, Chapter 14, Community Infrastructure
  The asset management section contains general policies of climate change adaptations, greenhouse gas (GHG) reduction opportunities, and opportunities for green infrastructure. The Stormwater Management section refers to efforts to "encourage the permeability of grassed or landscaped areas by protecting native soil, preventing soil compaction and aerating or loosening compacted soils". This could be of minor concern for future fuel treatments.
- Port Moody OCP, 2015, Chapter 16, Development Permit Area Guidelines
  This chapter refers to guidelines for Development Permit Areas (DPA) 4 and 5, ESAs and Hazardous Conditions. Development and ESA are described in chapters 6 and 12, reviewed above, while hazardous conditions refer to areas prone to soil liquefaction in the event of an earthquake, land slippage due to soil erosion on steep sites, and areas subject to flooding and debris flows during storm events. Both DPAs 4 and 5 were considered in the CWPP process.

RECOMMENDATION # 1: Review and amend OCP Chapter 16 to incorporate a Wildfire Development Permit Area with wildfire interface guidelines based on FireSmart principles and consider including single-family lot redevelopments into the scope of the Wildfire DPA: See *Planning and Development Considerations* in Section 5.2.2 for further details. PMFR, Planning and Development, and Environment and Parks should jointly develop building material and landscaping guidelines to inform the Wildfire DPA.

City of Port Moody Bylaws

Port Moody Bylaw No. 2070-C, 1991: Fireworks

This bylaw provides regulations for the sale, storage and use of fireworks, which are only to be discharged on October 31st, within restrictions.

Port Moody Bylaw No. 2470, 2000, Stream and Drainage System

This bylaw prohibits the addition of "prohibited material" into drainage systems, including sediment. Consideration of this bylaw will occur during the development of prescriptions for fuel treatments and will further be adhered to during fuel treatment operational works.

Port Moody Bylaw No. 2608, 2004, Littering and Dumping Prohibition

This bylaw prevents littering and dumping in public spaces.

RECOMMENDATION #2: Although the green waste program in Solid Waste Management has reduced the incidence of dumping on public land, problem areas still remain especially in natural areas bordering homes and neighbourhoods. The City should address dumping on public land behind residences across the WUI; locations usually with no access for fire suppression crews to action a fire. Therefore, the City should take steps to assess and map patterns of dumping on public land bordering residential properties and neighbourhoods and then develop a joint strategy with Environment and Parks, Operations (Solid Waste), PMFR, and Bylaw Enforcement to increase enforcement with notification to the public. This should be included in all FireSmart communications with the public.

Port Moody Bylaw No. 2835 C, 2010 (amended 2017): Fire Protection and Emergency Response

This bylaw provides for the prevention and suppression of fires, for regulating the conduct of persons at fires and to authorize the issuance of permits in order to protect life and property. It includes a description of the Fire-Rescue department and Chief (Section 3-4), area restrictions (including burning restrictions--Section 5), regulates public conduct and responsibilities for owners and occupiers in relation to fire risk (Sections 7-19), and states open burning regulations (Section 20).

RECOMMENDATION #3: Review and update Bylaw No. 2835-C, 2010: Fire Protection and Emergency Response to update the list of combustible materials that are prohibited to accumulate on private property on and under exterior projections, such as decks and patios, near the home, and in gutters and roofs. The revised bylaw should provide the City authority to require removal/clean-up of combustible materials or to complete removal and recoup costs from the owner. Consider including language specific to green waste, not just garbage, to ensure that there is an enforceable bylaw to prevent flammable materials to accumulate unless securely contained.

RECOMMENDATION #4: Align smoking and open burning regulations with Metro Vancouver. During PMFR's regular biannual meetings with Metro Vancouver, compliance and enforcement measures for open-burning, barbecue, and hot-works construction during periods of extreme fire danger should be discussed.

Port Moody Bylaw No. 2866, 2011, Emergency Program

This bylaw lays out roles, responsibilities, enactment mechanism, and cancellation procedure for local emergencies. It defines who is included in the Port Moody Emergency Program Administration and the collective responsibilities of administrating the Program. The means of enacting a State of Local Emergency are provided and the powers allowed the Emergency Operations Management and Policy Group. Powers include limited access to areas of the City, the ability to enact evacuations, and cause the demolition or removal of any trees, structures or crops in order to prevent, respond to or alleviate the effects of the emergency.

Port Moody Bylaw 2894-C, Parks and Community Facilities Rules and Regulations

This bylaw contains restrictions against discharging fireworks, lighting fires, smoking and entering trails or parks under high risk conditions. Restrictions also exist against altering or damaging vegetation and affecting natural features within parks.

Port Moody Bylaw 2901, 2008 (last amended 2018), Smoking

This bylaw restricts smoking in buildings, enclosed places, public transportation and spaces, and importantly for the purpose of the CWPP update, in City parks or beaches.

Port Moody Bylaw No. 2961, 2015, Tree Protection Bylaw

This bylaw states that City trees of a particular size are not to be cut unless by City employees or Arborists working on behalf of the City. It outlines the removal of trees on private property is prohibited when trees are in a Riparian Management Zone (RMZ, as defined in the Zoning Bylaw), ESA, or covered under other covenants or subject to development approval. Additionally, significant trees require Tree Removal Permits subject to alteration.

RECOMMENDATION #5: Establish a shared decision-making process between Environment and Parks, and PMFR to assess fuel loading, ignition potential and surface fuels for possible fuel treatment opportunities during hazard tree removal in the WUI to increase operational efficiencies and mobilization of staff resources and address wildfire and tree hazard issues during a single site visit.

RECOMMENDATION #6: Revise Bylaw No. 2961, 2015: Tree Protection Bylaw to include language which allows the issuance of a permit for cutting of trees if it is required to reduce wildfire hazard within the wildland urban interface, as determined by a qualified professional (QP). This bylaw should also be reviewed to ensure that it does not limit the ability of homeowners to address wildfire hazards associated with trees on private property immediately adjacent to homes.

Port Moody Bylaw No. 3012, 2015, Site Use and Alteration Bylaw

This bylaw restricts depositing soil or clearing sites for any reason without obtaining a permit. Growing medium is permitted for planting purposes as long as the addition does not exceed 150 mm in depth at any point.

2.5.4 Higher Level Plans and Relevant Legislation

TransPort Moody: Master Transportation Plan

This plan guides investment in transportation over the next 20 years and focuses on improving Port Moody's road network, and providing better options for walking, cycling, and using transit. The transportation goals relevant to wildfire management planning include ensuring the safe and efficient movement of people and goods within Port Moody and the surrounding area. This is important for evacuation planning and ensuring safe access and egress in the event of a wildfire including smoke and poor-visibility situations.

Environmentally Sensitive Management Strategy

This strategy was originally completed in 2003 and identified areas of low, medium and high sensitivity, including areas within 30 m of a stream and special features such as the tidal foreshore and intertidal environments of Port Moody Arm. These areas were identified because they provide critical habitat for protected species; they contain watercourses, wetlands, forested riparian areas and intertidal zone and act as important wildlife corridors; are undeveloped or less intensely developed portions of watersheds draining into fish bearing watercourses; and have high species richness or an unusual species assemblage. Management objectives within the strategy focus on protecting the habitat and natural features of ESAs. Wildfire risk was not specifically addressed, although provisions for public safety and property protection are noted. ESA management objectives and wildfire management objectives could provide co-benefits in some cases: for example, in preventing the introduction and spread of invasive plants, protecting the forested nature of the site through tree retention in the overstorey layer, and preventing the dumping of fine woody debris and hazardous fuels. The ESA strategy is currently in the process of being updated with completion in 2020; data and mapping may provide information that can inform fuel management prescriptions for fuel treatments.

Parks and Recreation Master Plan

Developed in 2015, this document provides a comprehensive strategy for the maintenance, development and renewal of the parks, trails and open spaces throughout the City of Port Moody over the next 10 years. It identifies park and recreational needs, trends and gaps, while also listing recommendations to address those needs. The document provides an analysis of existing park inventory, and identifies the possibility for new facilities, future capital projects, the current operational pressure points and service levels, as well as the opportunities and deficiencies in the present parks system.

High-use recreational parks and trails can be beneficial when high-use times provide increased early detection and reporting for fires. Alternatively, these areas can also potentially be locations of increased ignitions in the interface (high–use areas). For trails in particular, depending upon the width, clearance and surfacing, they can provide points of access for suppression efforts, serve as surface fire fuel breaks, and act as control lines for suppression efforts if a fire is nearby.

RECOMMENDATION #7: Review the OCP and Parks and Recreation Master Plan to consider parks acquisition and maintenance through a wildfire risk lens to require: 1) the use of a Qualified Professional (QP) in review, assessment, and siting of parks and park access prior to acceptance; and 2) ensure that bylaws provide the CPM authority to request modification (either fuels, access, or siting) based upon QP recommendation and prior to acceptance to ensure that parks are received in, and able to be maintained in, an acceptable range of risk.

Sensitive Ecosystem Inventory for Metro Vancouver and Abbotsford, 2011-2012[8]

This technical report uses standard provincial methodology to identify sensitive ecosystems across the land base of Metro Vancouver and Abbotsford. Orthophotography and existing Terrestrial Ecosystem Mapping (TEM) were used to assign Sensitive Ecosystem Inventory (SEI) values to ecosystem polygons. This inventory is an important resource to support land and environmental decisions and is relevant in the context of fuel treatment planning.

Much of the area bordering the City of Port Moody to the north, east (Belcarra Provincial Park), and south (ravines and watercourses) is classified as a 'Sensitive Ecosystems' (i.e., wetlands and old forest) or a 'Modified Ecosystems' (human modified but with significant ecological and biological value). Several class and subclasses within each ecosystem type are assigned and delineated in the inventory. Information from the SEI is being incorporated into the updated ESA Management Strategy. Both Metro Vancouver's SEI and the City's ESA data and mapping should be reviewed during fuel treatment planning to ensure that sensitive ecosystems are protected and potential co-benefits are achieved.

2.5.5 Ministry or Industry Plans

Reviewing and incorporating other important forest management planning initiatives into the CWPP planning process is a critical step in ensuring a proactive and effective wildfire mitigation approach in the AOI. This could include ecological restoration planning which may be relevant to the City of Port Moody given its range of ecological sites, environmentally sensitive areas and species-at-risk.

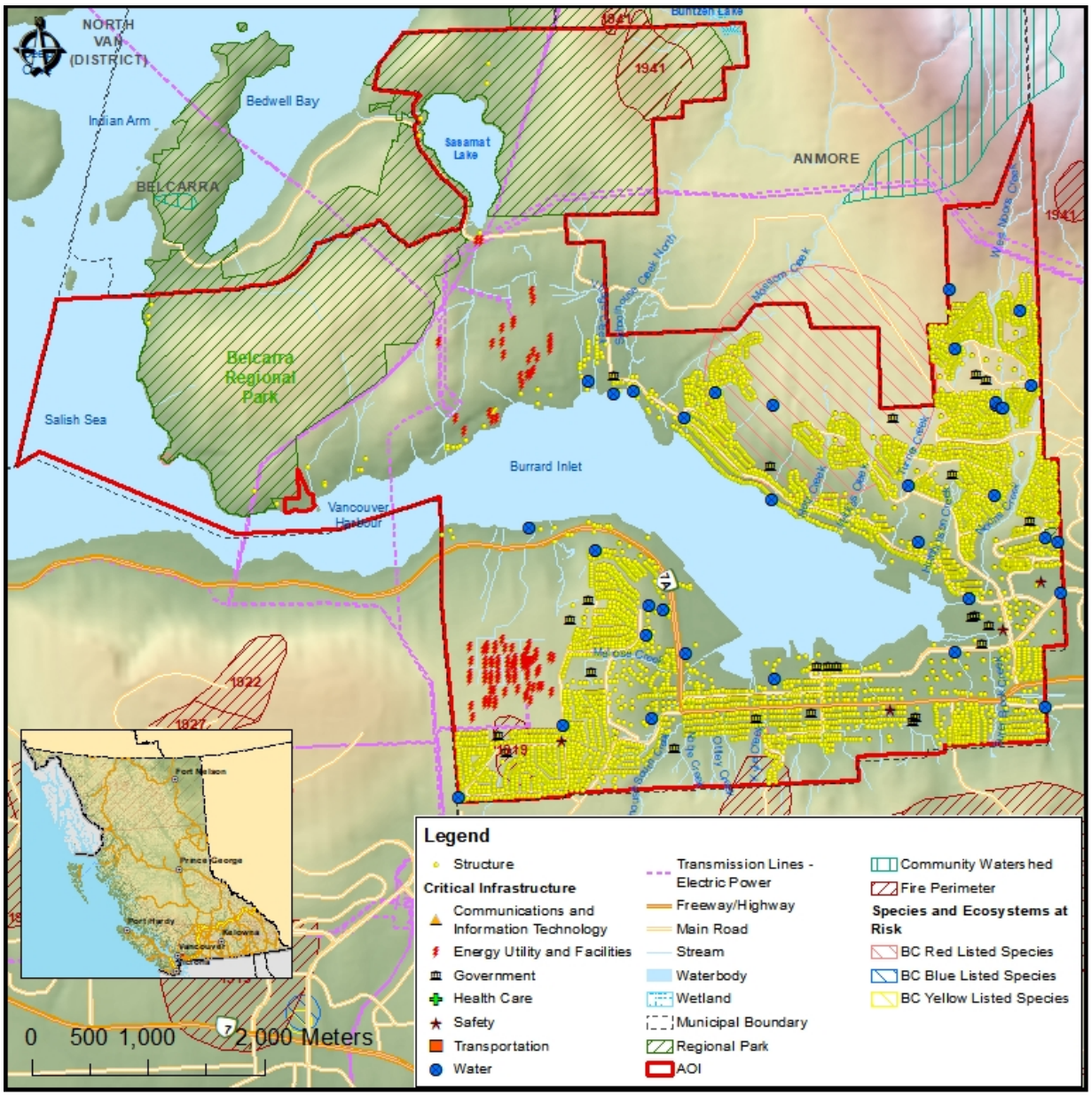
The South Coast Response Fire Management Plan (FMP)[9] was developed for the Sea to Sky Natural Resource District (NRD), the Sunshine Coast NRD, and the Chilliwack NRD (relevant to the CPM). The FMP was reviewed to identify any regional fire management planning objectives and their interpretation in the context of management considerations for the AOI. The 2018 South Coast FMP identifies values at risk and prioritizes broad categories of values as 'themes' for response planning through the Resource Strategic Wildfire Allocation Protocol (RSWAP). The South Coast FMP briefly speaks to the concept of wildfire prevention engineering within the region, which includes fuel management such as locally identified fuel breaks, proposed treatment areas, or demonstration and operational treatment areas. In order to reduce local fire threat and to build defensible space around critical infrastructure and/or residential areas, this CWPP identifies various fuel treatment opportunities (Section 5.1.1).

[8] Metro Vancouver. Regional Growth Strategy. Adopted 2011 and updated to 2017.

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

SECTION 3: VALUES AT RISK

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



Map 2. Values at Risk within the AOI.

3.1 HUMAN LIFE AND SAFETY

One of the primary goals of the BCWS is to support emergency response and provide efficient wildfire management on behalf of the BC government. BCWS aims to protect life and values at risk, while ensuring the maintenance and enhancing the sustainability, health and resilience of BC ecosystems.[10]

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

The population distribution (both people and structures) within the AOI is important in determining the wildfire risk and identifying mitigation activities. The population of the City of Port Moody has slightly increased in recent years. In 2016, it was measured at 33,551 persons, resulting in a 1.6% increase from the previous Census in 2011.[11] This compares to a 5.6% growth rate for the entire province of British Columbia between 2011 and 2016. According to the 2016 Census there are 13,318 private dwellings in the City of Port Moody, approximately 342 of which are occupied on a part-time basis. The aforementioned figures were calculated using the 2016 Census population statistics for the City of Port Moody.

The City of Port Moody is a significant destination for arts and culture, tourism, and outdoor recreation within the Lower Mainland. Recreation opportunities include: hiking, biking, boating, kayaking and paddle boarding. These activities can occur year-round but are especially popular during the fire season (April – October). Several parks and trails throughout the AOI experience high-use throughout the year: especially Belcarra Regional Park, Rocky Point Park, Bert Flinn Park, Alfred Howe Greenway, the Shoreline Trail and the Great Trail. Additionally, the seasonal increase in population due to tourism and industrial pursuits within the AOI also raises concern with regards to potential evacuation in the event of a wildfire. Furthermore, the Barnet Highway acts as a main travel hub for commuters, tourists and recreationalists who are either heading up to Belcarra Regional Park or to other Metro Vancouver municipalities, which may lead to additional pressures on emergency management resources, in the event of an evacuation.

Knowledge of and access to updated structure locations within an area is a critical step in efficient and successful emergency response planning and the development of mitigation strategies and recommendations. Field visits to the AOI and access to recent orthophotography and spatial data from the City has enabled the development of an updated structures dataset that accounts for the most recent development.

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

[11] Statistics Canada. 2016 Census.

3.2 CRITICAL INFRASTRUCTURE

Protection of critical infrastructure (CI) during a wildfire event is an important consideration for emergency response effectiveness, ensuring that coordinated evacuation can occur if necessary, and that essential services in the AOI can be maintained and/or restored quickly in the case of an emergency. Critical infrastructure includes emergency and medical services, electrical and gas services, transportation, water, social services, and communications infrastructure. A critical infrastructure dataset was provided by the City of Port Moody's GIS staff and this data is included in Map 2. Table 3 details an inventory of critical infrastructure identified by the City of Port Moody and via field visits.

The City of Port Moody Fire Rescue (PMFR), the Emergency Operations Centre (EOC) located in the Port Moody City Hall, and the Eagle Ridge Hospital located on 475 Guildford Way are critical to emergency response service in the community. However, in the event of a localized emergency within the City, adjacent municipalities with health care and emergency response facilities may also be able to provide rapid emergency response. PMFR also has informal agreements in place with Fire Departments in neighbouring jurisdictions that will provide assistance if capacity and resources allow. For example, PMFR assisted the City of Richmond Fire Rescue Services with the bog fire on Department of National Defence Lands and the Town of Agassiz with the Mount Hicks fire, both in 2018.

Protection of critical infrastructure is an essential wildfire preparedness function. Survival and continued functionality of these facilities not only support the community during an emergency but also determine the extent of disruption and cost of wildfire rehabilitation. Critical infrastructure provides important services that may be required during a wildfire event or may require additional protection.

As outlined in Section 5.2, FireSmart principles are important when reducing wildfire risk to critical infrastructure and are reflected in the outlined recommendations. During field visits, it was observed that critical infrastructure had variable compliance with FireSmart principles. For example, infrastructure in built-up areas was generally compliant, whereas some water pressure reducing valves are situated in forested areas.

RECOMMENDATION #8: Develop an emergency management plan for fire suppression in consultation with Metro Vancouver Parks and private industrial owners IOCO, BC Hydro, and FortisBC where currently no City utilities exist. There are no City utilities on the northwest side of Port Moody, including the area north of 1st Avenue and Bedwell Bay Road near Belcarra Regional Park, for water supply to action fires in this area.

RECOMMENDATION #9: Consider using fire-resistant building construction materials for all CI when completing upgrades, establishing new infrastructure or as part of routine maintenance. Landscaping and vegetation setbacks around critical infrastructure should be compliant with FireSmart guidelines, or guidelines from a wildfire hazard development permit area if Port Moody implements one.

3.2.1 Electrical Power

Electrical service for the City is received through a network of wood pole and underground distribution infrastructure supplied by a BC Hydro transmission line which runs in the north-south direction through the City. Neighbourhoods with small, street-side wooden poles connecting homes are particularly vulnerable to fire. A large fire has the potential to impact this service by causing a disruption in network distribution through direct or indirect means. For example, heat from the flames or fallen trees associated with a fire event may cause power outages. Consideration must be given to protecting this critical service and providing power back up at key facilities to ensure that the emergency response functions are reliable.

Secondary power sources are important to reduce critical infrastructure vulnerability in the event of an emergency which cuts power for days, or even weeks. Secondary power is available for some critical infrastructure. For instance, City Hall has a natural gas-fired generator, and Emergency Management has a large generator with power cords and lights that are portable to deploy throughout the City on request, if they are not required by the Emergency Operations Centre (EOC). Both PMFR firehalls and Port Moody Police Department (PMPD) have back up diesel generators. There is also back-up pumping capability for water and sewer pump and lift stations. Vulnerabilities for secondary power sources include mechanical failure, potentially insufficient power sources should a wide-scale outage occur, and fuel shortage in the event of very long outages. Back-up emergency generators have sufficient fuel capacity to operate up to 12 hours only depending on load.

With respect to water distribution systems, secondary power supply throughout Port Moody remains an issue due to the lack of redundancies to operate pump stations (beyond back-up generators) in the event of a wildfire that may disrupt their function. In contrast, the City of Port Moody's neighbouring municipality to the east, Coquitlam, has redundant power supply for their WUI during emergencies. For CPM, a prolonged power outage lasting beyond 12 hours, one of the biggest issues of concern is running out of fuel to power generators and ensuring that communication and power supplies are available to the Supervisory Control and Data Acquisition (SCADA) system, used to monitor and remotely control water distribution systems. The following facilities rely on a power supply to calculate water levels and monitor their function, and are vulnerable to a power outage:

- North Road Pump Station;
- Noons Creek Pump Station;
- Chestnut Way Pump Station; and
- Hickory Drive Reservoir.

For example, the Hickory Drive Water Reservoir may be damaged during an interface fire and since it relies on a power supply to calculate water levels, it is vulnerable to outages. This sequence of CI power outage can affect other pump stations in the network and disrupt water supply further uphill in a cascading sequence (personal communication with Operations Manager Jeff Little).

Refer to Section 6.1.2 for discussion and recommendations related to backup power and water availability for fire suppression.

RECOMMENDATION #10: Complete a vulnerability assessment of all critical infrastructure, secondary power sources, and fuel availability. Review current capability of secondary power sources, identify vulnerabilities, and prioritize needs, in the case of prolonged or extensive power outages. Upgrade or realign resources, as prioritized.

3.2.2 Communications, Pipelines and Municipal Buildings

The City of Port Moody is serviced by one hospital (Eagle Ridge Hospital), and one municipal building (City Hall). Within the AOI there are several transmission lines (as described in Section 3.2.1) that intersect the City of Port Moody, and a distribution terminal owned by IOCO which stores bulk petroleum products that arrive via railcar and are stored in tanks before being loaded onto trucks or barges. A network of FortisBC distribution pipelines supplies the CPM with natural gas and a FortisBC natural gas transmission pipeline intersects Port Moody, terminating at a station on Burrard Inlet within the municipal boundary. The FortisBC company website states that employees will consult with local authorities and BCWS in the event of a wildfire. A full inventory of critical infrastructure for communications and municipal buildings, and pipelines/energy provider infrastructure with updated locations is presented in Table 3 and Table 4 below.

Table 3: Municipal critical infrastructure identified in 2019 field visits.

Critical Infrastructure Type	Location
1. Aspenwood Elementary School (SD43)	2001 Panorama Drive
2. City of Port Moody Works Yard	3250 Murray Street
3. Eagle Ridge Hospital (Fraser Health)	475 Guildford Way
4. Glenayre Community Centre	492 Glencoe Drive
5. Glenayre Elementary School (SD43)	495 Glencoe Drive
6. Glenayre Fire Hall	955 Glenayre Drive
7. Heritage Mountain Community Center	200 Panorama Place
8. Heritage Mountain Elementary School (SD43)	125 Ravine Drive
9. Heritage Woods Secondary School (SD43)	1300 David Avenue
10. Inlet Centre Fire Hall	150 Newport Drive
11. Ioco School (closed) (SD43)	Ioco Road at First Ave
12. Kyle Centre	125 Kyle Street
13. Moody Elementary (SD43)	2717 St Johns Street
14. Moody Middle School (SD43)	130 Buller Street
15. Mountain Meadows Elementary School (SD43)	999 Noons Creek Drive
16. Old Mill Boat House	2715 Esplanade Ave
17. Old Orchard Hall	646 Bentley Road

Critical Infrastructure Type	Location
18. Pleasantside Elementary (SD43)	195 Barber Street
19. Port Moody City Hall	100 Newport Drive
20. Port Moody Public Library	100 Newport Drive
21. Port Moody Recreation Complex	300 Knowle Street
22. Port Moody Secondary School (SD43)	300 Albert Street
23. Public Safety Building	3051 St. Johns Street
24. Rocky Point Park Pool	2800 Murray Street
25. Rocky Point Park Service Building	2820 Murray Street
26. Seaview Elementary School (SD43)	1215 Cecile Drive
27. Vacant Building (SD43 – closed school)	300 Princeton Ave
28. Westhill Community Centre	203 Westhill Place

RECOMMENDATION #11: It is recommended that formal FireSmart assessments (by a Qualified Professional) be completed of critical infrastructure such as the fire halls, water infrastructure, and others as identified in this CWPP (Table 3) and by the City.

Additional critical infrastructure identified by the CPM related to energy providers is summarized below. This critical infrastructure is outside of the responsibility of CPM to maintain and operate.

Table 4. Energy provider critical infrastructure

Critical Infrastructure Type	Location
1. Burrard Generating Station: BC Hydro	north shore of Port Moody on Burrard Inlet Postal Code V3H 5B6
2. Ioco Substation: BC Hydro	south shore of Port Moody Postal Code V3H 3B4
3. Petro-Canada Substation: BC Hydro	south shore of Port Moody Postal Code V3H 1E5
4. Gate Station (“Ioco”): FortisBC	north shore of Port Moody Postal Code V3H 5B6
5. Customer Station (“Burrard Thermal”): FortisBC	north shore of Port Moody on Burrard Inlet Postal Code V3H 5B6
6. Gate Station (“Belcarra”): FortisBC	South of Sasamat Lake’s Southern tip, just beyond Bedwell Bay Road
7. Valve Assembly: FortisBC	north shore of Port Moody Postal Code V3H 5B6
8. Valve Assembly: FortisBC	Middle point of Thermal Plant Road in the right of way
9. Customer Station: FortisBC	north shore of Port Moody Postal Code V3H 5B6
10. Valve Assembly (“Belcarra Reg Stn”): FortisBC	South of Sasamat Lake’s Southern tip, just beyond Bedwell Bay Road

3.2.3 Water and Sewage

The City of Port Moody receives all its treated water supply from Metro Vancouver. The Glenayre, College Park, and Seaview neighbourhoods are supplied from Metro's Seymour Lake-Capilano Lake supply, with the remainder of the City fed from Metro's Coquitlam Lake supply[12]. Water supply is delivered from Metro Vancouver's Coquitlam Lake supply at the municipal boundary at both Guildford Way and Dewdney Trunk Road. Port Moody is supplied by Metro Vancouver's Seymour Lake-Capilano Lake supply at the municipal boundary at North Road. Water that is fed to the northern half of the City is pumped into a system of reservoirs that relies on electrical power for distribution. In the absence of electrical power or backup power, water supply to the northern portion of CPM is suspended.

The City of Port Moody supplies the Village of Anmore's water distribution system through a connection at Forest Park Way at East Road. This connection provides Anmore with water for domestic consumption and fire protection.

A detailed account of water availability for wildfire suppression is provided in Section 6.1.2, while Table 5 below outlines critical water infrastructure within the AOI which includes the name and location of water reservoirs and pump stations.

The City of Port Moody has one large sewer siphon running along the southern shore of Burrard Inlet that transports sewage out the City of Port Moody and southeast into Metro Vancouver's larger sewer system. Along the south shore several of the sewer system lift stations are reliant on power to move sewage along and prevent it from overflowing in the inlet. Should a power outage occur, back-up secondary power is available.

Table 5. Critical Infrastructure Identified in 2019 CWPP field visits.

Critical Infrastructure Type	Location	Standby Backup Power?
1. 17 Pressure Reducing Valves	Distributed Throughout AOI	Not required
2. Alderside Road Lift Station	840 Alderside Road	Requires mobile generator to operate in event of power failure
3. April Road Pump Station #1	90 Block April Road (station is underground)	Not capable of operation during power failure
4. Beach Avenue Lift Station	1679 Beach Avenue	Requires mobile generator to operate in event of power failure
5. Chestnut Way Re-chlorination Station	24 Chestnut Way	Backup standby power on site
6. Hickory Drive Reservoir	38 Hickory Drive	Not required
7. Ioco Road Cleansing Station	1890 Ioco Road	Backup standby power on site
8. Noons Creek Lift Station	340 Ioco Road	Backup standby power on site
9. Noons Creek Drive Pump Station	995 Noons Creek Drive	Backup standby power on site

[12] City of Port Moody. 2018 Annual Water Quality Report. Retrieved Sep 19th, 2019 from: https://www.portmoody.ca/en/city-hall/resources/Documents/2018_Annual_Water_Quality_Report.pdf

Critical Infrastructure Type	Location	Standby Backup Power?
10. North Road Reservoir	North of where the Trans Canada Trail intersects the Powerline Trail	Not required
11. Chestnut Way Reservoir	24 Chestnut Way	Backup standby power on site
12. Ioco Road Re-chlorination Station	340 Ioco Road	Backup standby power on site
13. Chestnut Way Pump Station	24 Chestnut Way	Backup standby power on site

A number of privately-owned critical infrastructure facilities exits within the municipal boundary that provide essential services and these include: BA Pump Station (water) owned by Suncor; Heritage Peak Road Pump Station that provides water distribution and fire suppression for the Heritage Peak Road subdivision; and Flavelle Cedar Mill Lift Station and Reed Point Marina Lift Station (sewer). In addition, there are two Metro Vancouver facilities: the Murray Street and Short Road Lift Stations (sewer).

RECOMMENDATION #12: Identify areas where upgrades to systems, flows, hydrant number or location, and water storage, power can be completed to enhance wildfire response. Prioritize and rank projects and complete or require upgrades as resources allow.

RECOMMENDATION #13: Identify components of the water distribution system that can be reinforced through improvements or repairs that enhance resiliency to ensure the City's system can function independently. Conducting such an assessment will increase the water system's resiliency by addressing its vulnerability that only one route exists for supplying water to Port Moody's north shore neighbourhoods and that if power supply and water delivery systems fail, then water delivery to critical interface neighbourhoods such as Heritage Mountain, Heritage Woods, Mountain Meadows, and Pleasantside remain vulnerable and at-risk.

3.3 HIGH ENVIRONMENTAL AND CULTURAL VALUES

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

3.3.1 Drinking Water Supply Area and Community Watersheds

As outlined above, the City of Port Moody receives all of its potable water from Metro Vancouver. Protection from contamination for these valuable water sources is ensured through the following avenues: 1) restricted access to watersheds; 2) restoration of disturbed areas and deactivation of watershed roads that are no longer in use; 3) management of watershed via minimal intervention (i.e., in the event infrastructure is required); and 4) cooperative management with adjoining municipalities to preserve water quality.[13]

[13] Metro Vancouver Drinking Water Management Plan 2011. Available online at: http://www.metrovancouver.org/services/water/WaterPublications/DWMP-2011.pdf

City staff expressed that if Metro Vancouver's Seymour Lake-Capilano Lake supply failed, the Glenayre, College Park and Seaview neighbourhoods in the southern portion of the AOI could not be supplied with water; this would also impact the Suncor Port Moody Terminal by reducing one of their sources of water.

3.3.2 Cultural Values

The Coast Salish are the main First Nations group whose territory overlaps the CPM. Within this group, a total of fifteen First Nations with aboriginal interests were identified in the AOI using the BC Consultative Areas Database. These include the following mainland-based First Nations: Kwikwetlem First Nation, Tsleil-Waututh Nation, Musqueam Nation, Soowahlie First Nation, Seabird Island Band, Skawahlook First Nation, Shxw??whámel First Nation, Stó:l? Nation and Sto:lo Tribal Council, and Squamish Nation; and the following Vancouver Island based First Nations: Halalt First Nation, Stz'uminus First Nation, Lake Cowichan First Nation, Lyackson First Nation, and Penelakut Tribe. The Kwikwetlem First Nation responded requesting that any archaeological activities or environmental monitoring taking place as a result of the CWPP will require the attendance of a Kwikwetlem First Nation field technician to provide oversight. Any future fuel management prescription work undertaken by CPM will provide further opportunities for First Nations consultation.

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

Due to site sensitivity, the locations of archaeological sites may not be made publicly available, however, data provided by the MFLNRORD Archaeology Branch confirms that multiple sites do exist. The City should ensure that they have direct access to Remote Access to Archaeological Data (RAAD), which allows the City to look up or track any archeological sites in the area.[14] Prior to stand modification for fire hazard reduction, and depending on treatment location, preliminary reconnaissance surveys may be undertaken to ensure that cultural heritage features are not inadvertently damaged or destroyed. Pile burning and the use of machinery have the potential to damage artifacts that may be buried in the upper soil horizons. Above ground archaeological resources may include features such as culturally modified trees (CMT), which could be damaged or accidentally harvested during fire hazard reduction activities. Fuel treatment activities should include consultation with all identified First Nations at the site

[14] MFLNRORD, Archaeology. Retrieved online at: https://www.for.gov.bc.ca/archaeology/accessing_archaeological_data/obtaining_access.htm

level and should ensure sufficient time for review and input regarding their rights and interests prior to prescription finalization or implementation.

There is substantial overlap of the AOI with sites that have been registered as historic places. Port Moody has two recognized heritage conservation areas which include Moody Centre and Ioco Townsite.

3.3.3 High Environmental Values

Most natural areas within the CPM, including forests, streams and tidal areas, are identified as Environmentally Sensitive Areas, with specific objectives identified for protecting key habitats and special features, in particular from development activities. The ESAs delineated in the City's OCP and ESA Management Strategy, as well as Metro Vancouver's SEI, reflects the full extent of environmental values that should be considered in assessing impacts to VAR (see Section 2.5).

Wildfire management planning typically looks at species at risk occurrences to reflect environmental values on a site-specific level. To identify species and ecosystems at risk within the AOI, the Conservation Data Centre (CDC) database was referenced. Two classes of data are kept by the CDC: non-sensitive occurrences for which all information is available (species or ecosystems at risk and location); and masked, or sensitive, occurrences where only generalized location information is available and represents a larger scale overview. A finer level scale is provided by CPM's ESA Strategy and includes creeks and setbacks, and significant wildlife areas such as Important Bird Area (IBA) designations.

There are three occurrences of BC Red-listed species within the AOI (Table 6). Red-listed species are species at the highest risk of being extirpated, endangered, or threatened within the City AOI. The database also showed a masked occurrence; however, when more data was requested, the CDC confirmed that no masked occurrences were mapped within 5 km of the project area. Through consultation with the CDC and a biologist or qualified professional, all site level operational plans must determine if the occurrence will be impacted by fuel management or other wildfire mitigation activities. All future fuel treatment activities or those associated with recommendations made in this plan should consider the presence of, and impact upon, potentially affected species. Additionally, all site level operational plans should consult the most recent data available to ensure that any new occurrences or relevant masked occurrences are known and considered in the operational plan to mitigate any potential impacts on species at risk.

Table 6. Publicly available occurrences of Red-listed species recorded within the AOI.

Common Name	Scientific Name	Category	BC List	Habitat Type
Washington spring beauty	*Claytonia Washingtoniana*	vascular plant	Red	Terrestrial: Epiphytic; Coarse Woody Debris
Pacific water shrew	*Sorex bendirii*	mammal	Red	Terrestrial: Forest Mixed
Roell's brotherella	*Brotherella roellii*	vascular plant	Red	Terrestrial: Epiphytic; Coarse Woody Debris

3.4 OTHER RESOURCE VALUES

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

The Fraser Timber Supply Area (TSA) does not encompass the City of Port Moody, as it is an urbanized region in which no primary forestry activities occur. As such, higher level planning documents associated with the TSA do not apply and fuel reduction treatments will not have an effect on the timber harvesting land base due to the fact that the AOI does not currently contribute to this measure.

3.5 HAZARDOUS VALUES

Hazardous values are defined as values that pose a safety hazard to emergency responders and have the fuel that could ignite during an ember shower. Three major distribution stations, multiple transmission substations and many transmission lines and a pipeline intersect the AOI. Table 7 lists these hazardous sites and where they are found within the AOI. The City did not identify any other hazardous values.

Although the City has a significant number of industrial sites that could be considered hazardous values (Table 7) such as the Imperial Oil Ioco Terminal, Ioco Substation, Suncor Terminal, and Suncor Energy – Burrard Products Terminal, these facilities store combustible products (oil) in sealed containers and no residual fuel is exposed. As long as these facilities continue to store and move product in clean, fully sealed containers, they can be considered non-hazardous.

The management and treatment of fuels in proximity to hazardous infrastructure is critical in order to reduce the risks associated with both structural fire and wildfire. Specifically, best management practices for hazardous values include: 1) incorporating FireSmart planning and setback requirements for all infrastructure in this category; and 2) maintaining emergency fuel/propane emergency shut off procedures to be enacted immediately and efficiently in the event of an approaching wildfire or ember shower, and 3) reducing hazardous materials in the wildland urban interface.

Table 7. Hazardous Infrastructure identified in 2019 CWPP field visits.

Critical/Hazardous Infrastructure Name	Location
Pacific Coast Terminal	2300 Columbia St
Flavelle Sawmill	2400 Murray St
Imperial Oil Ioco Terminal*	2225 Ioco Rd
Ioco Substation*	Port Moody, BC V3H 3B4
Burrard Generating Station*	Port Moody, BC V3H 5B6
Suncor Terminal*	9950 Barnet Hwy
Suncor Energy Svc Inc	1155 Glenayre Dr

Critical/Hazardous Infrastructure Name	Location
Suncor (Petro Can) Substation*	Located on Suncor Energy Svc Inc property
Ioco Substation*	North of Imperial Oil Ioco Terminal
Burrard Synch Condenser*	At the end of Thermal plant Rd
FortisBC Ioco distribution station	West of Ioco Rd past the Imperial Oil Ioco Terminal
FortisBC Belcarra gate station	South of Bedwell Bay Rd before the Tum Tumay Whueton Rd turnoff

** Facilities that store combustible products (oil) in sealed containers. As long as these facilities continue to store and move product in clean, fully sealed containers, they are considered non-hazardous.*

SECTION 4: WILDFIRE THREAT AND RISK

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

The relationship between wildfire hazard, threat and risk can be demonstrated in the following example. If a fire (the hazard) ignites and spreads towards a community, the wildfire can become a threat to life and property, with an associated risk of loss, where:

$$\boldsymbol{Wildfire\ risk\ =\ Probability\ x\ Consequence}$$

and:

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

4.1 FIRE REGIME, FIRE WEATHER AND CLIMATE CHANGE

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

4.1.1 Fire Regime and Fire Weather

Historic Fire Regime

The Biogeoclimatic Ecosystem Classification (BEC) system describes zones by vegetation, soils, and climate. Regional subzones are derived from relative precipitation and temperature. Subzones may be further divided into variants based upon climatic variation and the resulting changes in the vegetative communities; variants are generally slightly drier, wetter, snowier, warmer, or colder than the climate of the regional subzone.[15] Biogeoclimatic subzones are categorized into five Natural Disturbance Types (NDTs) occurring in BC. NDTs are based on the size and frequency of natural disturbances (largely fire) that historically occur within the subzone. NDTs have influenced the vegetation dynamics and ecological functions and pathways that determine many of the characteristics of natural systems. The physical and temporal patterns, structural complexity, vegetation communities, and other resultant attributes should be used to help design fuel treatments, and where possible, to help ensure that treatments are

[15] BECWeb: https://www.for.gov.bc.ca/hre/becweb/system/how/index.html#basic_concepts

ecologically and socially acceptable.[16] The AOI is characterized by the BEC subzones and associated NDTs as outlined in Table 8 and illustrated in Map 3.

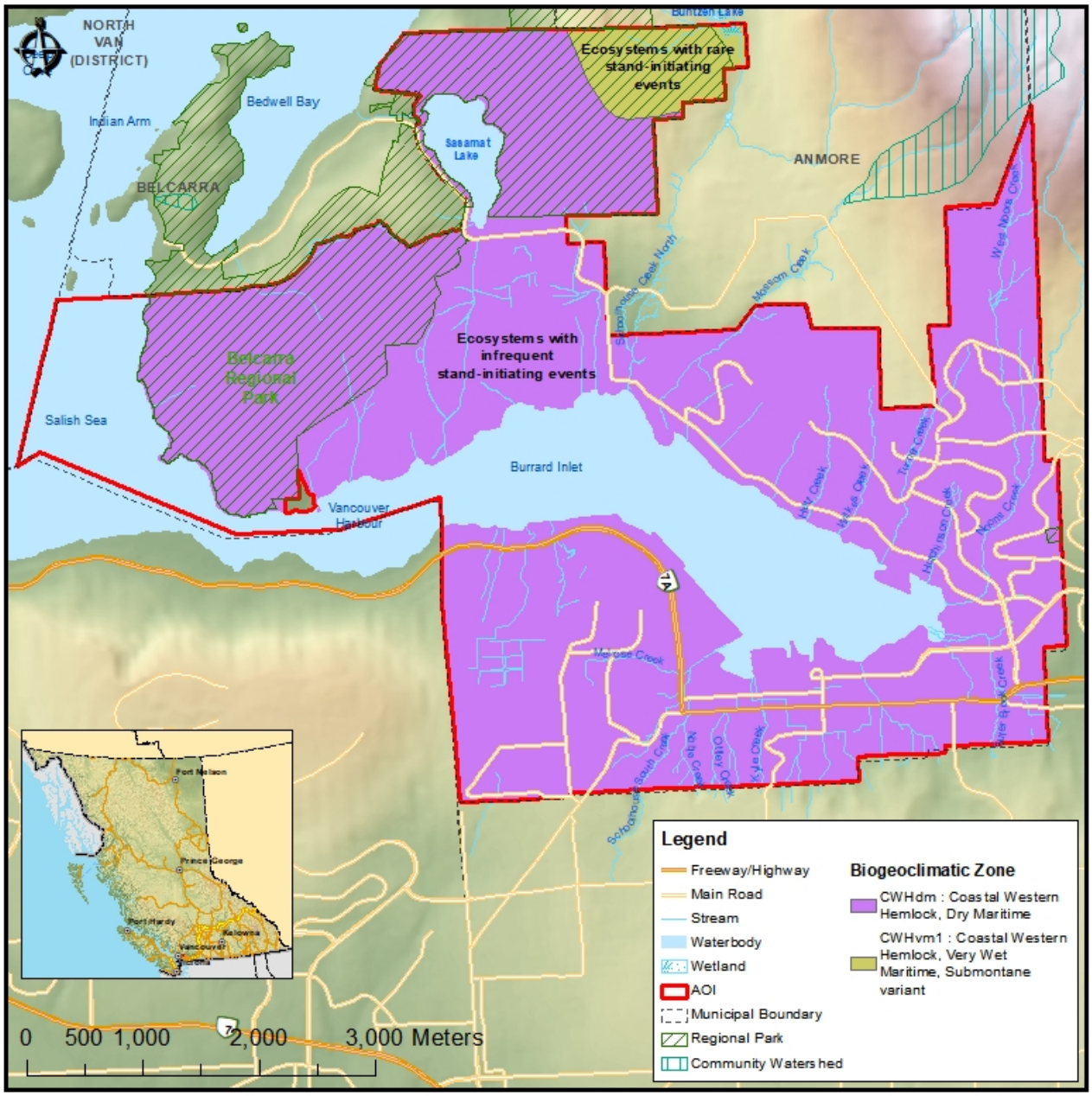
Table 8. BEC zones and natural disturbance types found within the AOI.

Biogeoclimatic Zone	Natural Disturbance Type	Area (ha)	Percent (%)
CWHdm: Coastal Western Hemlock, Dry Maritime	NDT 2	3,189	97%
CWHvm1: Coastal Western Hemlock, Very Wet Maritime, Submontane variant	NDT 1	94	3%
TOTAL		**3,282**	100%

Natural Disturbance Type 2 is predominant in the AOI and is represented by the CWHdm covering 97% of the AOI. Natural Disturbance Type 2 is comprised of forest ecosystems with infrequent stand initiating events where fires were often of moderate size (20 to 1,000 ha) with a mean return interval of fire of approximately 200 years[16]. Many of these fires occur after periods of extended drought and produce a forested landscape characterized by extensive areas of mature forest with intermixed patches of younger forests.[16] Although the fire frequency is not high and fires are generally not large, pre-planning and preparation are essential to reduce the negative impacts of a wildfire.

Natural Disturbance Type 1 (3% of the AOI in the CWHvm1) comprises ecosystems with rare stand-initiating events. These are forest ecosystems that experience relatively small disturbances in terms of spatial extent. They have historically resulted in uneven-aged, heterogeneous stand structures from rare and small disturbances caused by fire, wind and/or landslides. The mean return interval for these disturbances has generally been 250 years for the CWH. [16]

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



Map 3. Biogeoclimatic Zones and natural disturbance regimes within the AOI.

Forest Health Issues

A few forest health issues were identified during field assessments in the CPM AOI. Overall occurrences of invasive species within some of the parks and protected areas is generally low due to effective park management. The occurrence of species such as Himalayan blackberry (*Rubus armeniacus*), English holly (*Ilex aquifolium*) and English ivy (*Hedera helix*) were noted in low-disturbance interface forest stands within 200 m from the nearest road or establishment. If deemed necessary, and in conjunction with work completed under the invasive plant management program implemented by Environment and Parks, the removal of invasive species should occur concurrently with fuel treatments to ensure cost

efficiencies and improve the success of ecosystem restoration work. Site monitoring should occur post-treatment to evaluate treatment efficacy and assess further mitigation requirements. Himalayan blackberry treatment may be done manually, individual stems less than 1 cm in diameter can be pulled or dug out by root crowns and larger patches should be brushed or mowed twice seasonally. For the most effective results, the first treatment should be done in May and the second removal should be completed by the end of June once all the stored carbohydrates in the roots have been deployed into the foliage. English holly treatment may be in the form of manual removal, with small plants being pulled to remove the roots and large plants cut at the root collar to suppress the growth of future sprouts. English ivy mitigation can occur via manual pruning or pulling of the plant at the root and removal of resulting plant material from the site, avoiding cuttings, as those can sprout. Areas treated for English ivy removal should be mulched or covered in chips produced during the fuel treatment, and frequently monitored and managed post-treatment.

Impacts of hemlock dwarf mistletoe (*Arceuthobium tsugense*) were scattered throughout most of the second-growth western hemlock leading stands. Dwarf mistletoe causes stem and branch swelling, with research showing that hemlock mistletoe results in significant reductions in radial growth, annual volume and height increment in mature hemlock trees[17] and increased susceptibility to other disturbances such as windthrow. Highly infected stems and limbs represent a hazard from both a fuel management and public safety perspective. In order to increase forest resilience within the CPM, it is recommended that second-growth hemlock leading stands within 300 m of interface development or critical infrastructure be assessed and targeted for restoration treatments. Given the potential for windthrow and increased surface fuel loading resulting from hemlock dwarf mistletoe, it is imperative that the CPM consider strategies to reduce the hazard associated with these types of stands. Strategies could include implementing patchy gap openings, where hemlock dwarf mistletoe infected trees are targeted for removal, followed by low-density planting of other site-appropriate species. Post-treatment planting will help ensure that the natural hemlock infill process is delayed or mitigated.

The Coast Forest Health Overview outlines forest health issues present within the Fraser TSA.[18] This overview and forest health strategy (2015-2017) outlines several forest health issues that are most prevalent within the timber supply area. Of particular concern, due to the severity or extent of outbreaks, are the Douglas-fir beetle (*Dendroctonus pseudotsugae*), Swiss needle cast and Douglas-fir needle cast, root diseases (primarily laminated root disease and *Armillaria* spp.), drought, and windthrow. Outbreaks of western hemlock looper (*Lambdina fiscellaria lugubrosa*) and western spruce budworm *(Choristoneura occidentalis)* were a concern in the past, however, occurrences of most these pests have declined in recent years, with the exception of hemlock looper which is currently displaying an outbreak in population numbers, within certain coastal areas, including the Coquitlam watershed and City of Coquitlam forests.

[17] Thomson, Alan & B. Smith, R & Alfaro, Rene. (2011). Growth patterns in immature and mature western hemlock stands infected with dwarf mistletoe. Canadian Journal of Forest Research. 14. 518-522. 10.1139/x84-096.
[18] 2015-17 Coastal Timber Supply Areas Forest Health Overview. 2015.

Spatial data available through DataBC[19] indicates scattered instance of Douglas-fir beetle (1995, high severity infection centers) within Belcarra Regional Park. Other than these minor pest disturbances, forest health are low and currently not a major concern. Nevertheless, these forest health factors have implications for the fire behaviour potential, level of surface fuel accumulation in affected stands, as well as access and working conditions for fire fighters in the event of wildfire.

RECOMMENDATION #14: Formalize the invasive plant management program into a Strategy document in order to prioritize and target treatments and monitoring in areas with known invasive species occurrences in the WUI. Identify where fuel treatments have occurred and ecological restoration and planting initiatives have been implemented. Continue addressing invasive species management during fuel treatment implementation in the CPM wildland urban interface, in order to improve forest resilience and promote ecological restoration of degraded sites.

Human Development and Natural Events

Since the establishment of communities in the AOI, there have been numerous anthropogenic and natural changes that have occurred on the landscape. Most land cover change in the AOI in recent years can be described as residential and commercial development. This process entails land clearing and road building. Abiotic and biotic natural events have typically occurred at small geographic scales. The overall implication of human development is an increase in human ignition potential with a decrease in hazardous fuels cover as land clearing for human development generally increases the non-fuel and O-1a/b fuel types.

The following is a list of notable changes observed within the AOI and a description of associated implications regarding wildfire behaviour.

- Residential and industrial land development has occurred in the AOI since the mid-19th century, following settlement by early pioneers engaging in resource-based activities. Over the past century, new residential development has expanded from the original Ioco Townsite and the Moody Centre. This has resulted in an increased WUI in particular areas and an increase in fire suppression in ecosystems that had a historic fire interval of 200-250 years. Population growth is expected to continue and the CPM's favourable climate, high recreational and landscape values, and proximity to Vancouver make it a desirable place to live, work or retire.

- With increasing population numbers, front-country and back-country use of trails within the CPM has increased in recent years. Increased recreational use of forested areas has implications for human caused ignitions, particularly when these activities are undertaken during the hot and dry summer months. Back-country activities have the added complication of being areas with poor access for suppression efforts.

[19] https://catalogue.data.gov.bc.ca/pt_BR/dataset/pest-infestation-polygons (current as of September, 2017)

Fire Weather Rating

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

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

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

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

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

Figure 1 displays the average frequency of Fire Danger Class days between the months of April and October. The data summarized comes from the Seymour QD2 fire weather station (years 2009-2018) which provides the longest fire weather data collection interval within the AOI. According to Figure 1, the months with the highest average number of 'high' and 'extreme' fire danger class days are July,

August and September. August historically has the highest number of days in both the 'high' and 'extreme' classes when compared to June, July and September. Although highest fire danger is within the three months of July, August and September, it should be noted that there are 'high' danger class days which extend into June and October.

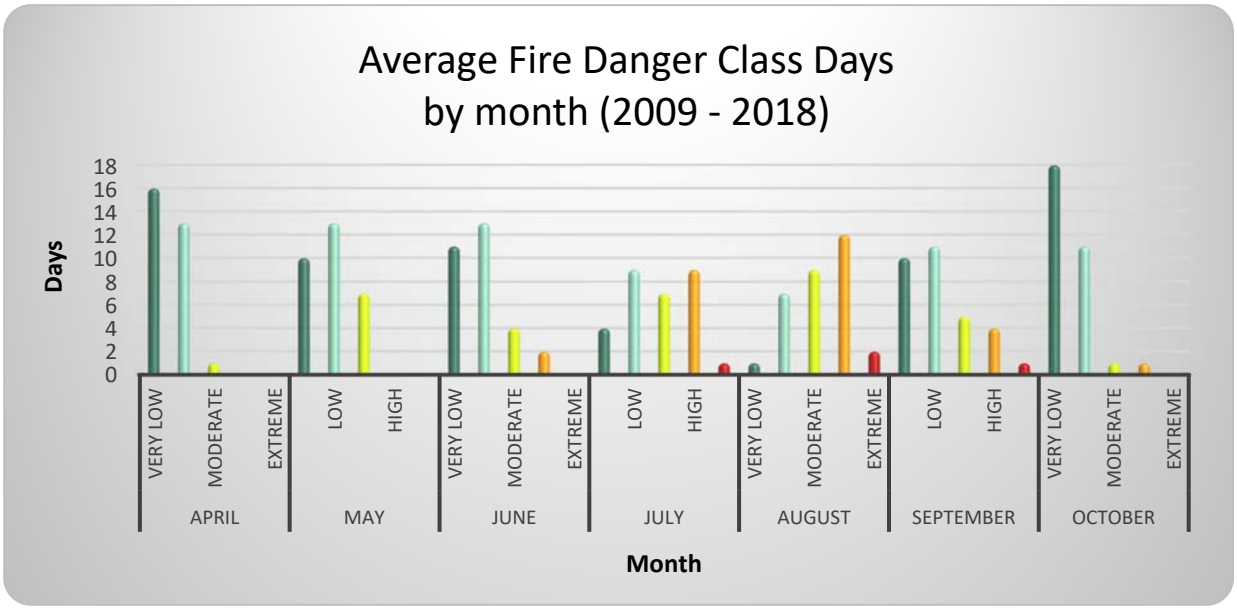


Figure 1. Average number of danger class days for the Seymour QD2 fire weather station. Summary of fire weather data for the years 2009 - 2018.

4.1.2 Climate Change

Climate change is a serious and complex aspect to consider in wildfire management planning. Numerous studies outline the nature of these impacts on wildland fire across Canada and globally.[20] Current "climate change projections point to a warmer and drier environment and shifts in vegetation with the following implications in some areas of the province:

- Increased disturbances due to insects and disease
- Shifts in vegetation. Potential ranges of species will move northward and upward in elevation
- Increased forest fire frequency
- Longer and more intense wildfire seasons
- Increased number of high and extreme fire danger days for an average year.

As a result, some existing forests have an increased probability of more frequent, intense and more difficult to control wildfires that are likely to result in increased tree mortality, detrimental impacts to soils and hydrology, and increased threat to the community and interface areas."[21]

[20] Flannigan, M.D et al. 2009.

[21] Strategic Wildfire Prevention Working Group, 2018. Community Wildfire Protection Plan Template.

Climate change projections modelled by the Pacific Climate Impacts Consortium (PCIC) for the Metro Vancouver area, which includes the City of Port Moody, are outlined in *Climate Projections for Metro Vancouver*[22]. The following climate changes were projected for the 2050s:

- Lengthening of dry-spell duration by 20%, from 21 to 26 consecutive days per year;
- Average increase in temperature of 3 °C;
- Doubling of the average number of hot summer days (above 25 °C) from an average of 22 days to 55 days per year;
- Increase in the 1-in-20 hottest temperature (a temperature that has a 5% chance of occurring in any year) from 34 °C to 38 °C;
- Increase in the length of the growing season by 20% and a 45% increase in growing degree days;
- Overall 5% increase in precipitation, primarily occurring during extreme events, while the amount of rain in summer is expected to decrease by 20%; and
- Decrease in the April 1 snowpack depth in the watersheds of approximately 60%.

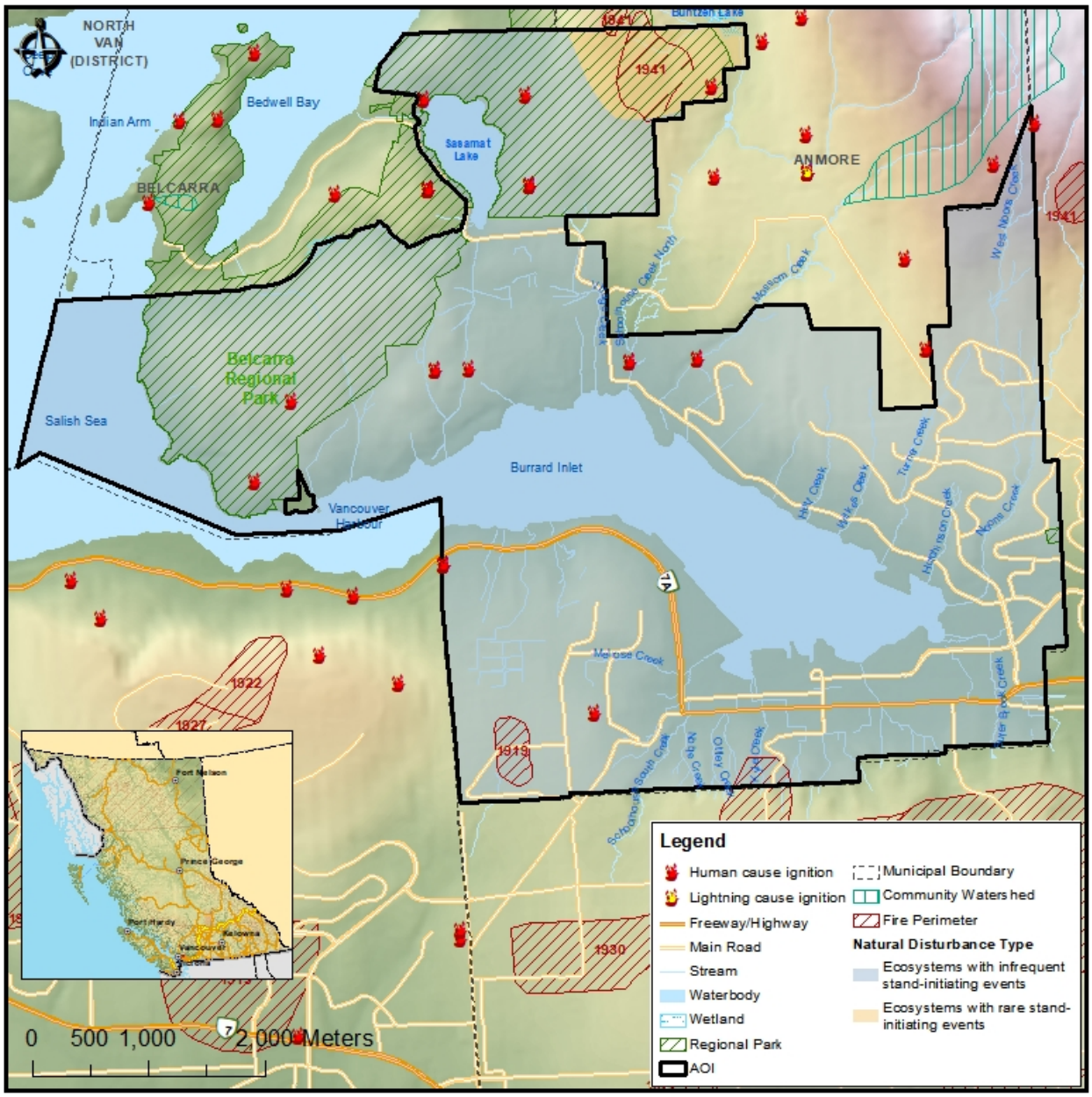
An increased frequency of natural disturbance events is also expected to occur as a result of climate change with coincident impacts to ecosystems. These include: storm events, including catastrophic blowdown and damage to trees from snow and ice; wildfire events and drought. Furthermore, an Increase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

Insects and disease occurrence of Douglas-fir beetle (*Dendroctonus pseudotsugae*), spruce beetle (*Dendroctonus rufipennis*) and Swiss needle cast (*Phaeocryptopus gaeumannii*) may increase; outbreaks of western hemlock looper *(Lambdina fiscellaria lugubrosa*) may also increase.[23] Other research regarding the intricacies of climate change and potential impacts on wildfire threats to Canadian forests has found that: firstly, fuel moisture is highly sensitive to temperature change and projected precipitation increases will be insufficient to counteract the impacts of the projected increase in temperature. Results conclude that future conditions will include drier fuels and a higher frequency of extreme fire weather days[24].Secondly, the future daily fire severity rating (a seasonally cumulative value) is expected to have higher peak levels and head fire intensity is expected to increase significantly in Western Canada. A bi-modal (spring-late summer) pattern of peak values may evolve to replace the historical late summer peak which is the current norm[25]. Fire season severity seems to be sensitive to increasing global temperatures; larger and more intense fires are expected and fire management will become more challenging[26]. Thirdly, Future climatic conditions may be more suitable for, or give competitive advantage to, new species of plants, including invasive species[27].

[22] PCIC, 2016.
[23] MFLNRO, 2016
[24] Flannigan, M.D. et al. 2016
[25] deGroot, W. J. et al. 2013
[26] Price, D.T. et al. 2013
[27] PCIC, 2017.

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

CPM is in the completion phase of a Climate Action Plan which references wildfire risk. Release of the document to the public is expected in autumn of 2020.



Map 4. Fire Regime, Ecology and Climate Change.

4.2 PROVINCIAL STRATEGIC THREAT ANALYSIS

The Provincial Strategic Threat Analysis (PSTA) evaluates multiple data sets to provide a coarse (high-level) spatial representation of approximate relative wildfire threats across BC. It provides a starting point to assess the local wildfire threat. Three inputs are combined to create the PSTA wildfire threat analysis component[28]:

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

The final wildfire threat analysis value was developed through an average weighting process of the aforementioned three layers[29].The values were then separated into 10 classes (1 – 10) which represent increasing levels of overall fire threat (the higher the number, the greater the fire threat); threat class 7 is considered the threshold. Threat classes of 7 and higher are locations where the threat is severe enough to potentially cause catastrophic losses in any given fire season, when overlapping with values at risk. Classes were grouped into the following general threat class descriptions: low (1 – 3); moderate (4 – 6); high (7 – 8); and, extreme (9 – 10).

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

- Limited accuracy and variability of the fire history point data;
- Sensitivity to fuel type and the associated limitations of using fuel type approximations for fire behaviour modelling; and,

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

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

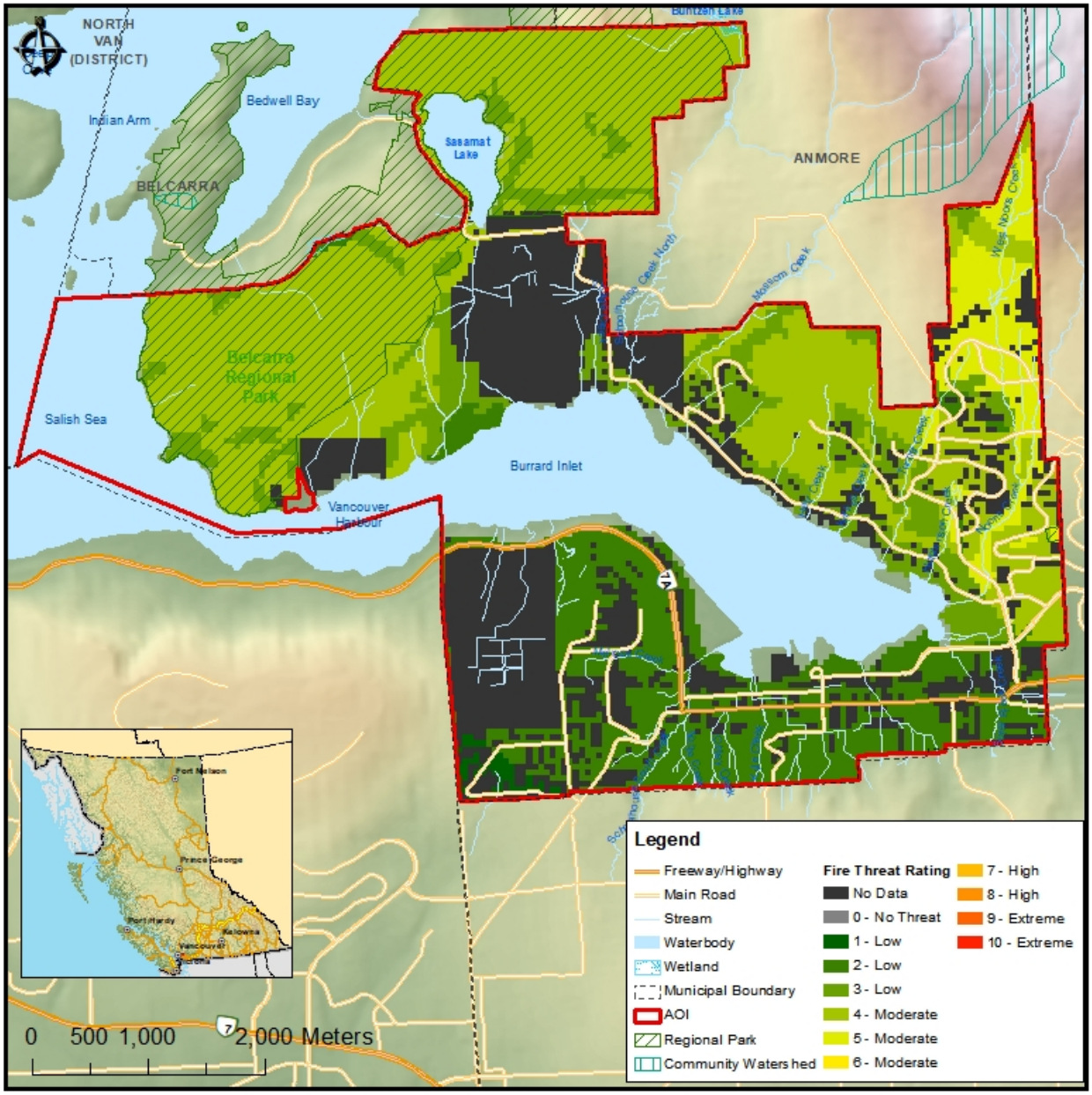
- 90th percentile rating for HFI, which represents a near worst-case scenario which may be artificial in some circumstances.

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

The fire threat ratings from the PSTA are summarized in Table 9 and spatially illustrated in Map 5. Approximately 665 ha of the AOI (20%) is categorized as either private land or private managed forest land and has no data for wildfire threat in the PSTA. Low threat areas cover 23% of the AOI (water coverage is an additional 23%). Approximately 34% of the AOI is categorized as having a moderate wildfire threat rating in the provincial Wildfire Threat Analysis (Table 9). High and extreme threat ratings do not occur within the AOI. Threat class 5 (the highest moderate rating) areas are most prevalent around the junction between BC Hydro and FortisBC right-of-way for transmission lines and the residential subdivision developments in the Heritage Woods and Heritage Mountain neighbourhoods in the north eastern part of the AOI (Map 5).

Table 9. Overall PSTA Wildfire Threat Analysis for the AOI (rounded to the nearest hectare).

Threat Class	Area (ha)	Threat Class Description	Percent of AOI
-3	665	No Data (Private Land)	20%
-2	0	No Data (Private Managed Forest Land)	0%
-1	755	Water	23%
0	0	No Threat	0
1	16	Low	23%
2	442		
3	295		
4	968	Moderate	34%
5	141		
6	0		
7	0	High	0
8	0		
9	0	Extreme	0
10	0		
Total	**3,282**	**-**	**100%**



Map 5. Provincial Strategic Threat Rating.

4.2.1 Fire History

Fire ignition and perimeter data are depicted in Map 4. The following PSTA fire ignition data is available from 1950-2018 and fire perimeter data is available from 1919-2018 for the area. The fire ignition data revealed that there have been 28 fire incidents within the AOI between 1950-2018; all of which were human-caused. Small and medium historical wildfires have burned throughout the AOI, which ranged in size from 3 ha to 93 ha. Based on the fire perimeter data, two out of the four fires that burned within the AOI were naturally caused by lightning and the other two were human-caused. Both of the lightning caused fires occurred in 1941, and the two human caused fires occurred between 1919 and 1922. No

recent wildfires have occurred within the AOI. The fire history demonstrates that nearly all of the fires occurred in the second half of the 20th century and were the direct result of human activity.

4.3 LOCAL WILDFIRE THREAT ASSESSMENT

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

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

WUI Threat Assessments were completed over four field days in July 2019 and one day in September, in conjunction with verification of fuel types (see Appendix C for WUI Threat Assessment worksheets and photos). WUI Threat Assessments were completed in interface (*i.e*. abrupt change from forest to urban development) and intermix (*i.e*. where forest and structures are intermingled) areas of the AOI to support development of priority treatment areas, and in order to confidently ascribe threat to polygons which may not have been visited or plotted, but which have similar fuel, topographic, and proximity to structure characteristics to those that were.

Field assessment locations were prioritized based upon:

- PSTA wildfire threat analysis class – Field assessments were clustered in those areas with wildfire threat analysis classes of 5 or higher.
- Proximity to values at risk – Field assessments were clustered in the intermix and interface, as well as around critical infrastructure.
- Prevailing fire season winds –Field time was spent assessing areas upwind of values at risk.
- Slope position of value – More field time was spent assessing areas downslope of values at risk. Similarly, values at top of slope or upper third of the slope were identified as particularly vulnerable.
- Land ownership – Crown and municipal land was the main focus of field assessments.

- Local knowledge – Areas identified as hazardous, potentially hazardous, with limited access/egress, or otherwise of particular concern as vulnerable to wildfire, as communicated by fire officials and BCWS zone staff.
- Observations – Additional areas potentially not recognized prior to field work were visually identified as hazardous and assessed during the week.

A total of 37 WUI threat plots were completed and over 314 other field stops (i.e., qualitative notes, fuel type verification, and/or photograph documentation) were made across the AOI (see Appendix F for WUI threat plot locations).

Using the verified and updated fuel types (Appendix A-1, Map 8) combined with field wildfire threat assessments and office-based analysis (Appendix A-1 to A-4), local wildfire threat for the AOI was updated. Using the Wildfire Threat Assessment methodology[30], there are two main components of the threat rating system: the wildfire behaviour threat class (fuels, weather and topography sub-components) and the WUI threat class (structural sub-component).

The result of the analysis shows that the AOI is composed of a mosaic of all threat classes but is dominated by moderate threat class stands. The variability in wildfire threat is dictated primarily by the level of natural and anthropogenic disturbances that have historically occurred and persist on the landbase. The AOI has less than 1% extreme threat class rating, 10% high, 35% moderate, 4% low and 25% very low/water (Table 10). The remaining 26% of the AOI is classified as private land and as such has not been allocated fire threat data. Assessment of fire threat on private land is outside the scope of this CWPP. Table 10 indicates the differences between the original PSTA threat rating and this CWPP's corrected fire behaviour threat.

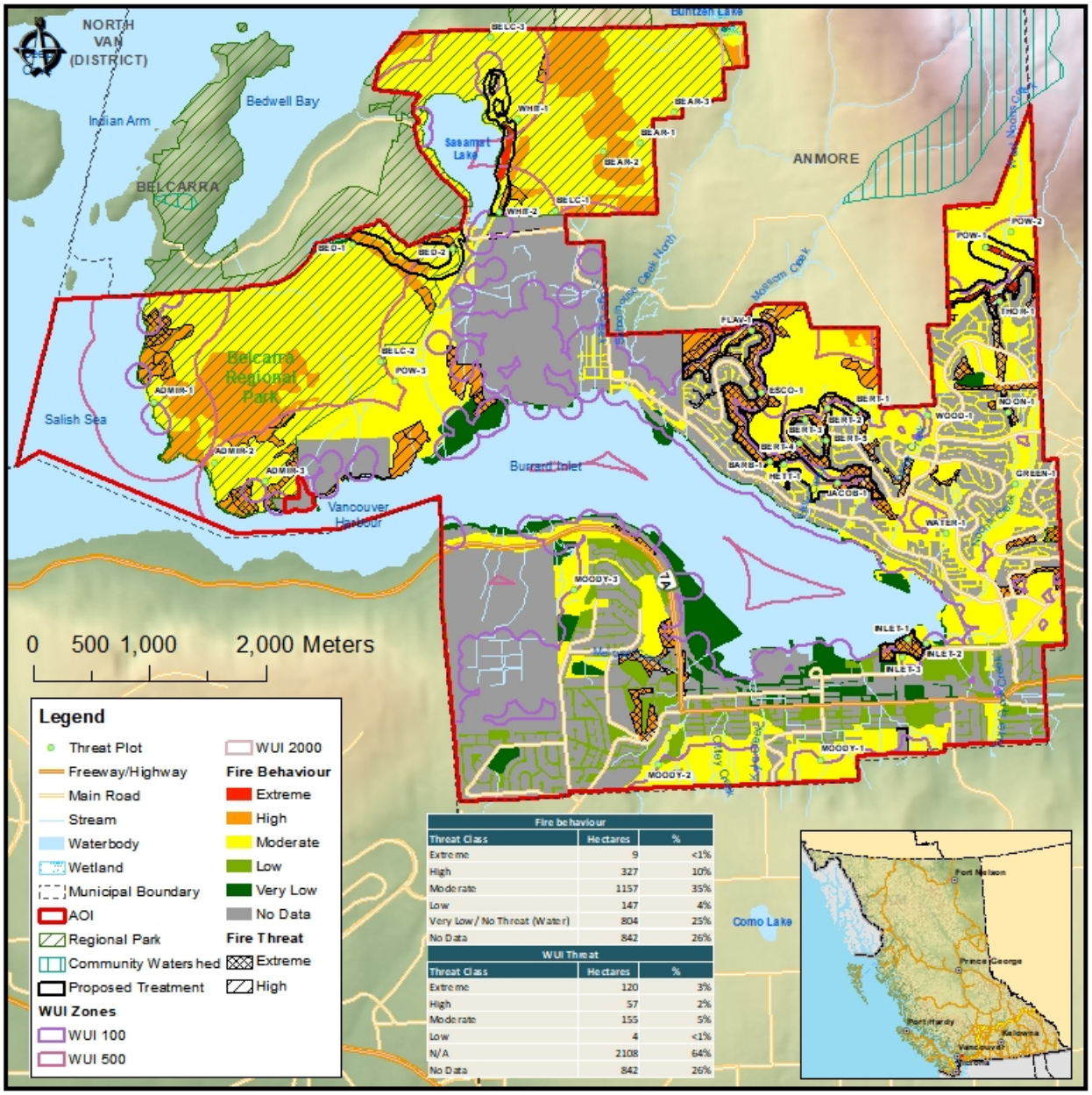
The areas that represent the highest wildfire behavior potential and greatest risk to values within the City of Port Moody AOI are areas of high and extreme threat class behind subdivision developments on the north shore of Burrard Inlet and Heritage Woods, Bert Flinn Park, Inlet Park, and the primary access routes into Belcarra Regional Park.

For detailed field data collection and spatial analysis methodology for the local threat assessment and classification, see Appendix H – WUI Threat Assessment Methodology.

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

Table 10. Fire behaviour threat summary for the AOI.

Wildfire Behaviour Threat Class	2017 PSTA Data	2019 CWPP
	Percent of AOI	Percent of AOI
Extreme	0	<1
High	0	10
Moderate	34	35
Low	23	4
Very Low/ No Threat (Water)	23	25
No Data (Private Land and Private Managed Forest Land)	20	26



Fire behaviour		
Threat Class	Hectares	%
Extreme	9	<1%
High	327	10%
Moderate	1157	35%
Low	147	4%
Very Low / No Threat (Water)	804	25%
No Data	842	26%

WUI Threat		
Threat Class	Hectares	%
Extreme	120	3%
High	57	2%
Moderate	155	5%
Low	4	<1%
N/A	2108	64%
No Data	842	26%

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

SECTION 5: RISK MANAGEMENT AND MITIGATION FACTORS

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

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

5.1 FUEL MANAGEMENT

Fuel management, also referred to as vegetation management or fuel treatment, is a key element of wildfire risk reduction. For the purpose of this discussion, fuel management within the WUI generally refers to native vegetation/fuel modifications in forested areas greater than 30 m from homes and structures. The principles of fuel management are outlined in detail in Appendix I – Principles of Fuel Management.

The objectives for fuel management are to:

- Reduce wildfire threat on private and public lands nearest to values at risk; and,
- Reduce fire intensity, rate of spread, and ember showers/spotting such that the probability of fire containment increases and the impacts on the landscape and community are reduced.

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

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

fuel treatments have the potential to decrease potential fire intensity and the likelihood of extreme fire behaviour, they can also increase surface wind speeds and potentially reduce fuel moisture content by opening up the canopy and therefore have the potential to increase the speed at which a fire may spread across the landscape. Those undertaking the planning and implementation of fuel treatments should acknowledge this and plan accordingly.

Fuel management on Crown lands may be funded by the Union of BC Municipalities (UBCM), through the new Community Resiliency Investment (CRI) Program, and by the Forest Enhancement Society of BC (FESBC). The CRI Program (formerly the Strategic Wildfire Prevention Initiative or SWPI) also provides funding for selected FireSmart activities and planning on private land (subject to program requirements and limits).[31] However, the best approach to mitigate fuels on private lands is to urge private landowners to comply with FireSmart guidelines (as described below in Section 5.2) and to conduct appropriate fuel modification using their own resources (CRI Program funding may be available). In general, when considering fuel management to reduce fire risk, the following steps should be followed:

- Carefully anticipate the likely wildfire scenarios to properly locate fuel modification areas;
- Acquire an understanding of local ecological, archaeological, and societal values of the site;
- Prescriptions should be developed by a qualified professional forester working within their field of competence;
- Public consultation should be conducted during the process to ensure community support;
- Potential treatment areas and draft prescriptions should be referred to First Nations with sufficient time for meaningful review and input;
- Treatment implementation should weigh the most financially and ecologically beneficial methods of fulfilling the prescription's goals;
- Treatment implementation should consider the possibility of invasive species spread during treatments and mitigation options should be considered;
- Pre- and post-treatment plots should be established to monitor treatment effectiveness; and
- A long-term maintenance program should be in place or developed to ensure that the fuel treatment is maintained in a functional state.

The fuel treatment opportunities identified in this document include the use of primary fuel breaks, interface fuel breaks, and trailside treatments as defined in Section 5.1.1, to reduce the wildfire potential around the AOI. Potential treatment activities include fuel removal, thinning, stand conversion, pruning, and chipping, or a combination of two or more of these activities. Stand conversion encourages forests with a higher proportion of deciduous trees, and has been shown to be effective at reducing wildfire potential in mixed-wood or conifer dominated stands. This approach generally involves a thin-from-below to reduce ladder fuels and crown fuels continuity, targeting the removal of conifer species and the retention of broadleaf species.

[31] 2019 CRI FireSmart Community Funding & Supports – Program & Application Guide: https://www.ubcm.ca/assets/Funding~Programs/LGPS/CRI/cri-2019-program-guide.pdf

5.1.1 Proposed Treatment Units

Funding opportunities from UBCM under the CRI Program will consider fire prevention activities including fuel management on provincial Crown land, in addition to local government and reserve land[32]. Fire prevention activities on private land that may be funded under this program are related to FireSmart activities (including FireSmart planning and assessments, local rebate programs for completion of eligible FireSmart activities, and provision of off-site disposal of vegetation management debris), subject to program requirements. This does not preclude other current and future funding opportunities or potential partnerships and changes to existing programs.

The potential fuel management treatment areas represent moderate, high or extreme fire hazard areas which are close to values at risk (structures or infrastructure) and are located on land designated as Crown Provincial or Municipal. It should be noted that the location of proposed treatment units on these land ownership types does not imply that high and extreme hazard areas do not exist on private land within the AOI. As stated in Section 5.1, mitigation approaches should also be pursued on private land where hazard exists, bearing in mind the different funding resources and objectives on these land types. Recommendations for treatment in areas of moderate fire hazard have been addressed in order to create continuity with high hazard treatment units. For example, of the four proposed treatment units surrounding residential parcels in Bert Flinn Park (Bert Flinn 1-4) two are rated as high hazard and two rated as moderate hazard, which could provide an interconnected fuel break if all parcels receive fuel management treatments. During the identification of suitable areas, all polygons identified for potential treatment have been prioritized based on fire hazard, operational feasibility, estimated project cost, type and number of values at risk, common fire weather (wind direction), and expected efficacy of treatment. Although potential treatment areas have been ground-truthed during field work, additional refinement of the polygons will be required at the time of prescription development. Polygons will require detailed site-level assessment to stratify treatment areas (and areas of no treatment), identify values and constraints, and identify and engage all appropriate Provincial agencies, First Nations, and stakeholders.

Recommended treatment areas within the AOI are outlined in Table 11 (listed in order of priority) and displayed in Map 7.

Fuel Treatment Types

The intent of establishing a fuel break (and associated treated patches) is to modify fire behaviour and create a fire suppression option that is part of a multi-barrier approach to reduce the risk to values (i.e., structures). A fuel break in and of itself, is unlikely to stop a fire under most conditions. The application of appropriate suppression tactics in a timely manner with sufficient resources is essential for a fuel

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

break to be effective. Spotting over and across a fuel break is a possibility (increasing with more volatile fuel types and fire weather) and has the potential to create spot fires beyond the fuel break that can expand in size and threaten values at risk, or land directly on or near structures and ignite them. To address spotting, fuels between the fuel break and the values at risk should be evaluated and treated to create conditions where extinguishment of spot fires is possible. Furthermore, FireSmart standards should be applied to structures and associated vegetation and other fuel to reduce the risk of structures igniting. A multi-barrier approach that reduces the risk to values can include: establishing multiple fuel breaks (Interface Fuel Break and Primary Fuel Break) and applying FireSmart standards to structures and the surrounding vegetation. Fuel breaks require periodic maintenance to retain their effectiveness.

Trailside Treatments

Trailside treatments are implemented to address hazardous fuels adjacent to publicly used trails, where ignition potential may be higher due to increased recreational use by hikers and both motorized and non-motorized off-road vehicles. The primary objective of these treatments is to reduce potential fire intensity and the probability of ignition, which is achieved through the creation of defensible space surrounding these features. Potential strategies include reducing ladder and surface fuels, increasing crown base height of trees, and retaining fire-resistant tree species. Trailside treatments vary in size and are often in the form of linear features which follow trail systems.

Interface Fuel Break

Fuel breaks immediately adjacent to private land and in close proximity to the wildland urban interface and/or intermix areas, are termed interface fuel breaks. These are designed to modify fire behaviour, create fire suppression options, and improve suppression outcomes. Interface fuel breaks are relatively small (approximately 100 meters wide) and when treated with appropriate fuel reduction measures can break the crown fire threshold and reduce the risk of a crown fire reaching values at risk. Treatment widths can be varied to allow for alignment and to take advantage of natural and human-constructed fire resilient features that enhance effectiveness. Surface fire spread across the fuel treatment and spotting across the fuel treatment, are both concerns and rely on suppression actions to be effective. In order to reduce potential fire intensity and spotting, fuel on private land between the interface fuel break and structures should be treated according to FireSmart vegetation management standards. Structures in interface areas should be constructed or retrofitted to FireSmart design standards.

Primary Fuel Break

Primary fuel breaks are located in strategic locations beyond the interface fuel treatments. Primary fuel breaks are designed to modify fire behaviour and create fire suppression options that reduce the risk of a crown fire reaching a community and/or adjacent private lands. Primary fuel breaks may be located to completely surround a community or be strategically placed upwind of communities and perpendicular to fire season winds. Primary fuel breaks have sufficient width and appropriate fuel reduction measures to break the crown fire threshold and reduce fire intensity such that overstory fire moves to the ground surface and spread rates are reduced. While there are no absolute standards for fuel break width or fuel manipulation in the literature, distances will vary based on fuel type, topography, and expected fire

behaviour[33]. A 300-metre fuel break width is generally recommended. The spotting and fire suppression concerns with regards to primary fuel breaks are the same as the ones described for interface fuel breaks.

RECOMMENDATION #15: Proceed with detailed assessment, prescription development and treatment of proposed treatment units identified and prioritized in this CWPP Update. Prescriptions must be developed within the context of the Environmentally Sensitive Area (ESA) Strategy and Metro Vancouver's Sensitive Ecosystem Inventory (SEI). Consult with a qualified biologist during prescription development to ensure all concerns are addressed.

[33] Agee, J.K., Bahro, B., Finney, M.A., Omi, P.N., Sapsis, D.B., Skinner, C.N., van Wagtendonk, J.W., Weatherspoon, C.P. The use of shaded fuelbreaks in landscape fire management. Forest Ecology and Management, 127 (2000), 55-66.

Table 11. Proposed Treatment Area Summary Table*

**During prescription development an Eligible Consulting Archaeologist should be engaged to determine the steps in managing impacts from proposed fuel treatment activities.*

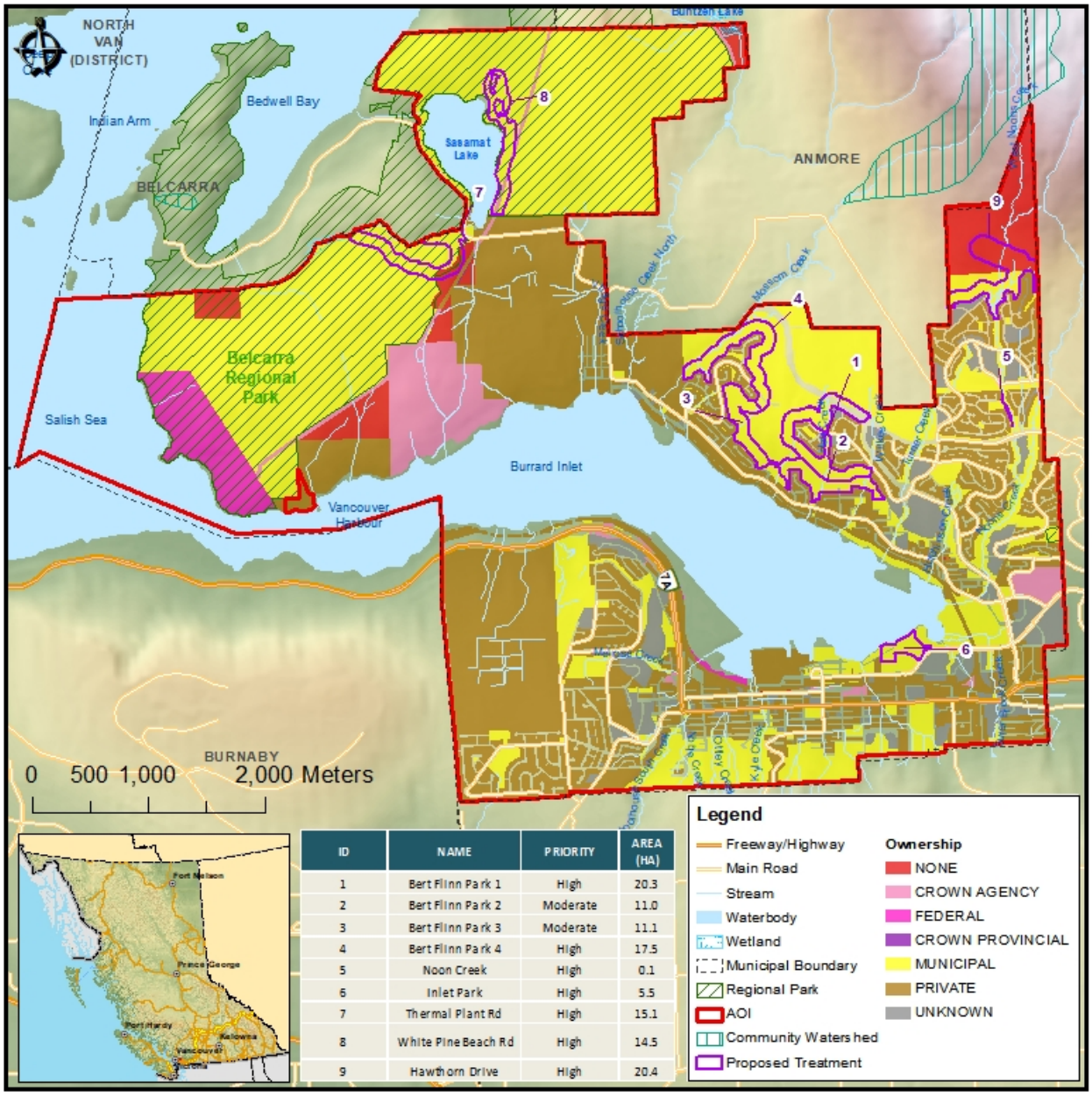
FTU #	Proposed Treatment Unit Name	Priority	Total Area (ha)	Treatment Unit Type/Objective	Local Fire Threat (ha)			Overlapping Values/Treatment Constraints*	Treatment Rationale/Recommendations
					Extreme /High	Mod	Low/ V. Low		
1	Bert Flinn Park 1	High	20.3	**Interface fuel break/** By reducing surface, ladder, and crown fuels, the fuel treatment will result in forest stands with lower overall wildfire behaviour threat and ignition potential.	11.1	9.15	0.0	A red-listed species at risk occurrence and critical habitat for Pacific water shrew (*Sorex benidrii*) overlap significant portions of the Bert Flinn 1 proposed treatment unit (PTU). The vicinity of the PTU has an environmental sensitivity rating of 'High' according to CPM's OCP. Consideration of ESA management objectives and consultation with a qualified biologist must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is located adjacent (<100 m) to private residences within Bert Flinn Park along April Rd, Parkside Dr, and Eagle Pass. It is comprised primarily of C-3 fuel types and a minor component of C-5 fuel types. High density conifer stands surround the park and abut private land. This area has been recommended for treatment due to its proximity to private residences, and the high hazard fuel type (C-3 fuel type). This interface fuel break is intended to provide separation between the homes and flammable vegetation. Recommended treatments include removal of understory conifers, pruning to increase crown base height, and removal of surface fuels. When implemented, this fuel break will increase safety and improve access for firefighters actioning a fire approaching from Bert Flinn Park to the west and south or from the residential neighbourhoods below.
9	Hawthorn Drive	High	20.4	**Interface fuel break/** By reducing surface, ladder, and crown fuels, the fuel treatment will result in forest stands with lower overall wildfire behaviour threat and ignition potential.	7.5	12.9	0.0	The PTU is located adjacent to a BC Hydro transmission circuit right-of-way (ROW) and FortisBC transmission pipe. Consultation with BC Hydro and FortisBC must occur during prescription development and prior to implementation to ensure all concerns are addressed. Consideration of ESA management objectives and consultation with a qualified biologist must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is located at the end of Hawthorn Drive and directly adjacent to homes backing onto extant forest land. It is comprised of C-5 and C-3 fuel types. Stand density varies within this unit, from high understory conifer densities (> 4,000 stems per hectare [SPH]) near homes, to more open, mature, conifer-dominated stands. The greatest concern in this PTU is dense stands of young conifers. Recommended treatments include removal of understory conifers, pruning to increase crown base height, and removal of surface fuels.

FTU #	Proposed Treatment Unit Name	Priority	Total Area (ha)	Treatment Unit Type/Objective	Local Fire Threat (ha)			Overlapping Values/Treatment Constraints*	Treatment Rationale/Recommendations
					Extreme /High	Mod	Low/ V. Low		
4	Bert Flinn Park 4	High	17.5	**Interface fuel break/** By reducing surface, ladder, and crown fuels, the fuel treatment will result in forest stands with lower overall wildfire behaviour threat and ignition potential.	11.7	5.8	0.0	This treatment unit is adjacent to the municipally managed, Bert Flinn Park and interfaces with a housing subdivision. A red-listed species at risk occurrence and critical habitat for Pacific water shrew (*Sorex benidrii*) overlap significant portions of the Bert Flinn Park 4 PTU. The vicinity of the PTU has an environmental sensitivity rating of 'High' according to CPM's OCP. Consideration of ESA management objectives and consultation with a qualified biologist must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This treatment unit is adjacent to the municipally managed, Bert Flinn Park and interfaces with a housing subdivision which is located in the central portion of the AOI and adjacent to the municipal boundary shared with the Village of Anmore. D-1/2, M-1/2 and C-5 stands are present throughout the PTU, yet high density conifer stands surround the subdivision. This area has been recommended for treatment due to its proximity to private residences, and the high hazard fuel type (C-3 fuel type) and high fuel loading present. The combination of low crown base heights, interlocking crowns, and ladder fuels, results in an increased potential for crown fire behaviour. Recommended treatments include removal of understory conifers, pruning to increase crown base height, and removal of surface fuels.
8	White Pine Beach Rd	High	14.5	**Primary fuel break/** By reducing surface, ladder, and crown fuels, the fuel treatment will result in forest stands with lower overall wildfire behaviour threat and ignition potential, will improve access/egress for the public during evacuation, for CPM utilities staff and firefighters, and will create an anchor point for firefighting suppression efforts.	4.2	9.8	0.5	A BC Hydro Transmission Circuit ROW intersects the southern portion of the PTU. Consultation with BC Hydro must occur during prescription development and prior to implementation to ensure all concerns are addressed. The vicinity of the PTU has an environmental sensitivity rating of 'High' according to CPM's OCP. Consideration of ESA management objectives and consultation with a qualified biologist must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is located along that portion of White Pine Beach Rd within Belcarra Regional Park between the Sasamat Lake day use area and Bedwell Bay Rd. The park is a recreational destination serving both the local and metropolitan area. White Pine Beach Rd is an approximately 1.2 km one-way access road with the day use area and parking lots at the terminus. This area was identified for roadside treatment (50 m on either side of the road) due to the C-3 fuel type fringing the 2-lane road which could cause evacuation and entrapment issues in peak use periods which coincide with the wildfire season and could be further compounded with poor visibility from smoke. Recommended treatments include removal of understory conifers <12.5 cm dbh, pruning to increase crown base heights, and removal of surface fuels.

FTU #	Proposed Treatment Unit Name	Priority	Total Area (ha)	Treatment Unit Type/Objective	Local Fire Threat (ha)			Overlapping Values/Treatment Constraints*	Treatment Rationale/Recommendations
					Extreme /High	Mod	Low/ V. Low		
6	Inlet Park	High	5.5	**Trailside treatment/** By reducing surface, ladder, and crown fuels, the fuel treatment will result in forest stands with lower overall wildfire behaviour threat and ignition potential adjacent to trail(s).	5.5	0.0	0.0	Portions of Inlet Park are identified as special features with an environmental rating of 'High'. Consideration of ESA management objectives and consultation with a qualified biologist must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is located on the southeast shore of Burrard Inlet and is a frequently used park due to its central location in the developed part of the AOI. The stands within this PTU are comprised of C-3 fuel types with very dense small stemmed conifers and variable fuel loading with uniform laddering fuels. When implemented, this fuel break will reduce the potential for human ignitions. Recommended treatments include removal of understory conifers, pruning to increase crown base heights, and removal of surface fuels. Invasive plant management should be of particular concern in this park, and prescriptions should be planned to coordinate with ongoing work programs to prevent spread and eradicate invasive species.
5	Noon Creek	High	0.1	**Trailside treatment/** By reducing surface, ladder, and crown fuels, the fuel treatment will result in forest stands with lower overall wildfire behaviour threat and ignition potential adjacent to trail(s).	0.1	0.0	0.0	The Noons Creek PTU is adjacent to a water reservoir and the Chestnut Way Pump Station and water treatment facility. It is also near a major FortisBC transmission pipe. The vicinity of the PTU has an environmental sensitivity rating of 'High'. Riparian corridors are highly valued wildlife and fish habitat. Consideration of ESA management objectives and consultation with a qualified biologist must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is located along the top of bank (TOB) along the western edge of West Noons Creek in Noons Creek Park, between Panorama Drive to the north and David Avenue to the south. The close proximity of subdivisions on both sides of the creek account for the C-3 fuel type in this riparian area due to disturbance from development. High density conifers (primarily western redcedar and western hemlock) have low crown base heights and high crown fuel continuity. Fuel loading is moderate throughout the PTU. Recommended treatments include removal of understory conifers along either side of Noons Creek Trail, pruning of residual trees to increase crown base heights, and removal of surface fuels in a 3 m strip along either side of the trail to reduce the likelihood of fire starts from human ignitions.

FTU #	Proposed Treatment Unit Name	Priority	Total Area (ha)	Treatment Unit Type/Objective	Local Fire Threat (ha)			Overlapping Values/Treatment Constraints*	Treatment Rationale/Recommendations
					Extreme /High	Mod	Low/ V. Low		
7	Thermal Plant Rd	High	15.1	**Primary fuel break/** By reducing surface, ladder, and crown fuels, the fuel treatment will result in forest stands with lower overall wildfire behaviour threat and ignition potential. Moreover, it will aid evacuation efforts and create an anchor point for firefighting suppression efforts	7.3	7.8	0.0	A BC Hydro transmission circuit right-ROW and FortisBC transmission pipe intersect the eastern portion of the PTU. Consultation with BC Hydro and FortisBC must occur during prescription development and prior to implementation to ensure all concerns are addressed. The vicinity of the PTU has an environmental sensitivity rating of 'High' according to CPM's OCP. Consideration of ESA management objectives and consultation with a qualified biologist must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is located along Thermal Plant Rd which leads to the Village of Belcarra and also connects to the road leading to the Burrard Thermal Plant on Burrard Inlet. This PTU is also located within Belcarra Provincial Park. It has C-3 fuel along road edge sections, especially on the switchback portion with slopes of ~40%. Stem density is high and has varying amounts of fine, medium, and coarse woody debris loading. Soils are thin and rocky which has led to tree mortality of younger species associated with drought. It is recommended that thinning treatments remove these dead and dying trees in order to reduce future fuel loading. Other treatment recommendations include surface fuel removal, thinning of understory conifers, and pruning to increase crown base heights.
2	Bert Flinn Park 2	Moderate	11.0	**Interface fuel break/** By reducing surface, ladder, and crown fuels, the fuel treatment will result in forest stands with lower overall wildfire behaviour threat and ignition potential.	3.8	7.2	0.0	This treatment unit is adjacent to the municipally managed, Bert Flinn Park and interfaces with a subdivision. A red-listed species occurrence and critical habitat for Pacific water shrew (*Sorex benidrii*) overlap portions of the Bert Flinn Park 2 PTU. The vicinity of the PTU has an environmental sensitivity rating of 'High' according to CPM's OCP. Consideration of ESA management objectives and consultation with a qualified biologist must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This treatment unit is adjacent to Bert Flinn Park and below subdivisions. A fire starting in this PTU has the potential to not only impact the homes of this PTU but to move upslope and affect the subdivisions at the top of the slope even though the fuel type has been classified as C-5. Stand density and laddering potential vary throughout this unit and are especially high adjacent to stand edges near homes. Surface fuel loading is moderate throughout, with patches of very high fuel loading where windthrown trees exist. Recommended treatments include removal of understory conifers, pruning to increase crown base heights, and removal of surface fuels.

FTU #	Proposed Treatment Unit Name	Priority	Total Area (ha)	Treatment Unit Type/Objective	Local Fire Threat (ha)			Overlapping Values/Treatment Constraints*	Treatment Rationale/Recommendations
					Extreme /High	Mod	Low/ V. Low		
3	Bert Flinn Park 3	Moderate	11.1	**Interface fuel break/** By reducing surface, ladder, and crown fuels, the fuel treatment will result in forest stands with lower overall wildfire behaviour threat and ignition potential.	9.3	1.8	0.0	This treatment unit is adjacent to the municipally managed, Bert Flinn Park and interfaces with a subdivision. A red-listed species at risk occurrence and critical habitat for Pacific water shrew (*Sorex benidrii*) overlap significant portions of the Bert Flinn Park 3 PTU. The vicinity of the PTU has an environmental sensitivity rating of 'High' according to CPM's OCP. Consideration of ESA management objectives and consultation with a qualified biologist must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This treatment unit is adjacent to the municipally managed, Bert Flinn Park and on a slope and situated between housing subdivision. The PTU has mostly a M-1/2 fuel type except for a small patch of C-3 fuel adjacent to Pleasantside Elementary school. Recommended treatments are thin from below, remove dead stems and prune ladder fuels to 2 m to top of short slope adjacent to the school or approximately 15 m as measured from the school building. Fine surface fuel loading is moderate.



ID	NAME	PRIORITY	AREA (HA)
1	Bert Flinn Park 1	High	20.3
2	Bert Flinn Park 2	Moderate	11.0
3	Bert Flinn Park 3	Moderate	11.1
4	Bert Flinn Park 4	High	17.5
5	Noon Creek	High	0.1
6	Inlet Park	High	5.5
7	Thermal Plant Rd	High	15.1
8	White Pine Beach Rd	High	14.5
9	Hawthorn Drive	High	20.4

Map 7. Proposed Fuel Treatments.

5.1.2 Maintenance of Previously Treated Areas

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

RECOMMENDATION #16: As/if treatments are implemented; treatment monitoring to be completed by a qualified professional to schedule next set of maintenance activities (5 – 10 years out).

5.2 FIRESMART PLANNING AND ACTIVITIES

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

5.2.1 FireSmart Goals and Objectives

FireSmart® is the comprehensive nationally accepted set of principles, practices and programs for reducing losses from wildfire.[34] FireSmart spans the disciplines of hazard/threat assessment; regional planning and collaboration; policy and regulations; public communication and education; vegetation/fuel management; training and equipment; and, emergency preparedness and response. FireSmart concepts provide a sound framework for advancing the goal of wildfire loss reduction, as it is a common goal shared with CWPPs.

The FireSmart approach and concepts, including recommended FireSmart guidelines[35], have been formally adopted by almost all Canadian provinces and territories, including British Columbia in 2000. FireSmart has become the de facto Canadian standard. FireSmart is founded in standards published by the National Fire Protection Association (NFPA). The objective of FireSmart is to help homeowners, neighbourhoods, whole communities and agencies with fire protection and public safety mandates to work together to prepare for the threat of wildfire in the WUI. Coordinated efforts between all levels of planning and action are integral to effectively and efficiently reducing the risk to communities.

The following are key principles of FireSmart:

- Wildland fires are a natural process and critical to the health of Canadian ecosystems.
- Mitigation and response efforts must be carefully coordinated through all stages of planning and implementation.
- Threats and losses due to wildfires can be reduced by working together. Responsibility for effectively mitigating hazards must be shared between many entities including homeowners, industry, businesses and governments.[36]
- There are seven broad disciplines to help address the threat of wildfire: education, vegetation management, legislation and planning, development considerations, interagency cooperation, emergency planning, and cross training.[36]

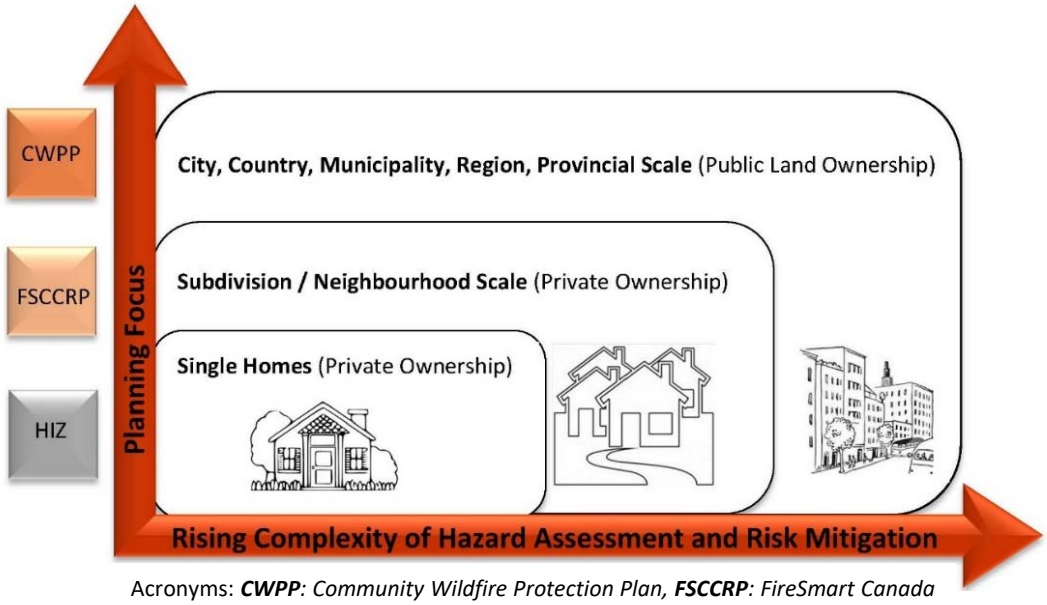
[34] FireSmart is the registered trademark held by the Partners in Protection Association.

[35] FireSmart guidelines first published in the 1999 manual "*FireSmart: Protecting Your Community from Wildfire*", with a second edition published in 2003.

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

- Solutions are required at all scales from individual backyards, to communities and the wider landscape. In order to succeed, these efforts must be integrated across the mosaic of land ownership (Figure 2).
- The ultimate root of the WUI interface problem is the vulnerability of structures and homes to ignition during wildfire events, in particular vulnerability to embers (spotting). This leads to an emphasis on risk mitigations on private properties.

The highest level of planning within the FireSmart program is strategic direction, such as that provided in CWPPs.



Acronyms: ***CWPP**: Community Wildfire Protection Plan, **FSCCRP**: FireSmart Canada Community Recognition Program, **HIZ**: Home Ignition Zone*

Figure 2. The various coordinated levels of the FireSmart program.[37]

The overarching goal of FireSmart is to encourage communities and citizens to adopt and conduct FireSmart practices to mitigate the negative impacts of wildfire to assets on public and private property. While responsibility for effectively mitigating hazards must be shared between many entities including homeowners, industry, businesses and governments;[38] the ultimate root of the WUI interface problem is the vulnerability of structures and homes to ignition during wildfire events, in particular vulnerability to embers. This leads to an emphasis on risk mitigations on private properties. Findings from an investigation of how homes survived and ignited during the Fort McMurray 2016 Horse River wildfire, indicate that the vast majority of initial home ignitions in the WUI were caused by embers rather than

[37] Figure and content developed by A. Westhaver. Adapted by A. Duszynska, 2017.
[38] https://www.firesmartcanada.ca

direct contact by flames or radiant heat.[39] Surviving homes in both urban and rural areas exhibited many attributes of FireSmart principles, regardless of the broader wildfire threat surrounding them.[39]

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

- "Reduce the potential for an active crown fire to move through private land
- Reduce the potential for ember transport through private land and structures
- Create landscape conditions around properties where fire suppression efforts can be effective and safe for responders and resources
- Treat fuel adjacent and nearby to structures to reduce the probability of ignition from radiant heat, direct flame contact and ember transport
- Implement measures to structures and assets that reduce the probability of ignition and loss"[40]

Home Ignition Zone

Multiple studies (including the previously referenced recent Fort McMurray WUI fire investigation) have shown that the principal factors regarding home loss to wildfire are the structure's characteristics and immediate surroundings; the area that determines the ignition potential is referred to as the Home Ignition Zone (HIZ).[41,42] The HIZ includes the structure itself and four concentric, progressively wider defined 'Priority Zones'. HIZ Priority Zones are based upon distance from structure: 0 to 1.5 m (Priority Zone 1a- fuel free zone), 0 – 10 m (Priority Zone 1), 10 – 30 m (Priority Zone 2), and 30 – 100 m (Priority Zone 3). These zones help to guide risk reduction activities, with recommended FireSmart guidelines being most stringent closest to the structure. The likelihood of home ignition is mostly determined by the area within 30 m of the structure (Priority Zones 1a, 1 and 2). Recommended FireSmart guidelines address a multitude of hazard factors within the HIZ: building materials and design; vegetation (native or landscaped materials); and the presence of flammable objects, debris, and vulnerable ignition sites. More detail on Priority Zones can be found in Appendix J and the FireSmart Manual[43].

It has been found that, during extreme wildfire events, most home destruction has been a result of low-intensity surface fire flame exposures, usually ignited by embers. Firebrands (embers) can be transported long distances ahead of the wildfire, across fire guards and fuel breaks, and accumulate within the HIZ in densities that can exceed 600 embers per square meter. Combustible materials found

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

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

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

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

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

within the HIZ combine to provide fire pathways allowing spot surface fires ignited by embers to spread and carry flames or smoldering fire into contact with structures.

Because ignitability of the HIZ is the main factor driving structure loss, the intensity and rate of spread of wildland fires beyond the community has not been found to necessarily correspond to loss potential. For example, FireSmart homes with low ignitability may survive high-intensity fires, whereas highly ignitable homes may be destroyed during lower intensity surface fire events.[42 44] It is for this reason that the key to reducing WUI fire structure loss is to reduce home ignitability; mitigation responsibility must be centered on homeowners. Risk communication, education on the range of available activities, and prioritization of activities should help homeowners to feel empowered to complete simple risk reduction activities on their property.

FireSmart Canada Community Recognition Program

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

WUI Disaster Sequence

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

Once multiple homes are ignited in an urban area, there is increasing potential for fire to spread from structure to structure, independently of the wildland vegetation. This is known as an urban conflagration. Effective fire protection depends on ignition resistant homes and properties during extreme wildfire events.[45]

---

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

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

Overall, FireSmart leads to communities that are better adapted to wildfire; are safer, more resilient, and able to recover following wildfires by sustaining fewer losses and disruption. Action by homeowners is key for reducing structure loss in the event of a WUI fire, but the overall adaptation of the community to wildfire is multi-pronged and the landscape should not be ignored.[45]

Figure 3. Wildland/urban interface disaster sequence.[46]

5.2.2 Key Aspects of FireSmart for Local Governments

Reducing the fire risk profile of a community through FireSmart implementation requires coordinated action from elected officials, municipal planners, developers, private land owners and industrial managers. This section presents various options of FireSmart practices, which when enacted, provide avenues for reducing fire risk within the community. The following presents an evaluation of the current level of FireSmart implementation within the CPM.

Education

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

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

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

The CPM has undertaken some public education outreach in the community which has entailed neighbourhood blitzes conducted by Port Moody Fire Rescue (PMFR) staff with FireSmart training, (four PMFR staff members hold Local FireSmart Representative [LFR] status) and which included door to door visits and the dissemination of FireSmart literature. Additionally, PMFR staff attend community events and staff FireSmart booths in order to capture a wider segment of Port Moody's population as these have been opportunities to engage in dialogue, answer questions and demonstrate that CPM is actively addressing interface fire risk. Prior to the 2019 fire season, the CPM organized and coordinated a public evening presentation with guest speakers on a variety of wildfire topics including FireSmart, the CWPP process, fuel management, and further augmented by experiences and case studies from other municipalities. These efforts can be expanded upon and/or adapted to further enhance wildfire preparedness and education.

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

Planning and Development Considerations

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

The planning objectives and considerations for the CPM are:

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

FireSmart policies and practices can be incorporated in various aspects of development design, zoning and permitting to reduce wildfire hazard on private land. The development objectives and considerations for the CPM are:

- To utilize regulatory and administrative tools to reduce wildfire hazard on private land and increase number of homes compliant with FireSmart guidelines (with low ignition potential). Tools include Development Permit Areas for wildfire hazard to ensure new development in the WUI are FireSmart compliant, and setting building and landscaping requirements.
- To ensure higher level planning and regulation (i.e., OCP and/or land use, engineering and public works bylaws) incorporate FireSmart policies, as applicable, to reduce wildfire hazard in

vulnerable WUI neighbourhoods, and include measures that address wildfire prevention and suppression in subdivision design.

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

FireSmart Vegetation Management

Some examples of actionable items for the CPM with regards to vegetation or fuel management and the FireSmart approach include: 1) policy development and implementation of FireSmart maintenance for community parks and open spaces (as per planning considerations discussed above); 2) implementing fire resistive landscaping requirements as part of the development permitting process (as per development considerations discussed above); and 3) provision of collection services for private landowners with a focus on pruning, yard and thinning debris (as per FireSmart activities for private land discussed below).

The CPM has not yet engaged in a proactive vegetation management strategy, targeting high-use areas near values at risk, within and immediately adjacent to developed areas. However, the City does deploy land use agreements with new sub division developers under FireSmart regulations and requests the developer financially assist with fire prevention and suppression incentives. The effectiveness of these suggestions has yet to be seen. More detailed recommendations regarding municipal policies and bylaws are provided below.

Development Permit Areas for Wildfire Hazard

The OCP within the CPM does not explicitly consider the establishment of a development permit (DP) area to address wildfire risk mitigation. It is recommended that the CPM review the OCP, with consideration towards establishing a wildfire development permit area. Other jurisdictions' wildfire development permit areas can serve as models for various components. [47]

In 2015, the province passed the *Building Act* as the new legislation to guide building and construction in the province (Spring 2015). This Act establishes the province as the sole authority to set building requirements and limits local government authority to set building requirements in their bylaws. Section 5 of the *Building Act* provides an exception to the above limitation to local governments by giving them the authority to set local building bylaws for unrestricted and temporarily unrestricted matters, such as exterior design and finish of buildings in relation to wildfire hazard and within a development permit area. The British Columbia Building Code does not have any wildfire-specific fire-resistant design components. Until revisions of the Building Code to include requirements specific to prevention of wildfire spread are completed, local governments can set exterior requirements within an established development permit area for wildfire risk mitigation.[48]

[47] The District of North Vancouver and City of Maple Ridge have robust and well-documented Wildfire Hazard Development Permit processes.

[48] Building and Safety Standards Branch. 2016. Bulletin No. BA 16-01 Building Act Information Bulletin: Update for Local Governments.

As per recommendation #1 in Section 2.5.3, the inclusion of wildfire as a natural hazard development permit area (DPA) should be considered by the CPM. The DPA should be continually updated to incorporate changes in zoning and the wildland urban interface (WUI). Prior to implementing, review similar DPAs established in other jurisdictions and use these as models for various aspects of the DPA process. The following aspects should be considered in the OCP review and wildfire DPA development: 1) Establish DPA objectives (e.g. minimize risk to property and people from wildland fires; minimize risk to forested area surrounding the AOI; and conserve the visual and ecological assets of the forests surrounding communities; etc.; and 2) Where possible, it is recommended to mandate FireSmart construction materials, some of which are likely not contained within the BC Building Code within the established wildfire hazard development permit area. In order to meet objectives, consider including the following elements: 1) minimum setbacks from forested edge based on FireSmart, 2) fuel management based upon qualified professional recommendations, 3) landscaping to FireSmart guidelines, 4) building materials and design based on NFPA 1144 or FireSmart standards, 5) underground servicing, 6) prompt removal of combustible construction materials or thinning/ fuel management waste, 7) management of non-compliant hedging in proximity to homes after the post-development inspection has been signed-off by a QP, and 8) setting a procedure for fire testing standards of alternative and novel non-flammable exterior building materials. These materials should be reviewed by the consultant with consideration for recent and applicable research findings prior to granting approval for use in the WUI.

RECOMMENDATION #17: Continue the process of ensuring development permit and building permit applications are provided to PMFR for opportunity for input prior to approval. If a Wildfire DPA is implemented (see recommendation #1) and more applications are received, the importance of communication and integration between the fire department and the Development Services department will increase.

RECOMMENDATION #18: Develop a landscaping standard which lists flammable non-compliant vegetation and landscaping materials, non-flammable drought and pest resistant alternatives, and tips on landscape design to reduce maintenance, watering requirements, avoid wildlife attractants, and reduce wildfire hazard. Consider making it publicly available for residents and homeowners outside of the planned DPA (can be provided at issue of building permit and made available at the Port Moody City Hall or other strategic locations). For further assistance in creating a FireSmart landscape and to obtain a list of fire-resistant plants, refer to the FireSmart Guide to Landscaping at https://www.firesmartcanada.ca/resources-library/firesmart-guide-to-landscaping.[49]
Other helpful links for finding fire resistant landscaping options can be found at:

- http://www.wacdpmc.org/images/Fire-Resistant-Plants.pdf
- http://www.firefree.org/wp-content/uploads/2016/02/Fire-Resistant-Plants.pdf
- https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/for-your-home-community
- http://articles.extension.org/pages/32729/selecting-firewise-plants

[49] Government of Alberta "FireSmart Guide to Landscaping"

RECOMMENDATION #19: Engage the development/building community (may include developers, builders, landscapers, and architects) in DPA development process. This can be accomplished through a series of workshops/informational sessions to: 1) increase awareness of wildfire risk, 2) demonstrate that there are a variety of actions which can be undertaken to immediately and measurably reduce the risk to the homeowner and community, 3) discuss various strategies and actions which could be implemented to meet DP objectives, and 4) educate and inform regarding the DP process and expectations.

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

Subdivision Design

Subdivision design should include consideration to decrease the overall threat of wildfire. Aspects of subdivision design that influence wildfire risk are access, water pressure and hydrant locations. The number of access points and the width of streets and cul-de-sacs determine the safety and efficiency of evacuation and emergency response. Although the available area for new subdivision developments in Port Moody is limited, changes in future land-use and zoning may allow opportunities for significant re-development initiatives which could perpetuate the creation of one-way access/evacuation routes with dead-end cul-de-sacs, and the implementation of exterior building materials and landscaping that are not compliant with FireSmart principles.[50] For instance, poor access has contributed to deaths associated with entrapments and vehicle collisions during wildfires,[51] therefore, methodologies for access design at the subdivision level can provide tools that manage car volume during egress within a given period of time.[50] These factors should be considered during the review of applications for new developments occurring on vacant lots within the CPM's wildland urban interface.

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

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

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

- Development and/or maintenance of Structural Protection Units (SPUs) which can be deployed in the event of a WUI fire;

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

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

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

A detailed account of current local capacity for the CPM and recommendations to address gaps is provided in SECTION 6:.

RECOMMENDATION #20: It is recommended that the City consider enhancing the capability of the existing sprinkler protection program from approximately 20 homes to 50 homes and is particularly applicable to FireSmart priority neighbourhoods identified in Section 5.2.3.

FireSmart Demonstration Projects

FireSmart demonstration projects for publicly owned buildings or public and provincially owned critical infrastructure (as identified in Section 3.2) can display the practices and principles of FireSmart to the public. This may be in the form of replacing building materials with fire resistant materials, replacing landscaping with fire-resistant plants, and demonstration HIZ fuel treatments. Appropriate/candidate FireSmart demonstration projects may be identified by the CPM based on assessment by internal trained Local FireSmart Representatives or external Local FireSmart Representative consultant.

RECOMMENDATION #21: The City should apply for a FireSmart demonstration grant through the CRI program. This type of fuel treatment can display the practices and principles of FireSmart activities to the public in the form of demonstration treatments. These small projects are not necessarily completed to reduce fire behaviour or increase stand resiliency in any measurable way, but instead are prioritized more by their visibility to the public and combining the treatment with elements of public education (signage, community work days, public tours, active demonstrations of operations).

FireSmart Activities for Private Land

The best approach to mitigate fuels on private lands is to urge private landowners to comply with FireSmart guidelines and to conduct appropriate fuel modifications using their own resources (CRI program funding may be available subject to current funding requirements). The CPM can facilitate uptake within the community by: 1) supporting and/or facilitating planning for private land; 2) offering local rebate programs to homeowners on private land who complete eligible FireSmart activities on their properties; 3) providing off-site debris disposal for private landowners who undertake their own vegetation management (with a focus on pruning, yard and thinning debris). Off-site debris disposal

options include providing a dumpster, and chipper or other collection method. Planning for private land may include facilitating FireSmart Community Plans (i.e., for a WUI neighbourhood, community, or subdivision) and conducting FireSmart home and property assessments.

RECOMMENDATION #22: Develop and implement a community chipper program with the help of neighbourhood representatives. As a demonstration, this program can begin twice per year in two separate neighbourhoods. This program can also be implemented in conjunction with community clean up days. Apply for CRI funding to establish the Community Local Rebate program.

FireSmart Compliance within the AOI

As could be expected, there is a wide range of FireSmart compliance on private properties in the AOI. There are large differences in the degree to which FireSmart best practices are visible within individual HIZs, and in neighbourhoods throughout the City. Landscaping in the AOI is also in a range of FireSmart compliance. Generally speaking, most homes in interface areas do not maintain 10 m defensible space. These areas and neighborhoods include Heritage Woods, subdivisions adjacent to Bert Flinn Park on the north shore of Burrard Inlet, and homes adjacent to creek ravines and riparian corridors such as Noons Creek. Particularly in new developments, greatest concerns exist in relation to ubiquity of flammable landscaping options (i.e., cedar hedging) in proximity to residences, across all aforementioned areas; additionally, there is a general lack of defensible space between property footprints and adjacent forested areas. Otherwise, bark mulch is commonly used as a landscaping material within the HIZ, and accumulations of conifer foliage in roof corners and gutters are not uncommon. Storage of combustible items under decks, carports, and other horizontal surfaces was also noted. On the other hand, many residences are surrounded by lawn, 10 m defensible space, and/or hardscaping (rocks), all of which are FireSmart compliant. Within the CPM, homes adjacent to sports fields, cleared industrial sites, water bodies, or utility rights-of-way exhibiting routine vegetation management had the highest FireSmart compliance rate. Overall, most neighbourhoods within the CPM represent the full spectrum of FireSmart compliance rates ranging from no defensible space with wood constructions to completely FireSmart compliant homes.

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

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

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

5.2.3 Priority Areas within the AOI for FireSmart

The identified areas where FireSmart activities have been prioritized are outlined in Table 12 and neighbourhood names are consistent with the neighbourhood planning areas identified in the OCP. These priorities are based on general field observations, and discussion with the CPM; they are not based on a scientific sample or formal data collection. Recommended FireSmart activities are essentially the same for each neighbourhood or area; however, it is recommended that the CPM prioritize the neighbourhoods in Table 12. In addition, every neighbourhood (including the downtown and surrounding areas) within the AOI should continue and improve upon existing FireSmart activities and equally participate in the CPM's FireSmart program.

Table 12. 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
Priority Area #1: Heritage Woods	E	N	N	The following is a non-extensive list of FireSmart activities for which the City can engage suggested neighbourhood residents: 1) Provide guidance to ensure landscaping complies to the FireSmart standard; 2) Incentivise private landowners to engage in retrofitting homes with building materials and design based on NFPA 1144 or FireSmart standards; 3) Encourage prompt removal of combustible construction materials or yard waste from private properties; and 4) Coordinate monthly or bi-monthly yard waste removal with the City's existing green waste weekly pick-up prior to and during the fire season to reduce WUI fire hazard; 5) Promote FSCRP (FireSmart Community Recognition Program) status for each neighbourhood; and 6) Conduct ongoing community engagement and education in partnership with Metro Vancouver and BCWS.
Priority Area #2: Twin Creeks	H	N	N	
Priority Area #2: April Road/ Pleasantside	H	N	N	
Priority Area #3: Heritage Mountain	M	N	N	
Priority Area #4: Noons Creek	H	N	N	
Priority Area #6: Critical infrastructure (i.e., utility infrastructure sites)	M	Y	N	Based on field observations, most critical infrastructure has had some level of FireSmart setback from forested areas. Consider conducting frequent (2-3 years) maintenance treatments to ensure the wildfire risk does not reach higher than moderate. It is recommended that fuel treatments be considered for areas adjacent to critical infrastructure in order to bolster the effect of previous FireSmart treatments. FireSmart treatments may include thinning from below to reduce ladder fuels and crown fire potential, pruning of retained trees to 3 m, and reducing surface fuels. Additionally, consider adding regular brushing activities to the maintenance treatment schedule to control weeds and grasses around critical infrastructure.

5.3 COMMUNICATION AND EDUCATION

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

Based on the consultation completed during the development of this Plan, it is evident that CPM staff and some residents have a good level of awareness of interface fire risk and the CPM is committed to build upon past FireSmart education initiatives through public engagement and outreach. Some of the initiatives the CPM has undertaken include:

1. Staff attendance at four City-sponsored events each year educating citizens on the FireSmart Program. FireSmart questions are answered and educational materials are handed out;
2. Staff have conducted FireSmart blitzes in which identified areas in the City are visited with staff going door to door speaking in person with residents. If no one is home, door hangers are left behind with information on FireSmart and direction on how information on the FireSmart Program and CPM's Emergency Preparedness can be accessed;
3. In May 2019, PMFR conducted the first annual FireSmart Presentation, open to all CPM residents, at Heritage Woods Secondary High School. Included on the itinerary was a panel of local experts from BCWS, Metro Vancouver, District of North Vancouver, the local FireSmart member, EMBC, and CPM Parks Department;
4. Four large FireSmart flags have been displayed at all PMFR FireSmart events;
5. Distribution of FireSmart events and opportunities through both PMFR and City of Port Moody's social media accounts, as well as displaying and regularly updating the current Fire Rating for the area on the PMFR's website. Additionally, wildfire safety and FireSmart information is provided on the PMFR's website; and
6. The installation of a new Fire Danger sign at the intersection of Murray St, and Ioco Rd. This sign is updated every Monday and Thursday throughout the fire season.

However, field observations confirmed the need for ongoing community education at large, on how private land owners can build a FireSmart community and take personal responsibility for the ignition potential of their homes, businesses, lands, and neighbourhoods. Often, the risk of wildfire is at the forefront of public awareness during or after major wildfire events, whether close to home or further afield. The challenge is to retain this level of awareness outside these times. The communication and education objectives for the CPM are:

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

Bringing organizations together to address wildfire issues that overlap physical, jurisdictional or organizational boundaries is a good way to help develop interagency structures and mechanisms to reduce wildfire risk. Engagement of various stakeholders can help with identifying valuable information about the landscape and help provide unique and local solutions to reducing wildfire risk. The CPM should consider creating/formalizing an Interface Steering Committee to coordinate wildfire risk reduction efforts. The steering committee could include key stakeholders such as CPM staff, PMFR, Metro Vancouver, BCWS, recreational groups/representatives, utility providers, and industrial operators.

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

RECOMMENDATION #23: Port Moody media (The Now, Tri-City News) should be engaged on the issue of interface wildfire risk with the intention of capturing a wider segment of the area's population. More frequent and regular contact with the media can improve the transfer of information to the public.

RECOMMENDATION #24: This CWPP Update report and associated maps should be made publicly available through webpage, social media, and public FireSmart meetings. Re-visit the CPM's social media strategy and ensure that its full power is leveraged to communicate fire bans, high or extreme Fire Danger days, wildfire prevention initiatives and programs, easily implementable FireSmart activities, updates on current fires and associated air quality, road closures, and other real-time information in an accurate and timely manner.[52]

RECOMMENDATION #25: Continue to promote FireSmart approaches for wildfire risk reduction to CPM residents through various engagement and education events. Aim to conduct these engagement/promotion campaigns prior to and during the fire season when public attention to wildfire issues is high. Continue supplying FireSmart materials to homeowners in the interface during these engagement campaigns.

[52] Appendix L has general communication and social media information.

RECOMMENDATION #26: The CPM should also continue to hold the annual wildfire presentation evening every spring prior to the start of the fire season, and consider organizing the wildland specific Fire Prevention Day or Week, or similarly formatted event as well. Timely educational materials to increase preparedness would be most effective immediately prior to the fire season.

RECOMMENDATION #27: Complete or schedule periodic updates of the CWPP to gauge progress and update the threat assessment (hazard mapping) for changes in fuels, forest health, land planning, stand structure or changes to infrastructure in the interface. The frequency of updates is highly dependent upon major changes which would impact the CPM's wildfire threat assessment or the rate at which wildfire risk reduction efforts are implemented. An evaluation of major changes (including funding program changes that may lead to new opportunities) should be initiated every 5 - 7 years.

RECOMMENDATION #28: Facilitate the FSCCRP uptake within the CPM and enhance its applications by including the following: 1) inviting BCWS crews to participate in and support the annual FireSmart events set up by participating neighbourhoods. 2) Encourage individual homeowner participants to complete the self-administered FireSmart home assessment tool. 3) Include within the FireSmart Canada Community Assessment Report the standard recommendation that participating neighbourhoods hold a home hazard assessment workshop as one of their FireSmart events.

RECOMMENDATION #29: Promote the use of the FireSmart Home Partners Program offered by the Partners in Protection Association, which facilitates voluntary FireSmart assessments on private property. Use the opportunity to educate the home or business owner about the hazards which exist on their property and provide easy improvements to reduce their risk.

RECOMMENDATION #30: The CPM should consider developing a school fire education program to include an element of wildfire preparedness education to be presented annually in elementary and secondary schools. Programming could include volunteer/advocacy work from professional foresters, wildland firefighters or prevention officers, and CPM staff.

5.4 OTHER PREVENTION MEASURES

In addition to fuel treatment and community communication and education, fire prevention in the AOI is also addressed via the following avenues: 1) public display of danger class rating signs throughout the AOI; 2) fire ban alignment with provincial fire bans; 3) potential enforcement of restricted access to regional park trails are similar to provincial requirements; and 4) enforcement of local bylaws such as the Smoking Regulation Bylaw 1488 and Unsightly Premises Bylaw 2773. The aforementioned activities are either currently being applied or have potential to be applied in order to reduce the potential and threat of wildfire ignitions within the AOI.

Risk of human-caused ignition within the AOI is not limited to private property owners and individual residents. Power lines and industrial activities pose a risk of ignition, particularly in areas where cured fuels or fuel accumulations exist. Tree failures adjacent to power lines (transmission and distribution) are common occurrences and represent significant risks to ignition within the AOI. A cooperative

approach for addressing the industrial area concerns must be undertaken by the CPM and pertinent industrial partners.

RECOMMENDATION #31: Amend the Unsightly Premise Bylaw No. 1488, and insert a clause that states PMFR can conduct an inspection to determine fuel sources, ignition potential, or to determine if a FireSmart assessment is warranted.

RECOMMENDATION #32: Work with industrial operators such as BC Hydro and FortisBC to ensure that high risk activities, such as grubbing/brushing and right-of-way mowing work do not occur during high fire danger times to reduce chance of ignitions as per the *Wildfire Act*. It is recommended that communications are coordinated via weekly fire calls.

RECOMMENDATION #33: Work with industrial operators (i.e., BC Hydro) to ensure that rights-of-way do not contain fine fuel accumulations (< 7.5 cm, easily cured) and significant regeneration of conifer vegetation prior to and during the fire season and are maintained in a low hazard state (to serve as fuel breaks).

SECTION 6: WILDFIRE RESPONSE RESOURCES

This section provides a high-level overview of the local government resources accessible for emergency response and preparedness use. Accordingly, in emergency situations when multiple fires are burning in different areas of the Province, resource availability may be scarce. Therefore, local government preparedness and resource availability are critical components of efficient wildfire prevention and planning. Deployment of provincial resources occurs as per the process detailed in the *Provincial Coordination Plan for Wildland Urban Interface Fires* document[53]. The aforementioned document establishes a protocol for collaborative and integrated emergency management in the event of WUI fires within British Columbia.

6.1 LOCAL GOVERNMENT FIREFIGHTING RESOURCES

Firefighting efforts and effectiveness can be affected by access to secondary power sources, water pressure and supply, and existing local government contingency plans. In the event of a wildfire emergency situation and loss of power, Emergency Management has access to a large diesel generator with power cords and lights to deploy throughout the City on request, if not required in the EOC. The generator was built on a deck that the fire hall Squad Truck can quickly pick up and deliver to the designated location. Engineering and Operations has two mobile generators that are used for backup power at water and sewer utility sites. Standby backup power generators are in place at City Hall and Inlet Centre Fire Hall (ICFH), with the City Hall unit fueled by natural gas. However, should a wide-scale outage occur, known vulnerabilities to secondary power sources include mechanical failure and potential fuel shortages. Some areas of the City near interface zones, such as the area around Belcarra

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

Regional Park, are not serviced by the City's water distribution system. Specific limitations of the CPM water system with regards to wildfire suppression are detailed in Section 6.1.2.

Formal mutual aid agreements are in effect between the Tri-Cities fire departments and non-formal agreements with many other neighbouring jurisdiction fire departments within the Metro Vancouver area. In the past, the CPM has assisted Richmond Fire Rescue with their bog fire (2018) and the District of Kent with the Mt. Hicks fire (2018). In the event of a WUI fire emergency, mutual aid for the CPM is activated, as required, from the fire departments of neighbouring jurisdictions. WUI fire events may also lead to aid requests with BCWS.

6.1.1 Fire Department and Equipment

The City of Port Moody Fire and Rescue (PMFR) is a well-resourced, highly organized department which is able to provide high quality emergency and public safety services to the CPM and surrounding area. Fire protection within the AOI is the responsibility of PMFR, operating out of two fire halls with approximately 45 career members and 20 volunteer members. The Fire Service Area includes the entirety of the City of Port Moody municipal boundary: approximately 3,282 ha of land. Outside the municipal boundary and contracted response area, the PMFR has mutual aid agreements with the City of Coquitlam Fire and Rescue and the City of Burnaby Fire Department as well as other local fire departments. City of Coquitlam Search and Rescue is a resource the CPM could request through Emergency Management British Columbia (EMBC). Port Moody Police (PMPD) would make the request for the assistance of neighbouring RCMP resources. Table 13 provides an overview of the fire services capacity in the AOI, including fire department personnel and equipment.

Table 13. Fire department capacity and equipment within the AOI.

Fire Protection Zone	Fire Department	Number of Stations	Number of Members	Apparatus type and number
City of Port Moody	Port Moody Fire Rescue	2	45 paid career and 20 volunteer members	**Structural Fire Equipment:** 4 Fire Engines, 1 Ladder Truck, 1 Rescue Truck, 1 Equipment Truck, 1 Command Truck **Wildfire Equipment:** Hook Lift Truck, SPU Pod, Type 5 Engine Deck Pod (400-gallon water tank, 20 hp pump), Flat Deck Pod, UTV, SPU trailer, various pumps and water storage capabilities to support SPU setup in remote location, hand tools.

Carreer and volunteer staff of the PMFR undergo significant training focused on structural firefighting and variable levels of training (at least once per year) related to wildfire, including annual Structure Protection Program (SPP). Currently the PMFR has 45 paid and 20 volunteer members both trained in

the Sprinkler Protection Training (WSPP-115) and in basic fire suppression and safety (S-100). S-100 training is delivered internally through the PMFR's Training Division.

The PMFR-owned wildfire fighting equipment includes a hook lift truck, which has the capabilities of being modified with various attachments, such as a sprinkler protection unit pod – to protect multiple residential units at once, a type 5 engine deck pod – equipped with a 400 gallon water tank connected to a 20 horse power pump with multiple quick response fire hose options, and a flat deck pod – which has the ability to transport a Utility Terrain Vehicle for initial reconnaissance and quick detainment. The PMFR is also equipped with a sprinkler protection unit trailer, used to protect multiple residences from wildfire, and also various other pumps and water storage capacities and quick response hand tools for fire spread containment in remote areas.

The level of cross-training and working relationship with MFLNRORD's BCWS is moderate (with no regular/formalized cross-training), though annual engagement activities with Metro-Vancouver and with BC Wildfire Service do take place when required. Cross-training with the BCWS would enable the local fire departments to prepare its responders with the technical and practical firefighting experience in order to action both structural and wildland fires.

6.1.2 Water Availability for Wildfire Suppression

Water is the single most important suppression resource. In an emergency response scenario, it is critical that a sufficient water supply be available. The Fire Underwriters Survey summarizes their recommendations regarding water works systems fire protection requirements, in *Water Supply for Public Fire Protection* (1999).[54] Some key points from this document include the need for:

- Duplication of system parts in case of breakdowns during an emergency;
- Adequate water storage facilities;
- Distributed hydrants, including hydrants at the ends of dead-end streets;
- Piping that is correctly installed and in good condition; and
- Water works planning should always take worst-case-scenarios into consideration. The water system should be able to serve more than one major fire simultaneously, especially in larger urban centers.

Water service within the City of Port Moody is an important component of emergency response for a wildland urban interface fire in the event of a large-scale emergency, and in particular for structural fires. For suppression within the AOI, hydrant service is provided within the fire services area boundaries at varying levels of coverage.

[54] http://www.scm-rms.ca/docs/Fire%20Underwriters%20Survey%20-%201999%20Water%20Supply%20for%20Public%20Fire%20Protection.pdf

The area north of First Avenue, including Bedwell Bay Road, is not serviced by the City's water system and has no hydrants. Steep terrain and long distances can affect access to hydrants in the Chineside area, as well as areas along Barnet Highway west of Union Street.

The northern half of the City is dependent upon a water distribution system that brings water from Metro Vancouver's supply at Guildford Drive through a system of pump stations and reservoirs to the highest elevation of Heritage Woods. If this system should fail from a water main break or mechanical issue, there is limited redundancy to continue supplying water to the northern half of the City, as well as the Village of Anmore. Municipal interconnections with the City of Coquitlam can supply water on a limited basis in the event of an emergency, however these sources do not provide redundant fire flow capabilities. Potential measures to increase the redundancy and resiliency of the City's water distribution system should be identified and reviewed.

The PMFR has potential to draw from natural water sources such as Buntzen Lake, Sasamat Lake, numerous creeks and smaller ponds on the north shore of the City. The ocean can also be used to draft water, depending upon equipment, as a last resort. Natural water sources are known and mapped; however, static water sources can be severely impacted by summer drought and these are limited within the CPM to begin with.

RECOMMENDATION #34: Identify interface areas with hazardous fuels that have limited water distribution system access, including where hydrant distances exceed current bylaw and best practice requirements, and investigate feasibility of installing appropriate water infrastructure to suit fire suppression needs.

RECOMMENDATION #35: Wherever possible, ensure City fleet equipment, including tankers, sewer cleaning trucks, or other equipment, is configured to allow for use as water tenders to supplement water availability in areas not currently serviced by the water distribution system

RECOMMENDATION #36: Review improvements to ensure the City's water distribution system has redundant, resilient features deliver uninterrupted water supply in the event of an emergency.

6.1.3 Access and Evacuation

Road networks in a community serve several purposes including providing access for emergency vehicles, providing escape/evacuation routes for residents, and creating fuel breaks. Access and evacuation during a wildfire emergency often must happen simultaneously and road networks should have the capacity to handle both. In the event of a wildfire emergency, main egress routes include Barnet Highway and Highway 7A as well as arterial roads such as Ioco Rd, Heritage Mountain Blvd, David Ave, 1st Ave, Bedwell Bay Rd, and White Pine Beach Rd which provide access to and from developments and recreation areas located in interface areas within the City. Significant emergency evacuation concerns have been identified for Sasamat Lake and Belcarra Regional Park. There is currently no reliable

secondary exit or bypass from these areas to provide egress for large numbers of residents and visitors are vulnerable to wildfires and vehicular accidents. If a wildfire were to impact these roads or any of the major evacuation routes described above, smoke and poor visibility, car accidents, wildlife, and other unforeseen circumstances can further complicate evacuations and hinder safe passage.

Forest Park Way and Ioco Road provide the only egress routes from the Village of Anmore, while Bedwell Bay Road and Ioco Road are the only routes out of the Village of Belcarra.

Within the AOI, some of the critical infrastructure is reached via narrow and/or private, forested roads, which may impede suppression efforts and response times. Furthermore, there is a significant portion of land within the AOI which is inaccessible by roads. As such, a review of the fire protection area, accessibility issues, and the risks and benefits associated with the current fire protection jurisdiction is suggested.

Emergency access and evacuation planning is of particular importance in the event of a wildfire event or other large-scale emergency. The City of Port Moody has developed the *City of Port Moody Interface Fire Immediate Response Plan* for a detailed scenario of evacuation conducted by first responders during an interface fire. In the event of a wildfire emergency within the AOI, there will likely be pre-warning and preparation time to rollout the detailed three-phase planned evacuation which includes:

- Evacuation Alert that provides residents an uncertain amount of lead time to make preparations for potential evacuation (residents in high-risk areas should make preparations to evacuation even before an Alert is given);
- Evacuation Order that authorizes the police to order residents to evacuate for their own safety; and
- Evacuation Rescind which is given once it is safe for residents to return to their homes, provided they are still structurally sound.

As neighbourhoods will be delineated into zones relative to the fire danger, evacuation can occur in a methodical manner, zone by zone. It is recommended that the CPM's Evacuation Plan includes the following provisions:

- Mapping and identification of safe zones, marshaling points and aerial evacuation locations;
- Planning of traffic control and accident management;
- Identification of volunteers that can assist during and/or after evacuation; and
- Development of an education/communication strategy to deliver emergency evacuation procedures to residents.

Recreation trails built to support ATVs can provide access for ground crews and act as fuel breaks for ground fires, particularly in natural areas. Strategic recreational trail development to a standard that supports ATVs, and further to install gates or other barriers to minimize access by unauthorized users can be used as a tool that increases the ability of local fire departments to access interface areas.

The creation of a map book or spatial file that displays the trail network available for fire departments to access during an emergency or for fire suppression planning must accompany any fire access trail building activities. In order to effectively use the trails as crew access or fuel breaks during suppression efforts, it is recommended that an Emergency Access Classification Plan (EACP) be developed. This plan should be made available to the PMFR, other local fire departments (under mutual aid agreement), and the BCWS in the event that they are aiding suppression efforts on an interface fire in the AOI. The plan should include georeferenced maps with associated spatial data and ground-truthed locations of potential optimal firebreaks, identify the type of access available for each access route, identify those trails that are gated or have barriers, and provide information on how to unlock or remove barriers. The plan should also identify those natural areas where access is insufficient. Access assessment should consider land ownership, proximity of values at risk, wildfire threat, opportunities for use as fuel break or control lines, trail and road network linkages where fuel-free areas or burn off locations can be created or used as potential sprinkler locations; and requirements for future maintenance activities such as operational access for fuel treatments and other hazard reduction activities.

In addition to providing the safest, quickest, and easiest access routes for emergency crews, an EACP would minimize the need for using machinery or motorized access in an otherwise undisturbed area. This would reduce the risk of soil disturbance and other environmental damage, as well as reduce rehabilitation costs.

RECOMMENDATION #37: Participate in regular testing of, and updates to, and mock exercises for an interface fire event as outlined in the City of Port Moody Evacuation Response Plan and Interface Fire Immediate Response Plan. Target City-identified areas with potential entrapment issues (i.e. Heritage Woods, White Pine Beach Rd, Belcarra Regional Park, Bedwell Bay Rd) with signage and fuel treatments.

RECOMMENDATION #38: Consider developing a community wildfire pre-planning brochure that addresses the following: 1) locations of staging areas; 2) communications requirements (i.e., radio frequencies); 3) minimum resource requirements for structure protection in the event of an interface fire, and values at risk; and 4) maps of the area of interest. This brochure would be intended for internal distribution and use only

RECOMMENDATION #39: Develop an Emergency Access Classification Plan to map and inventory trail and road networks in natural areas for suppression planning. This plan should also identify and map evacuation routes (*i.e.* White Pine Beach Rd, Bedwell Bay Rd) and may inform future access improvements and should include identification of the location, widths, and weight limits of roads and bridges. The plan should be updated every five years, or more regularly, as needed to incorporate additions and/or changes. Georeferenced maps with ground-truthed locations of potential optimal firebreaks should also be developed as part of the EACP and shared with fire suppression personnel and BCWS to support emergency response in the event of a wildfire. The plan should be updated every five years, or more regularly, as needed to incorporate additions and/or changes.

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

6.1.4 Training

The PMFR maintains a current level of structural protection training. In addition, PMFR staff have attended FireSmart sponsored educational seminars to become Local FireSmart Representatives (LFR), and recently in April 2019 PMFR staff attended a Wild Fire Symposium in Penticton, BC. PMFR staff and volunteer firefighters currently have S100 and WSPP-115 training. In an effort to continually upgrade training and seek opportunities where PMFR staff can be exposed to all facets of wildland and interface fire suppression, it is recommended that the CPM consider providing members with SPP-WFF1 (or equivalent), to ensure currency with techniques, applications and procedures for wildland urban interface fire suppression. Provision of training opportunities for structural firefighters in the realm of wildland firefighting is critical to building capacity for suppression and emergency management at the local level. Until these course developments are complete, it is recommended that the fire department engage in yearly practical wildland fire training with BCWS.

The current level of communication between the PMFR and BCWS is dictated by fire season demands. A BCWS Area Commander assists with education and presentations for PMFR when required (based out of Inlet Firehall). Cross-training with the BCWS would enable PMFR to prepare its responders with the technical and practical firefighting experience in order to action both structural and wildland fires.

It is recommended that the PMFR work cooperatively with the BCWS (Fraser Fire Zone, Cultus/Haig Fire Base) to conduct yearly mock exercises, where information and technical/practical knowledge are shared, such as: fireline construction, Mark 3 pump operations, sprinkler protection, skid pack operations, portable water tank deployment, and wildland hose operations. These practices could also provide training to wildland crews on hydrant hookup methods, as well as provide an avenue to discuss working together on inter-agency fires. Additional training options could include engaging adjacent fire departments outside the AOI (i.e., City of Coquitlam Fire Rescue; Sasamat Volunteer Fire Department which provides fire services to the Village of Anmore and Village of Belcarra; and the City of Burnaby Fire Department) to conduct joint training so as to further strengthen regional emergency response and firefighting training.

RECOMMENDATION #41: PMFR should work with BCWS to initiate and maintain an annual structural and interface training program. As part of the training, it is recommended that annual reviews are conducted to ensure PPE and wildland equipment resources are complete, in working order, and the crews are well-versed in their set-up and use. It is recommended PMFR engage in yearly practical wildland fire training with BCWS and Metro Vancouver that covers at a minimum: pump, hose, hydrant, air tanker awareness, and deployment of SPUs. Interface training should include completion of a joint wildfire simulation exercise and safety training specific to wildland fire and risks inherent with natural areas. It is recognized that BCWS crew resources are limited and their availability and is highly dependent upon the current fire season and other BCWS priorities.

RECOMMENDATION #42: PMFR should engage in regular cadence of communication with the BCWS Fraser Fire Zone, Cultus/Haig Fire Base to foster a strong relationship and identify potential cooperative wildfire risk reduction opportunities.

RECOMMENDATION #43: Ensure that PMFR maintains the capability to effectively suppress wildland fires, through wildfire-specific training sessions. Ensure all PMFR members continue to have S-100 at a minimum, as well as WSPP-115 (training for structural firefighters on the use of wildfire pumps and hose, and fire service hose and hydrants in the application of structural protection units [SPUs]). Expand the training program to maintain a high level of member education and training specific to interface and wildland fires and ensure all PMFR members have SPP-WFF 1 (Wildland Firefighter Level 1 for structure firefighters[55]) or BCWS equivalent (S-100 and S-185). The fire department should continue the practice of staying up to date on wildfire training opportunities, and to train members in this capacity, as training resources/budgets allow.

RECOMMENDATION #44: Train CPM parks and utilities staff in S-100, particularly those who undertake a considerable amount of work in the wildland urban interface and in forested areas within the City. The nature of their jobs may allow these staff members to have an opportunity to provide immediate initial response and suppression before PMFR or BCWS are able to respond.

6.2 STRUCTURE PROTECTION

PMFR is well resourced in both structural and wildland fire suppression equipment. For example, both the Inlet and Glenayre Fire Halls have access to additional sprinkler protection which can be used in the event of an interface fire. The fire halls maintain a current level of training in both wildfire and structural firefighting (see Section 6.1.1 for additional detail). PMFR is equipped with one mobile Structural Protection Unit (SPU).

The UBCM owns four complete SPUs, each equipped to protect 30 – 35 structures. The kits are deployed by the MFLNRORD/BCWS incident command structure and are placed strategically across the province during the fire season based on fire weather conditions and fire potential. When the kits are not in use, they may be utilized by fire departments for training exercises. SPUs can be useful tools in the protection of rural/ interface homes in the event of a wildfire. An important consideration in protecting the WUI zone from fire is ensuring that homes can withstand an interface fire event. Structure protection is focused on ensuring that building materials and construction standards are appropriate to protect individual homes from interface fire. Materials and construction standards used in roofing, exterior siding, window and door glazing, eaves, vents, openings, balconies, decks, and porches are primary

[55] Office of the Fire Commissioner, 2013: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/fire-safety/wildfire/spp-wff1-info.pdf. The SPP-WFF 1 course is acceptable to BCWS for structure firefighters to action wildfires on their behalf. This training SPP-WFF 1 (or the S-100) is a prerequisite for all structure firefighters to participate on Structure Protection Crews as deployed provincially by the OFC.

considerations in developing FireSmart neighbourhoods. Housing built using appropriate construction techniques and materials in combination with fire resistant landscaping are less likely to be impacted by interface fires.

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

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

The structure protection objectives for the City of Port Moody are to:

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

RECOMMENDATION #45: Expand on existing programs which serve to remove barriers to action for homeowners by providing methods for them to cheaply and easily dispose of wood waste removed from their property. This could include scheduled community chipping opportunities, and/or yard waste dumpsters available by month in neighbourhood. Programs should be available during times of greatest resident activity (likely spring and fall).

REFERENCES

BCWS. 2018. Wildfire Causes. Retrieved from: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-response/fire-characteristics/causes

City of Port Moody. 2018 Annual Water Quality Report. Retrieved online from: https://www.portmoody.ca/en/city-hall/resources/Documents/2018_Annual_Water_Quality_Report.pdf.

City of Port Moody. Official Community Plan.2014.

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

DeGroot, W. J., M. D. Flannigan., A.S. Cantin. 2013. Climate Change impacts on future boreal fire regimes. Forest Ecology and Management (2013) 294: 35-44. Accessed online at https://doi.org/10.1016/j.foreco.2012.09.027.

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

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

Government of Canada. Wildfire Season Summary. Retrieved from: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-history/wildfire-season-summary

Green, R. N., and K. Klinka. 1994. A Field Guide for Site Identification and Interpretation for the Vancouver Forest Region. Land Management Handbook Number 28. Retrieved from: https://www.for.gov.bc.ca/hfd/pubs/docs/lmh/lmh28.pdf

Metro Vancouver. Climate Projections for Metro Vancouver Report. September 2016. The full report can be accessed here: http://www.metrovancouver.org/services/air-quality/climate-action/regional-program/Pages/default.aspx

Ministry of Forests, Lands and Natural Resource Operations. 2015. Coast Area 2015-2017 Coastal Timber Supply Area Forest Health Overview. Retrieved from: https://www.for.gov.bc.ca/ftp/HFP/external/!publish/Forest_Health/TSA_FH_Strategies/2015-Coast%20FH%20Strategy.pdf

Ministry of Forests, Lands and Natural Resource Operations. 2016. Extension note. Adapting natural resource management to climate change in the West and South Coast Regions. Accessed

online at: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/regional-extension-notes/coasten160222.pdf

Ministry of Forests, Lands and Natural Resource Operations. Pest Infestation Polygons. Accessed online at: https://catalogue.data.gov.bc.ca/pt_BR/dataset/pest-infestation-polygons (current as of September, 2017).

Ministry of Forests, Lands and Natural Resource Operations. 2018. Community Wildfire Protection Plan Template. Strategic Wildfire Prevention Working Group.

Pacific Climate Impacts Consortium. 2016. Climate Projections for Metro Vancouver. Retrieved September 18, 2019, from: http://www.metrovancouver.org/services/air-quality/AirQualityPublications/ClimateProjectionsForMetroVancouver.pdf

Price, D. T., R.I. Alfaro, K.J. Brown, M.D. Flannigan, R.A. Fleming, E.H. Hogg, M.P. Girardin, et al. 2013. Anticipating the Consequences of Climate Change for Canada's Boreal Forest Ecosystems. Environmental Reviews. 21 (4): 322–65. Retrieved from: https://www.nrcresearchpress.com/doi/full/10.1139/er-2013-0042#.XYj7FihKjcs

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

Thomson, A., Smith, B., and Alfaro, R. 2011. Growth patterns in immature and mature western hemlock stands infected with dwarf mistletoe. Canadian Journal of Forest Research. 14. 518-522. 10.1139/x84-096.

APPENDIX A – LOCAL WILDFIRE THREAT PROCESS

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

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

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

A-1 FUEL TYPE ATTRIBUTE ASSESSMENT

The Canadian Forest Fire Behaviour Prediction (FBP) System outlines five major fuel groups and sixteen fuel types based on characteristic fire behaviour under defined conditions.[56] Fuel typing is recognized as a blend of art and science. Although a subjective process, the most appropriate fuel type was assigned based on research, experience, and practical knowledge; this system has been used within BC, with continual improvement and refinement, for 20 years.[57] It should be noted that there are significant limitations with the fuel typing system which should be recognized. Major limitations include: a fuel typing system designed to describe fuels which do not occur within the AOI, fuel types which cannot accurately capture the natural variability within a polygon, and limitations in the data used to create initial fuel types.[57] Details regarding fuel typing methodology and limitations are found in Appendix G. There are several implications of the aforementioned limitations, which include: fuel typing further from the developed areas of the AOI has a lower confidence, generally; and, fuel typing should be used as a starting point for more detailed assessments and as an indicator of overall wildfire threat, not as an operational, or site-level, assessment.

Table 14 summarizes the fuel types by general fire behaviour (crown fire and spotting potential). In the AOI, the fuel type that may be considered hazardous in terms of fire behaviour and spotting potential is C-3. This fuel type can sometimes represent hazardous fuels, particularly if there are large amounts of woody fuel accumulations or denser understory ingrowth. C-5 fuel types have a moderate potential for active crown fire when wind-driven.[57] An M-1/2 fuel type can sometimes be considered hazardous, depending on the proportion of conifers within the forest stand; conifer fuels include those in the overstory, as well as those in the understory.

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

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

[57] Perrakis, D. and G. Eade. 2015. BC Wildfire Service. Ministry of Forests, Lands, and Natural Resource Operations. *British Columbia Wildfire Fuel Typing and Fuel Type Layer Description* 2015 Version.

Table 14. Fuel Type Categories and Crown Fire Spot Potential. Only summaries of fuel types encountered within the AOI are provided.

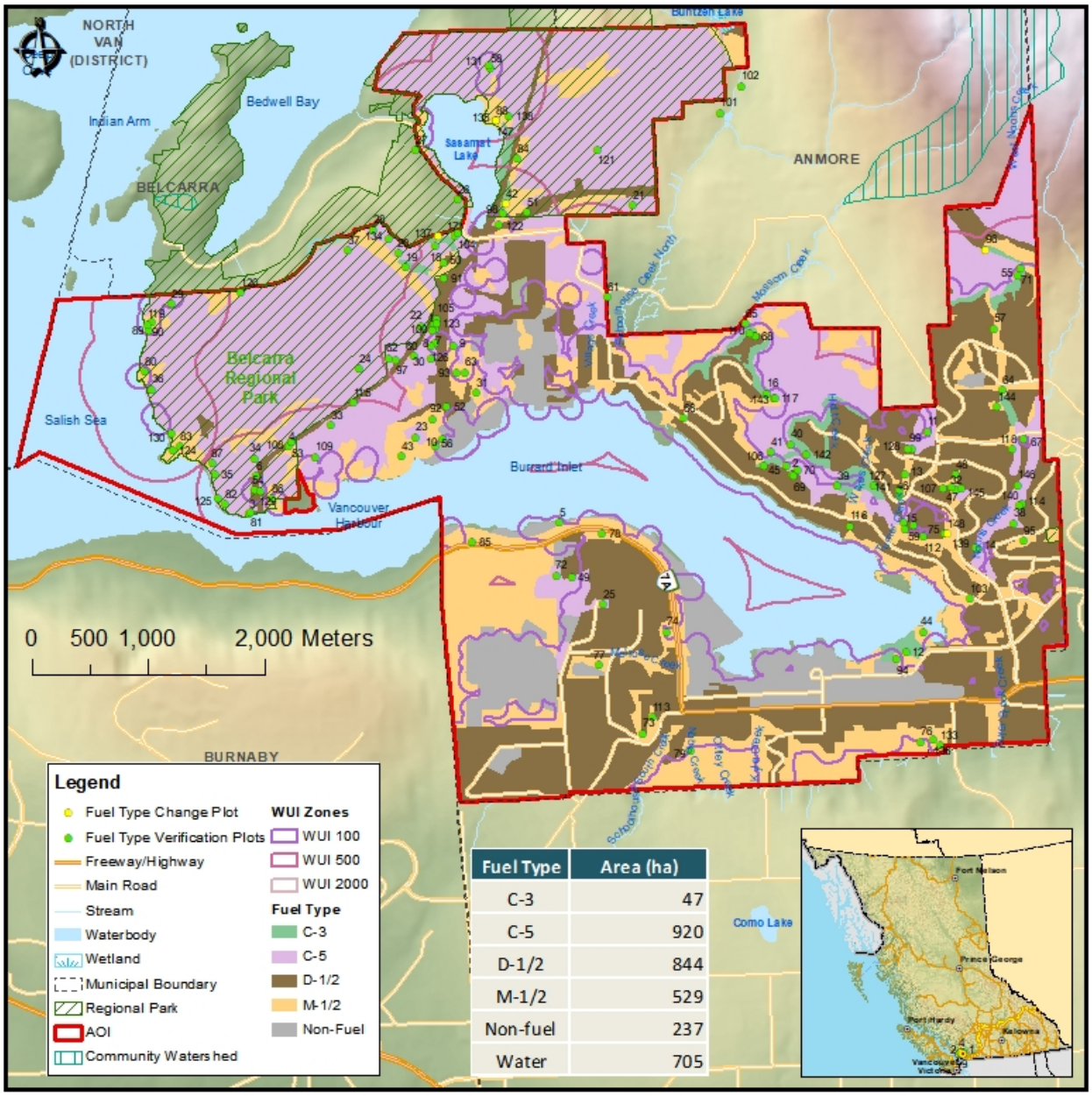
Fuel Type	FBP/CFDDRS Description	AOI Description	Wildfire Behaviour Under High Wildfire Danger Level	Fuel Type – Crown Fire/Spotting Potential
C-3	Mature jack or lodgepole pine	Fully stocked, late young forest (western redcedar, hemlock, and/or Douglas-fir), with crowns separated from the ground.	Surface and crown fire, low to very high fire intensity and rate of spread	High*
C-5	Red and white pine	Well-stocked mature forest, crowns separated from ground. Moderate understory herbs and shrubs. Often accompanied by dead woody fuel accumulations.	Moderate potential for active crown fire in wind-driven conditions. Under drought conditions, fuel consumption and fire intensity can be higher due to dead woody fuels	Low
M-1/2	Boreal mixed wood (leafless and green)	Moderately well-stocked mixed stand of conifers and deciduous species, low to moderate dead, down woody fuels.	Surface fire spread, torching of individual trees and intermittent crowning, (depending on slope and percent conifer)	<26% conifer (Very Low); 26-49% Conifer (Low); >50% Conifer (Moderate)
D-1/2	Aspen (leafless and green)	Deciduous dominated stands.	Always a surface fire, low to moderate rate of spread and fire intensity	Low
W	N/A	Water	N/A	N/A
N	N/A	Non-fuel: irrigated agricultural fields, golf courses, alpine areas void or nearly void of vegetation, urban or developed areas void or nearly void of forested vegetation.	N/A	N/A

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

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

- C3 fuel types being incorrectly identified by the PSTA as C5;
- M-1/2 fuel types identified as C-5;
- M-1/2 fuel types identified as D-1/2;
- M1/2 fuel types being identified as C3; and
- M1/2 fuel types identified as C5.

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



Fuel Type	Area (ha)
C-3	47
C-5	920
D-1/2	844
M-1/2	529
Non-fuel	237
Water	705

Map 8. Updated Fuel Type.

A-2 PROXIMITY OF FUEL TO THE COMMUNITY

Fire hazard classification in the WUI is partly dictated by the proximity of the fuel to developed areas within a community. More specifically, fuels closest to the community are considered to pose a higher hazard in comparison to fuels that are located at greater distances from values at risk. As a result, it is recommended that the implementation of fuel treatments prioritizes fuels closest to structures and/or developed areas, in order to reduce hazard level adjacent to the community. Continuity of fuel treatment is an important consideration, which can be ensured by reducing fuels from the edge of the community outward. Special consideration must be given to treatment locations to ensure continuity, as discontinuous fuel treatments in the WUI can allow wildfire to intensify, resulting in a heightened risk to values. In order to classify fuel threat levels and prioritize fuel treatments, fuels immediately adjacent to the community are rated higher than those located further from developed areas. Table 15 describes the classes associated with proximity of fuels to the interface.

Table 15. Proximity to the Interface.

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

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

A-3 FIRE SPREAD PATTERNS

Wind speed, wind direction, and fine fuel moisture condition influence wildfire trajectory and rate of spread. Wind plays a predominant role in fire behaviour and direction of fire spread and is summarized in the Initial Spread Index (ISI) Rose(s) from the local representative weather station, Seymour QD2 (Figure 4).[58] The ISI rose data is compiled hourly and provides an estimate of prevailing wind directions and wind speed in the area of the weather station.

During the fire season (April – October) winds are predominantly from the north and south directions, and to a lesser degree from the northeast and southeast, with wind speeds of 0-5 km/hour the majority of the time, increasing to 5-10 km/hour and occasionally gusting at 10-15 km/hour.

Winds occur from the north at speeds of 0-5 km/hour less than 20% of the time, and at speeds of 5-10 km/hour approximately 5% of the time and infrequently (<1%) occurring at speeds between 10-15 km/hr. Winds from the south occur at speeds of 0-5 km/hour less than 15% of the time and at speeds of 5-10 km/hour approximately 5% of the time. Winds occur least frequently from the northeast (just over 10% of the time), from the southeast (approximately 10% of the time), from the southwest (approximately 7% of the time) and from the northwest (approximately 6% of the time) in order of declining magnitude and frequency. The highest wind speeds (10 to 15 km/hour) tend to occur infrequently from the north and southwest during the fire season. Potential treatment areas were identified and prioritized with the predominant wind direction in mind; wildfire that occurs upwind of a value poses a more significant threat to that value than one which occurs downwind.

[58] Data provided by GVRD (Metro Vancouver).

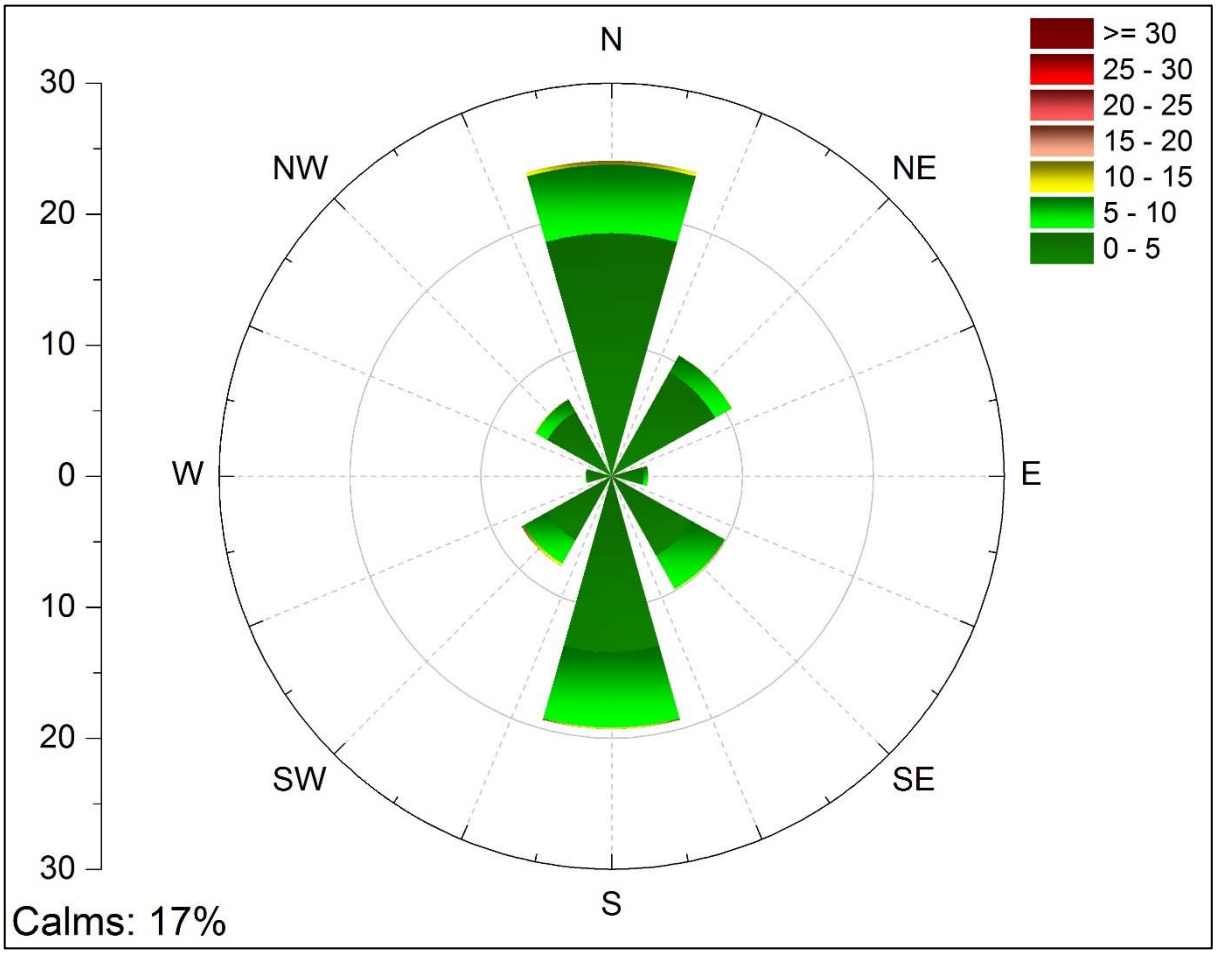


Figure 4. Wind rose for Seymour QD2 weather station based on hourly wind speed data during the fire season (April 1 – October 31) 2009-2018. The length of each bar represents the frequency of readings in percent and bar colour indicates the windspeed range.

A-4 TOPOGRAPHY

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

Slope Class and Position

Slope steepness affects solar radiation intensity, fuel moisture (influenced by radiation intensity) and influences flame length and rate of spread of surface fires. Table 16 summarizes the fire behaviour implications for slope percentage (the steeper the slope the faster the spread). In addition, slope position affects temperature and relative humidity as summarized in Table 17. A value placed at the bottom of the slope is equivalent to a value on flat ground (see Table 16). A value on the upper 1/3 of the slope would be impacted by preheating and faster rates of spread (Table 17). Nearly two-thirds of the AOI (64%) is on less than 20% slope and will likely not experience accelerated rates of spread due to slope class. It must be noted that this slope category also includes significant area of water. Approximately 13% percent of the AOI is likely to experience an increased or high rate of spread. On the larger topographic scale, the City and its industrial, commercial, recreational, and residential developments would be considered to be at the bottom of the slope through to the upper slope in the higher elevation residential areas (Heritage Woods) in the AOI. Some portions of recreational amenities and natural assets along creek ravines and corridors also occur in the higher elevation slope classes.

Table 16. Slope Percentage and Fire Behaviour Implications.

Slope	Percent of AOI	Fire Behaviour Implications
<20%	64%	Very little flame and fuel interaction caused by slope, normal rate of spread.
21-30%	22%	Flame tilt begins to preheat fuel, increase rate of spread.
31-45%	11%	Flame tilt preheats fuel and begins to bathe flames into fuel, high rate of spread.
46-60%	2%	Flame tilt preheats fuel and bathes flames into fuel, very high rate of spread.
>60%	0%	Flame tilt preheats fuel and bathes flames into fuel well upslope, extreme rate of spread.

Table 17. Slope Position of Value and Fire Behaviour Implications.

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

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

Provided separately as a PDF package.

APPENDIX C – WILDFIRE THREAT ASSESSMENT WORKSHEETS AND PHOTOS

Provided separately as a PDF package.

APPENDIX D – MAPS

Provided separately as a PDF package.

APPENDIX E – WILDLAND URBAN INTERFACE DEFINED

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

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

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

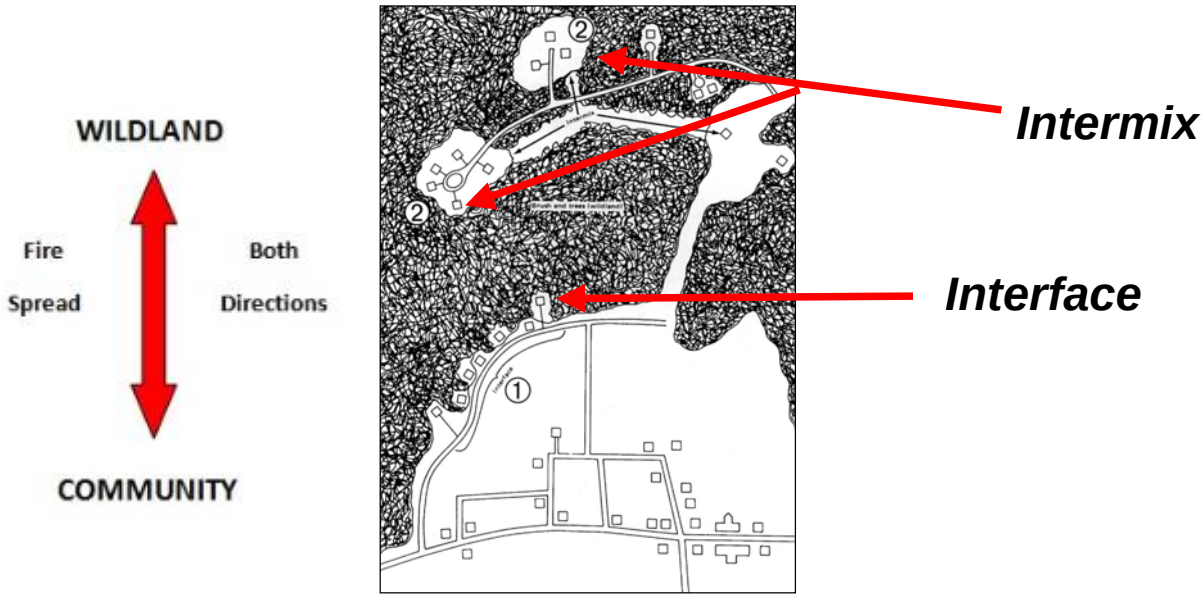


Figure 5. Illustration of intermix and interface situations.

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

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

1. From sparks or burning embers carried by the wind, or convection that starts new fires beyond the zone of direct ignition (main advancing fire front), that alight on vulnerable construction materials or adjacent flammable landscaping (roofing, siding, decks, cedar hedges, bark mulch, etc.) (Figure 6).
2. From direct flame contact, convective heating, conductive heating or radiant heating along the edge of a burning fire front (burning forest), or through structure-to-structure contact. Fire can ignite a vulnerable structure when the structure is in close proximity (within 10 meters of the flame) to either the forest edge or a burning house (Figure 7).

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

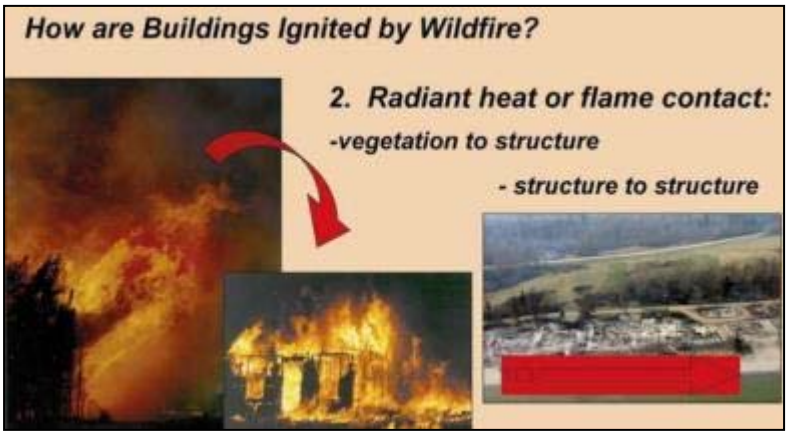


Figure 7. Radiant heat and flame contact allow fire to spread from vegetation to structure or from structure to structure.

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

APPENDIX F – WUI THREAT PLOT LOCATIONS

Table 18 displays a summary of all WUI threat plots completed during CWPP field work. The original WUI threat plot forms and photos will be submitted as a separate document. The following ratings are applied to applicable point ranges:

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

Table 18. Summary of WUI Threat Assessment Worksheets.

WUI Plot #	Geographic Location	Wildfire Behaviour Threat Class	WUI Threat Class
ADMIR-1	Admiralty Trail, Belcarra Regional Park	Moderate	N/A
ADMIR-2	Admiralty Trail, Belcarra Regional Park	Moderate	N/A
ADMIR-3	Upslope of Burrard Generating Plant	Moderate	N/A
BARB-1	Barber Street at the school	High	High
BEAR-1	Little Bear Trail, northeast CPM	Moderate	N/A
BEAR-2	Little Bear Trail, northeast CPM	Moderate	N/A
BEAR-3	Extent Forest near Little Bear Trail	Moderate	N/A
BED-1	Belcarra Regional Park, North	Moderate	N/A
BED-2	Belcarra Regional Park, North	High	High
BELC-1	Belcarra Regional Park	Moderate	N/A
BELC-2	Belcarra Regional Park	Moderate	N/A
BELC-3	Belcarra Regional Park	Moderate	N/A
BERT-1	Bert Flinn Trails	High	Extreme
BERT-2	Bert Flinn Trails	High	Extreme
BERT-3	Bert Flinn Trails	High	Extreme
BERT-4	Bert Flinn Trails	High	Extreme
BERT-5	Bert Flinn Trails	High	Extreme
ESCO-1	Escola Bay Road	High	High
FLAV-1	Flavelle Street Subdivision	High	High
GREEN-1	East of Deerwood Place	Moderate	N/A
HETT-1	Proximal to Hett Creek and Ioco Road	Moderate	N/A
INLET-1	Inlet Park	High	High
INLET-2	Inlet Park	Moderate	N/A
INLET-3	Inlet Park	Moderate	N/A
JACOB-1	Jacob and Forest Hills Roads	High	High
MOODY-1	Chineside Park	Moderate	N/A

WUI Plot #	Geographic Location	Wildfire Behaviour Threat Class	WUI Threat Class
MOODY-2	Chineside Park	Moderate	N/A
MOODY-3	Glenayre Drive	Moderate	N/A
NOON-1	Noons Creek	High	High
POW-1	BC Hydro Transmission Line, Heritage Woods	Extreme	High
POW-2	BC Hydro Transmission Line, Heritage Woods	Moderate	N/A
POW-3	Thermal Plant Road	Moderate	N/A
THOR-1	Cliffwood Dr, Heritage Woods	Extreme	High
WATER-1	Water Street	Moderate	N/A
WHIT-1	White Pine Beach Lake Rd	Moderate	N/A
WHIT-2	White Pine Beach Lake Rd	High	High
WOOD-1	Heritage Woods Secondary School, Blackberry Drive	Moderate	N/A

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

APPENDIX G – FUEL TYPING METHODOLOGY AND LIMITATIONS

The initial starting point for fuel typing for the AOI was the 2015 provincial fuel typing layer provided by BCWS as part of the *2015 Provincial Strategic Threat Analysis* (PSTA) data package. This fuel type layer is based on the FBP fuel typing system. PSTA data is limited by the accuracy and availability of information within the Vegetation Resource Inventory (VRI) provincial data; confidence in provincial fuel type data is very low on private land. The PSTA threat class for all private land within the AOI was not available. Fuel types within the AOI have been updated using ortho-imagery of the AOI with representative fuel type calls confirmed by field fuel type verification. Polygons not field-verified were assigned fuel types based upon similarities visible in orthophotography to areas field verified. Where polygons were available from the provincial fuel typing layer, they were utilized and updated as necessary for recent harvesting, development, etc.

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

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

For information on the provincial fuel typing process used for PSTA data as well as aiding in fuel type updates made in this document, please refer to Perrakis and Eade, 2015.[59]

[59] Ibid.

APPENDIX H – WUI THREAT ASSESSMENT METHODOLOGY

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

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

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

- AOI
- Fire Threat
- Fuel Type
- Proposed Treatment
- Threat Plot.

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

Field Data Collection

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

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

1. Update fuel-typing using orthophotography provided by the client and field verification.
2. Update structural data using critical infrastructure information provided by the client, field visits to confirm structure additions or deletions, and orthophotography
3. Complete field work to ground-truth fuel typing and threat ratings (completed 37 WUI threat plots on a variety of fuel types, aspects, and slopes and an additional 314+ field stops with qualitative notes, fuel type verification, and/or photographs)
4. Threat assessment analysis using field data collected and rating results of WUI threat plots – see next section.

Spatial Analysis

Not all attributes on the WUI Threat Assessment form can be determined using a GIS analysis on a landscape/polygon level. To emulate as closely as possible the threat categorization that would be determined using the Threat Assessment form, the variables in Table 19 were used as the basis for building the analytical model. The features chosen are those that are spatially explicit, available from existing and reliable spatial data or field data, and able to be confidently extrapolated to large polygons.

Table 19. Description of variables used in spatial analysis for WUI wildfire threat assessment.

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

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

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

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

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

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

- fuel scores were reviewed and applied to the fuel type in which the threat plot was completed;
- conservative fuel scores were then applied to the polygons by fuel type to check the initial assessment;

- high Wildfire Behaviour Threat Class polygons were reviewed in google earth to confirm their position on slope relative to values at risk.

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

Limitations

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

The threat assessment is based largely on fuel typing, therefore the limitations with fuel typing accuracy (as detailed in Appendix G – Fuel Typing Methodology and Limitations) impacts the threat assessment, as well.

APPENDIX I – PRINCIPLES OF FUEL MANAGEMENT

Fuel or vegetation management is a key element of the FireSmart approach. Given public concerns, fuel management is often difficult to implement and must be carefully rationalized in an open and transparent process. Vegetation management should be strategically focused on minimizing impact while maximizing value to the community. The decision whether or not to implement vegetation management must be evaluated against other elements of wildfire risk reduction to determine the best avenue for risk reduction. The effectiveness of fuel treatments is dependent on the extent to which hazardous fuels are modified or removed and the treatment area size and location (strategic placement considers the proximity to values at risk, topographic features, existing fuel types, etc.) in addition to other site-specific considerations. The longevity of fuels treatments varies by the methods used and site productivity.

What is Fuel Management?

Fuel management is the planned manipulation and/or reduction of living and dead forest fuels for land management objectives (*e.g.*, hazard reduction). Fuels can be effectively manipulated to reduce fire hazard by mechanical means, such as tree removal or modification, or abiotic means, such as prescribed fire. The goal of fuel management is to lessen potential fire behaviour proactively, thereby increasing the probability of successful containment and minimizing adverse impacts to values at risk. More specifically, the goal is to decrease the rate of fire spread, and in turn reduce fire size and intensity, as well as crowning and spotting potential (Alexander, 2003).

Fire Triangle:

Fire is a chemical reaction that requires fuel (carbon), oxygen and heat. These three components make up the fire triangle and if one is not present, a fire will not burn. Fuel is generally available in adequate quantities in the forest. Fuel comes from living or dead plant materials (organic matter). Trees and branches lying on the ground are a major source of fuel in a forest. Such fuel can accumulate gradually as trees in the stand die. Fuel can also build up in large amounts after catastrophic events such as insect infestations. Oxygen is present in the air. As oxygen is used up by fire it is replenished quickly by wind. Heat is needed to start and maintain a fire. Heat can be supplied by nature through lightning or people can be a source through misuse of matches, campfires, trash fires and cigarettes. Once a fire has started, it provides its own heat source as it spreads through a fuel bed capable of supporting it.

Forest Fuels:

The amount of fuel available to burn on any site is a function of biomass production and decomposition. Many of the forest ecosystems within BC have the potential to produce large amounts of vegetation

biomass. Variation in the amount of biomass produced is typically a function of site productivity and climate. The disposition or removal of vegetation biomass is a function of decomposition. Decomposition is regulated by temperature and moisture. In wet maritime coastal climates, the rates of decomposition are relatively high when compared with drier cooler continental climates of the interior. Rates of decomposition can be accelerated naturally by fire and/or anthropogenic means.

A hazardous fuel type can be defined by high surface fuel loadings, high proportions of fine fuels (<1 cm) relative to larger size classes, high fuel continuity between the ground surface and overstory tree canopies, and high stand densities. A fuel complex is defined by any combination of these attributes at the stand level and may include groupings of stands.

Surface Fuels:

Surface fuels consist of forest floor, understory vegetation (grasses, herbs and shrubs, and small trees), and coarse woody debris that are in contact with the forest floor. Forest fuel loading is a function of natural disturbance, tree mortality and/or human related disturbance. Surface fuels typically include all combustible material lying on or immediately above the ground. Often roots and organic soils have the potential to be consumed by fire and are included in the surface fuel category.

Surface fuels that are less than 7 cm in diameter contribute to surface fire spread; these fuels often dry quickly and are ignited more easily than larger diameter fuels. Therefore, this category of fuel is the most important when considering a fuel reduction treatment. Larger surface fuels greater than 7 cm are important in the contribution to sustained burning conditions, but, when compared with smaller size classes, are often not as contiguous and are less flammable because of delayed drying and high moisture content. In some cases, where these larger size classes form a contiguous surface layer, such as following a windthrow event or wildfire, they can contribute an enormous amount of fuel, which will increase fire severity and the potential for fire damage.

Aerial Fuels:

Aerial fuels include all dead and living material that is not in direct contact with the forest floor surface. The fire potential of these fuels is dependent on type, size, moisture content, and overall vertical continuity. Dead branches and bark on trees and snags (dead standing trees) are important aerial fuels. Concentrations of dead branches and foliage increase the aerial fuel bulk density and enable fire to move from tree to tree. The exception is for deciduous trees where the live leaves will not normally carry fire. Numerous species of moss, lichens, and plants hanging on trees are light and easily ignited aerial fuels. All of the fuels above the ground surface and below the upper forest canopy are described as ladder fuels.

Two measures that describe crown fire potential of aerial fuels are the height to live crown and crown closure (Figure 8 and Figure 9). The height to live crown describes fuel continuity between the ground surface and the lower limit of the upper tree canopy. Crown closure describes the inter-tree crown continuity and reflects how easily fire can be propagated from tree to tree. In addition to crown closure,

tree density is an important measure of the distribution of aerial fuels and has significant influence on the overall crown and surface fire conditions (Figure 10). Higher stand density is associated with lower inter tree spacing, which increases overall crown continuity. While high density stands may increase the potential for fire spread in the upper canopy, a combination of high crown closure and high stand density usually results in a reduction in light levels associated with these stand types. Reduced light levels accelerate self-tree pruning, inhibit the growth of lower branches, and decrease the cover and biomass of understory vegetation.

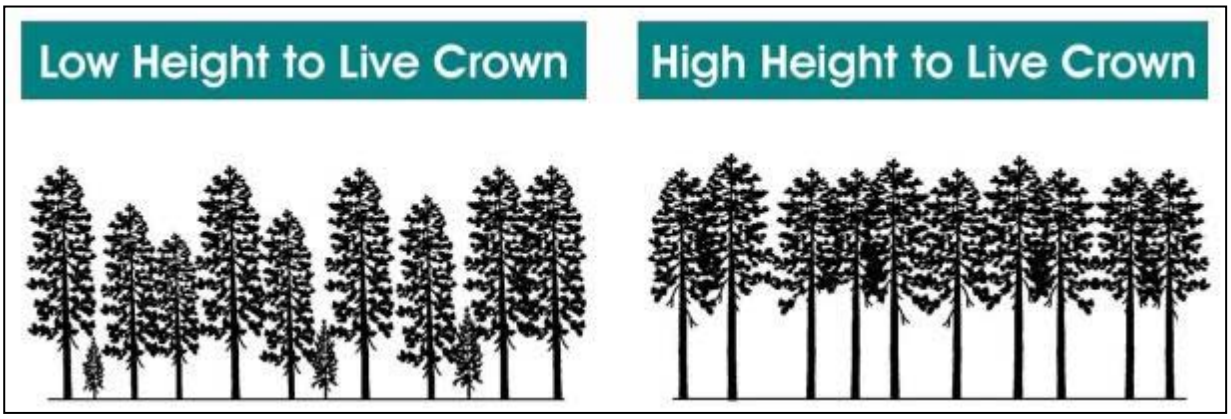


Figure 8. Comparison of stand level differences in height-to-live crown in an interior forest, where low height to live crown is more hazardous than high height to live crown.

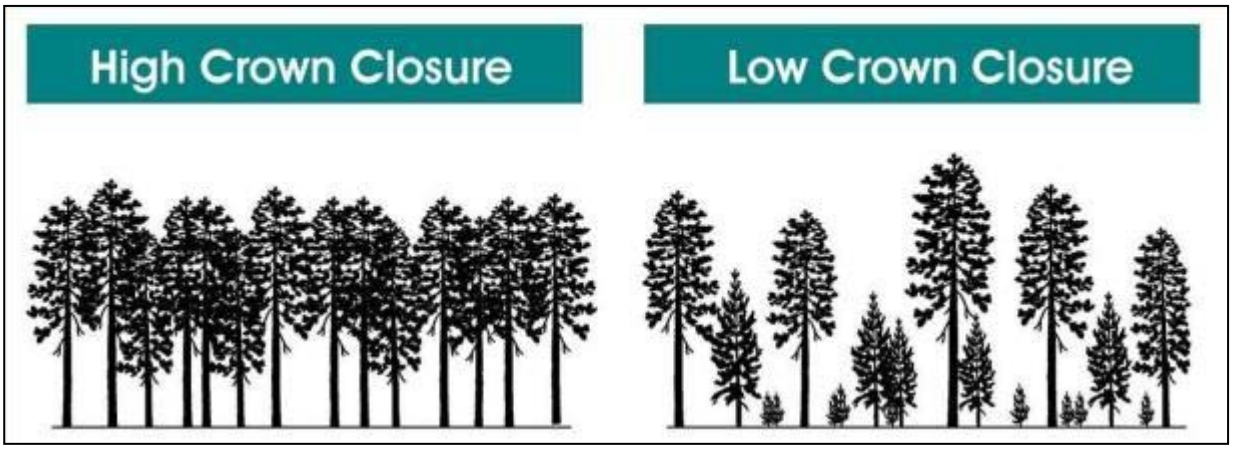


Figure 9. Comparison of stand level differences in crown closure, where high crown closure/continuity contributes to crown fire spread, while low crown closure reduces crown fire potential.

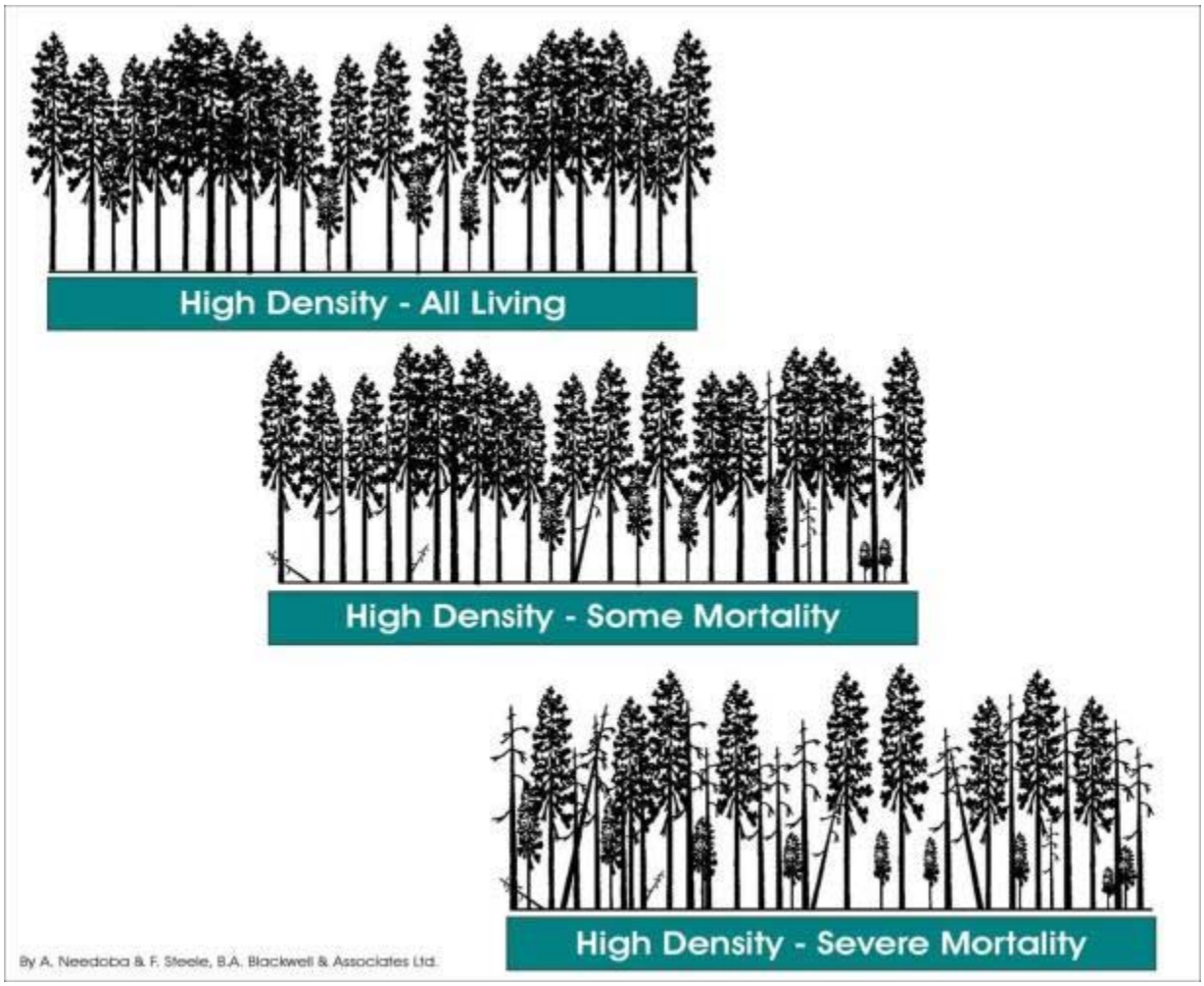


Figure 10. Comparison of stand level differences in density and mortality, and the distribution of live and dead fuels in these types of stands.

Thinning is a preferred approach to fuel treatment (Figure 11.) and offers several advantages compared to other methods:

- Thinning provides the most control over stand level attributes such as species composition, vertical structure, tree density, and spatial pattern, as well as the retention of snags and coarse woody debris for maintenance of wildlife habitat and biodiversity.
- Unlike prescribed fire treatments, thinning is comparatively low risk, and is less constrained by fire weather windows.
- Thinning may provide marketable materials that can be utilized by the local economy.
- Thinning can be carried out using sensitive methods that limit soil disturbance, minimize damage to leave trees, and provide benefits to other values such as wildlife.

The main wildfire objective of thinning is to shift stands from having a high crown fire potential to having a low surface fire potential. In general, the goals of thinning are to:

- Reduce stem density below a critical threshold to minimize the potential for crown fire spread;
- Prune to increase the height to live crown to reduce the potential of surface fire spreading into tree crowns; and
- Remove slash created by spacing and pruning to minimize surface fuel loadings while still maintaining adequate woody debris to maintain ecosystem function.

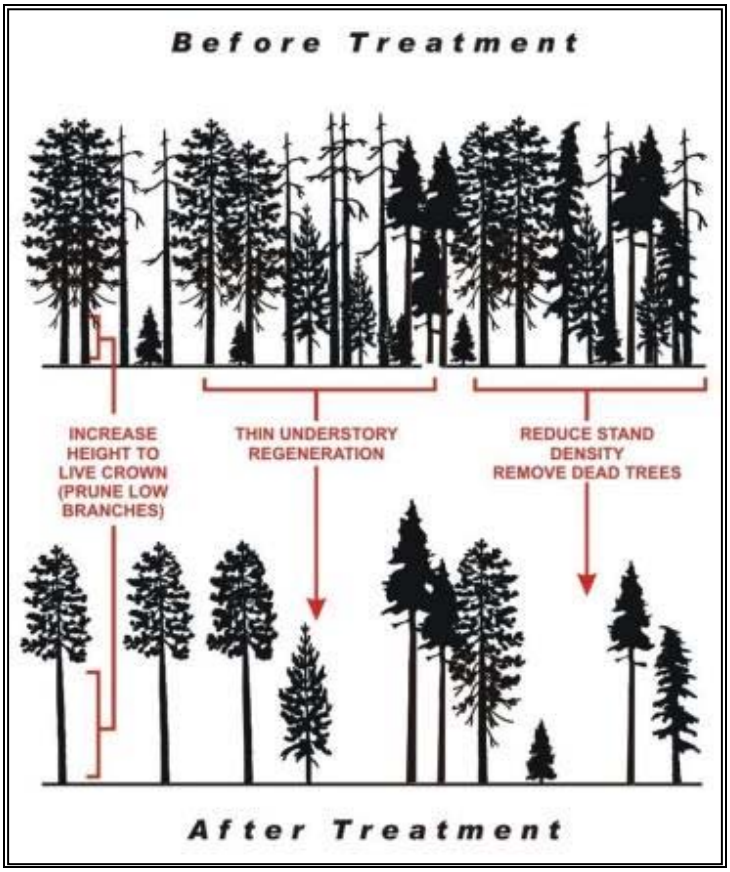


Figure 11. Illustration of the principles of thinning to reduce the stand level wildfire hazard.

Fuel type, weather and topography are all primary factors that influence the spread of fires. The three most important components of weather include wind, temperature and humidity. Fuel type and slope are primary concerns related to fire spread along the forested areas on the slopes surrounding the District communities. The steepness of a slope can affect the rate and direction a fire spreads and generally fires move faster uphill than downhill, and fire will move faster on steeper slopes. This is attributed to (MFLNRO, 2014):

- *On the uphill side, the flames are closer to the fuel;*
- *The fuels become drier and ignite more quickly than if on level ground;*
- *Wind currents are normally uphill and this tends to push heat flames into new fuels;*
- *Convected heat rises along the slope causing a draft which further increases the rate of spread;*
- *Burning embers and chunks of fuel may roll downhill into unburned fuels, increasing spread and starting new fires.*

APPENDIX J – FIRESMART FUEL TREATMENTS

The following information regarding fuel treatments is based on the FireSmart Manual (Partners in Protection 2002).

Priority Zone 1a is a 1.5 m combustible/fuel free zone around structures. This zone should be free of all vegetation (trees, shrubs, hedges, and grasses). This zone should only include non-flammable landscaping materials such as gravel, brick, or concrete. All living and dead vegetative material (branches, trees and woody shrubs) should be removed from this zone.

Priority Zone 1 is a 10 m fuel free zone around structures. This ensures that direct flame contact with the building cannot occur and reduces the potential for radiative or conductive heat to ignite the building. While creating this zone is not always possible, landscaping choices should reflect the use of less flammable vegetation such as deciduous shrubs, herbs and other species with low flammability. Coniferous vegetation such as juniper or cedar shrubs and hedges should be avoided, as these are highly flammable.

Priority Zone 2 extends from 10 to 30 m from the structure. In this zone, trees should be widely spaced 5 to 10 m apart, depending on size and species. Tree crowns should not touch or overlap. Deciduous trees have much lower volatility than coniferous trees, so where possible deciduous trees should be preferred for retention or planting. Trees in this area should be pruned as high as possible (without compromising tree health), especially where long limbs extend towards buildings. This helps to prevent a fire on the ground from moving up into the crown of the tree or spreading to a structure. Any downed wood or other flammable material should also be cleaned up in this zone to reduce fire moving along the ground.

Priority Zone 3 extends from 30 to 100 m from the home. The main threat posed by trees in this zone is spotting, the transmission of fire through embers carried aloft and deposited on the building or adjacent flammable vegetation. To reduce this threat, cleanup of surface fuels as well as pruning and spacing of trees should be completed in this zone (Partners in Protection 2002).

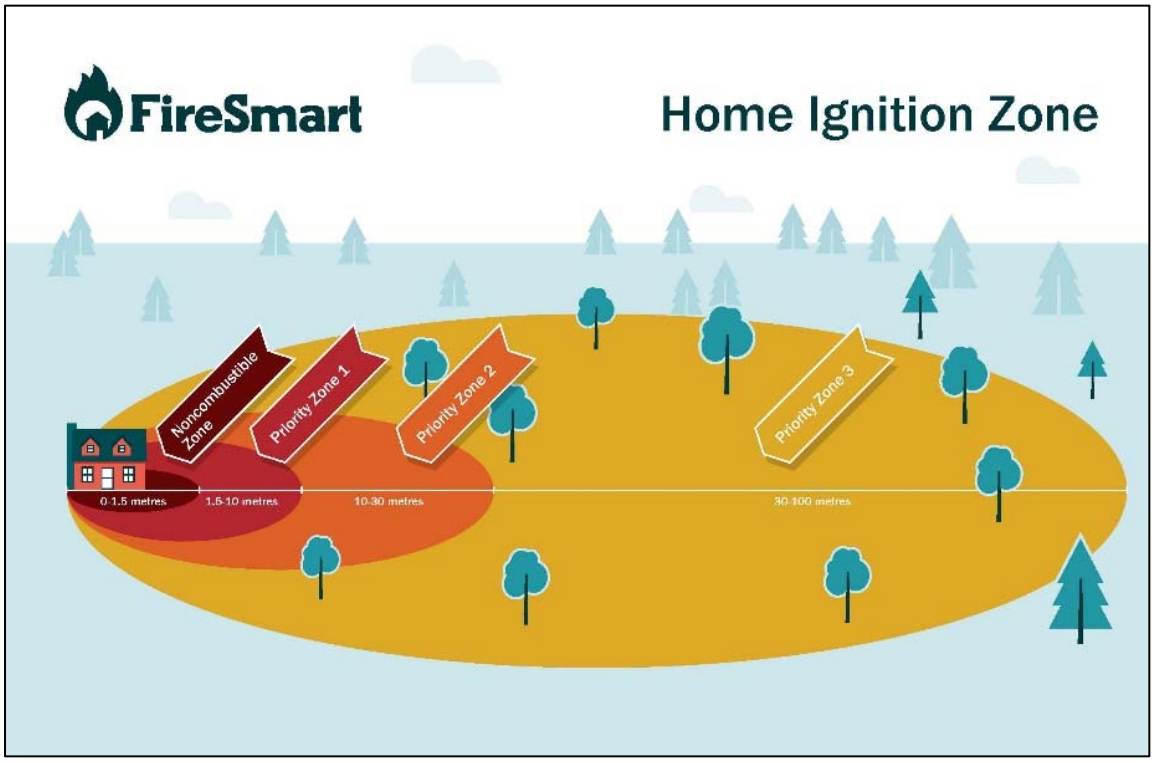


Figure 12. Illustration of FireSmart zones.
Retrieved from FireSmart Canada (https://www.firesmartcanada.ca/mdocs-posts/firesmart-home-ignition-zone-graphic/)

APPENDIX K – FIRESMART CONSTRUCTION AND LANDSCAPING

Two recent studies by Westhaver (2015, 2017) found that certain "fatal flaws", such as high-flammability landscaping like bulky ornamental junipers and large, easily ignited fuel sources (e.g. motorized vehicles, firewood, construction materials, *etc*.) were sufficiently influential to result in structure ignition of homes otherwise assessed as "Low" hazard by overwhelming the advantages provided by highly fire resistant structures[60].

In the 2017 Fort McMurray investigations (Westhaver) it was found that the most notable observed attributes of the surviving interface homes were: vegetation and fuels within the HIZ which were compliant with FireSmart practices, HIZs with relatively few combustible objects and ignition sites (examples of ignition sites include: combustible accumulations on roofs, gutters, *etc*.) , and Low to Moderate structural hazard ratings.[61,62] This investigation, and other similar investigations, indicate that the FireSmart principles can be effective at reducing structure loss, particularly in the urban perimeter where fire initially spreads from the forest to structures. .

The following link is an excellent four-minute video demonstrating the importance of FireSmart building practices during a simulated ember shower:
https://www.youtube.com/watch?v=IvbNOPSYyss.

FireSmart Construction

Roofing Material:

Roofing material is one of the most important characteristics influencing a home's vulnerability to fire. Roofing materials that can be ignited by burning embers increases the probability of fire related damage to a home during an interface fire event.

In many communities, there is no fire vulnerability standard for roofing material. Homes are often constructed with unrated materials that are considered a major hazard during a large fire event. In addition to the vulnerability of roofing materials, adjacent vegetation may be in contact with roofs, or roof surfaces may be covered with litter fall from adjacent trees. This increases the hazard by increasing the ignitable surfaces and potentially enabling direct flame contact between vegetation and structures.

Soffits and Eaves

Open soffits or eaves provide locations for embers to accumulate, igniting a structure. Soffits and eaves should be closed. Vents which open into insulated attic space are of particular concern, as they provide a clear path for embers to a highly flammable material inside the structure. Any exhaust or intake vents

[60] Westhaver, A. 2017. *Why some homes survived. Learning from the Fort McMurray wildland/urban interface fire disaster*. A report published by the Institute for Catastrophic Loss Reduction – ICLR research paper series – number 56. https://www.iclr.org/images/Westhaver_Fort_McMurray_Final_2017.pdf
[61] Ibid.
[62] Using the FireSmart hazard assessment system.

that open into attic spaces should resist ember intrusion with non-combustible wire mesh no larger than 3 mm.

Building Exterior - Siding Material:

Building exteriors constructed of vinyl or wood are considered the second highest contributor to structural hazard after roofing material. These materials are vulnerable to direct flame or may ignite when sufficiently heated by nearby burning fuels. The smoke column will transport burning embers, which may lodge against siding materials. Brick, stucco, or heavy timber materials offer much better resistance to fire. While wood may not be the best choice for use in the WUI, other values from economic and environmental perspectives must also be considered. It is significantly less expensive than many other materials, supplies a great deal of employment in BC, and is a renewable resource. New treatments and paints are now available for wood that increase its resistance to fire and they should be considered for use.

Balconies and Decking:

Open balconies and decks increase fire vulnerability through their ability to trap rising heat, by permitting the entry of sparks and embers, and by enabling fire access to these areas. Closing these structures off limits ember access to these areas and reduces fire vulnerability. Horizontal surfaces, such as decks, of flammable materials are vulnerable to ignition from embers. Fire resistant decking/ patio materials will reduce the ignitability of the home.

Combustible Materials:

Combustible materials stored within 10 m of residences are also considered a significant issue. Woodpiles, propane tanks, recreational motorized vehicles, and other flammable materials adjacent to the home provide fuel and ignitable surfaces. Locating these fuels away from structures helps to reduce structural fire hazards and makes it easier and safer for suppression crews to implement suppression activities adjacent to a house or multiple home.

FireSmart Landscaping

Future landscaping choices should be limited to plant species with low flammability within 10 m of the building. Coniferous vegetation such as Juniper, Cypress, Yew or Cedar hedging or shrubs of any height should not be planted within this 10 m zone as these species are considered highly flammable under extreme fire hazard conditions.

Decorative bark mulch, often used in home landscapes is easily ignitable from wildfire embers or errant cigarettes and can convey fire to the home. Alternatives to bark mulch include gravel, decorative rock, or a combination of wood bark and decorative rock.[63]

Landscaping Alternatives

The landscaping challenges faced by many homeowners pertain to limited space, privacy and the desire to create visually explicit edge treatments to demarcate property ownership from adjacent lots with evergreen vegetation screens. Ornamental plant characteristics fulfilling these criteria have an upright branching habit, compact form, dense foliage, as well as a moderate growth rate. Dwarf and ornamental conifers such as Arborvitae hedging are popular choices, yet conifers such as these which have needle

[63] *Fire Resistant Plants for Home Landscapes: Selecting plants that may reduce your risk from wildfire*. 2006. A Pacific Northwest Extension Publication (PNW 590).

or scale-like foliage are highly flammable and not compliant with FireSmart principles and should be omitted from the 10 m Fire Priority Zone of the planned home footprint.

There are a number of broadleaved deciduous and evergreen plants with low flammability which can be used for landscaping within FireSmart PZ 1 (within 10 m of structures). Landscaping should be selected for the appropriate Canadian Plant Hardiness Zone (see www.planthardiness.gc.ca for the Hardiness Zone specific to the various AOI). The majority of the areas would be within Zone 3b.

Plants that are fire resistant/ have low flammability generally have the following characteristics:

- Foliage with high moisture content (moist and supple),
- Little dead wood and do not tend to accumulate dry and dead foliage or woody materials, and
- Sap that is water-like and without a strong odour.[3]

It is important to note that even fire-resistant plants can burn if not maintained. Grass, shrubs, and herbs must be maintained in a state that reduces fire hazard by maintaining foliar moisture content. This can be accomplished by:

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

Depending solely on irrigation to maintain landscaping in a low flammability state can be limiting and may actually increase the fire hazard on the parcel, particularly in times of drought and watering restrictions. Lack of irrigation in times of watering restrictions may create a landscape which is unhealthy, unsightly, as well as dead, dry, and highly flammable.

There are a number of resources available to aid in development of FireSmart compliant landscaping curriculum or educational material; links can be found below.

The Canadian and U.S. systems for determining Plant Hardiness Zones differ.

- The USDA bases hardiness zones on minimum winter temperatures only: http://planthardiness.ars.usda.gov/PHZMWeb/Default.aspx,
- The Canadian system bases them on seven climatic factors including frost free days, and minimum and maximum temperature: http://www.planthardiness.gc.ca/

APPENDIX L – COMMUNICATION AND EDUCATION

Communicating effectively is the key aspect of education. Communication materials must be audience specific and delivered in a format and through a medium that will reach the target audience. Audiences should include home and landowners and occupiers, school students, local businesses, municipal officials and staff, community members, and other community groups. Education and communication messages should be engaging, empowering, simple yet comprehensive. A basic level of background information is required to enable a solid understanding of fire risk issues and the level of complexity and detail of the message should be specific to the target audience.

Websites and social media are some of the most cost-effective methods of communication available. Pew Research Center recently found that approximately 60% of Americans get their news from social media; 44% get their news from Facebook.[64] Twitter, LinkedIn, and Instagram are other social media platforms which can be used to provide real-time information to a large audience and are used, albeit to a lesser extent, by users as their primary news source.[65]

The challenge of all social media is to ensure that your message reaches the intended audience, accomplished by having users 'like' the page, engage with the posts, or re-share information to an even larger audience. There are communication experts who specialize in social media who can evaluate an organization's goals and offer tips to increase engagement and create compelling content to communicate the message. Likewise, it is important to be aware of the demographic of the community; a younger, more digitally connected community is more likely to use social media to get updates on 'newsworthy items'.[66]

[64] Pew Research Center Journalism and Media. Social media news use: Facebook leads the pack. May 25, 2016. Accessed December 17, 2017 from http://www.journalism.org/2016/05/26/news-use-across-social-media-platforms-2016/pj_2016-05-26_social-media-and-news_0-03/.

[65] Although the research cited in this document is of American social media users, it can be cautiously assumed that, while data and numbers are not likely exact to the Canadian demographic, similar trends in Canada likely occur.

[66] The Pew Research Center finds that 69% of Facebook users are 49 and younger. Only 8% of Facebook users are older than 65.

APPENDIX M – SUMMARY OF 2007 CWPP RECOMMENDATIONS

The following recommendations were provided as part of the 2007 CWPP for the City of Port Moody developed by B.A. Blackwell and Associates Ltd.

Education and Community Involvement:

- Strive to involve the public in interface issues through an effective education and public awareness program.
- The Port Moody media (The Now, Tri-City News) should be engaged on this issue with the intention of furthering public education and communication.
- Work with local developers to construct a FireSmart show home to be used as a tool to educate and communicate the principles of FireSmart to the public.
- Enhance their existing website to outline community fire risks and current fire danger. Information, such as fire danger and FireSmart demonstration/pilot projects, should be added to the local site.
- Signage consisting of current fire danger and warnings to be careful with fire should be posted at all major entrances to the community. Signs should be updated with current fire danger information as required.
- City of Port Moody Fire and Rescue Services should work with the Port Moody Chamber of Commerce to educate the local business community, particularly businesses that depend on forest use (*i.e.,* tourism and recreation), on FireSmart preparation and planning.
- Work with other lower mainland municipalities and the MOFR to develop a regional approach to enhancing education and communication related to this issue.
- Apply for UBCM funding to carry out a fuel treatment pilot project that will strategically mitigate fuel hazard within the treatment area. This pilot project will provide a tool to demonstrate the principles of fuel hazard reduction treatments to the public and contribute to fire risk reduction within the City.

Structure Protection:

- Conduct detailed FireSmart assessments in identified high risk areas of the community to further communicate and promote fire risk reduction on private property.
- Begin a process to review and revise existing bylaws and building codes to be consistent with the development of a FireSmart Community. In areas of identified high wildfire risk, consideration should be given to the creation of Wildfire Development Permit Areas and a Wildfire Bylaw that mandates fire resistant building materials, provides for good access for emergency response, and specifies fuel management on both public and private property.
- If Wildfire Development Permit Areas are established, the City should require roofing materials that are fire retardant with a Class A and Class B rating within new subdivisions in the Wildfire DP area.

- Consider working with the Building Policy Branch to create a policy structure that would enable the City to better address wildland urban interface protection considerations for buildings.
- the City should work closely with the Province and GVRD to identify and document hazardous fuel types adjacent to City boundaries and residential neighbourhoods. Efforts must be directed at encouraging the Province and the GVRD to initiate a fuel treatment program for these lands
- Incorporate building setbacks into bylaw with a minimum distance of 10 m when buildings border the forest interface.
- The City Tree Retention Bylaw should be reviewed to ensure that it does not limit the ability of homeowners to address wildfire hazards associated with trees on private property immediately adjacent to homes.

Emergency Response

- Work towards improving access in identified areas of the community that are considered isolated and that have inadequately developed access for evacuation and fire control.
- A City-wide evacuation plan should be developed and appropriate evacuation routes should be mapped. Major evacuation routes should be signed.
- Work with adjacent municipalities and the Ministry of Forests and Range to maintain a local helicopter with a bucket on standby within 15 minutes of the community during periods of high and extreme fire danger.
- Residences and businesses on steep slopes are vulnerable to increased fire behaviour potential and should be the immediate focus of initial attack if there is a fire start within these areas. More detailed assessment work is required to identify these areas.
- Contingency plans should be developed in the event that smoke causes evacuation of critical emergency facilities in Port Moody. The City should co-operate with Provincial and Regional governments to develop an alternate incident command location and mobile facility in the event that the City is evacuated.
- Consider enhancing the capability of the existing sprinkler protection program from approximately 20 homes to 50 homes.

Training

- The current level of training is considered adequate, but given the risk of fire to the community, the City of Port Moody Fire and Rescue Services should adopt an advanced program that fosters continuous improvement and skill renewal.
- Equip firefighters with appropriate personal protective equipment and wildland firefighting initial attack equipment in order to maintain the safety of firefighters and to effectively suppress wildland fires within the municipal boundary.

Fuel Management

- A number of high hazard areas immediately adjacent to or embedded in the community have been identified as part of the wildfire risk assessment. The City should investigate the potential for fuel management programs.

- A qualified professional, with a sound understanding of fire behaviour and fire suppression, should develop fuelbreak plans and fuel treatment prescriptions.
- Prioritize the development of a fuel break network that builds on existing breaks such as the BC Transmission Corridors running through the City.
- Work with British Columbia Transmission Corporation (BCTC) to ensure that transmission infrastructure can be maintained and managed during a wildfire event. Maintaining the transmission corridor to a fuel break standard will provide the community with a more reliable power supply that is less likely to fail during a fire event and will reduce the probability of fire spreading into the community.

Wildfire Rehabilitation Planning:

- Develop a plan for post fire rehabilitation that considers the procurement of seed, seedlings and materials required to regenerate an extensive burn area (1,000 ha).