Community Wildfire Protection Plan

Community of Port Renfrew

Considerations for Wildland Urban Interface Management

PORT RENFREW

COMMUNITY WILDFIRE PROTECTION PLAN

Considerations for Wildland Urban Interface Management for Port Renfrew, British Columbia

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1.0 Introduction

In 2010 B.A. Blackwell & Associates Ltd. were retained by the Capital Regional District (CRD) and the District of Sooke to develop Community Wildfire Protection Plans (CWPPs) for Sooke, the Juan de Fuca Electoral Area communities and Piers Island. 'FireSmart – Protecting Your Community from Wildfire'[1] was used to guide the protection planning process. For Port Renfrew, the assessment considered important elements of community wildfire protection including communication and education, structure protection, emergency response and vegetation management.

The social, economic and environmental losses associated with the 2003 and 2009 fire seasons emphasized the need for greater consideration and due diligence in regard to wildfire risk in the wildland urban interface (WUI). In considering wildfire risk in the WUI, it is important to understand the specific risk profile of a given community, which can be defined by the probability and the associated consequence of wildfire to the community. While the probability of fire in coastal communities is substantially lower when compared to the interior of British Columbia (BC), the consequences of a large fire are likely to be very significant in communities given access and evacuation constraints, population size (especially during summer months), values at risk, topography and environmental considerations.

This CWPP will provide Port Renfrew with a framework to assess the Fire Protection Area's fire risk. Additionally, the information contained in this report will help to guide the mitigation strategies that will best address wildfire risk in the community.

The scope of this project included three distinct phases of work:

- **Phase I** –Assess fire risk and develop a Wildfire Risk Management System (WRMS) to spatially quantify the probability and consequence of fire.
- **Phase II –** Conduct a structured decision making workshop to define each community's most important objectives for wildfire protection, and to develop the mitigation strategy alternatives that would best meet community needs.
- **Phase III –** Develop the Plan, which outlines measures to mitigate the identified risk through communication and education, structure protection, emergency response and vegetation management.

[1] Partners in Protection. 2004. FireSmart Protecting your Community from Wildfire. http://www.partnersinprotection.ab.ca/downloads/index.php

2.0 Port Renfrew

2.1 Study Area

The Town of Port Renfrew is located on south-western Vancouver Island and is approximately 100 km west of Victoria, on Highway 14 (Figure 1). Highway 14 is the major route in and out of the area. Recently, Port Renfrew has become connected to the eastern side of Vancouver Island with the completion of the Pacific Marine Circle Route. This route connects Port Renfrew to Lake Cowichan, completing a south Island loop. The total Port Renfrew Fire Protection Area is 754 ha.

Figure 1. Google Map image of Port Renfrew and surrounding areas.

2.2 Population

Port Renfrew is one of several unincorporated rural communities that make-up the Juan de Fuca Electoral Area, under the jurisdiction of the CRD. The Juan de Fuca Electoral Area covers over 1,500 km^2 and is home to approximately 4,500 residents. Port Renfrew has approximately 180 permanent residents with a large tourist population during the summer months. The study area has a rich history in forestry and fishing. However in recent years forestry has declined and tourism has grown. The West Coast Trail, Juan de Fuca trail, the Pacific Marine Circle Route and numerous natural area attractions bring thousands of people through the town each year. A new cottage development will bring additional summer residents to the area.

2.3 Infrastructure

The Port Renfrew Utility Services Committee administers sewage disposal, street lighting, Port Renfrew Water and Snuggery Cove Water services, whereas the Port Renfrew Local Services Committee administers three services:

- Fire Protection and Emergency Response;
- Community Recreation; and
- Solid Waste Disposal.

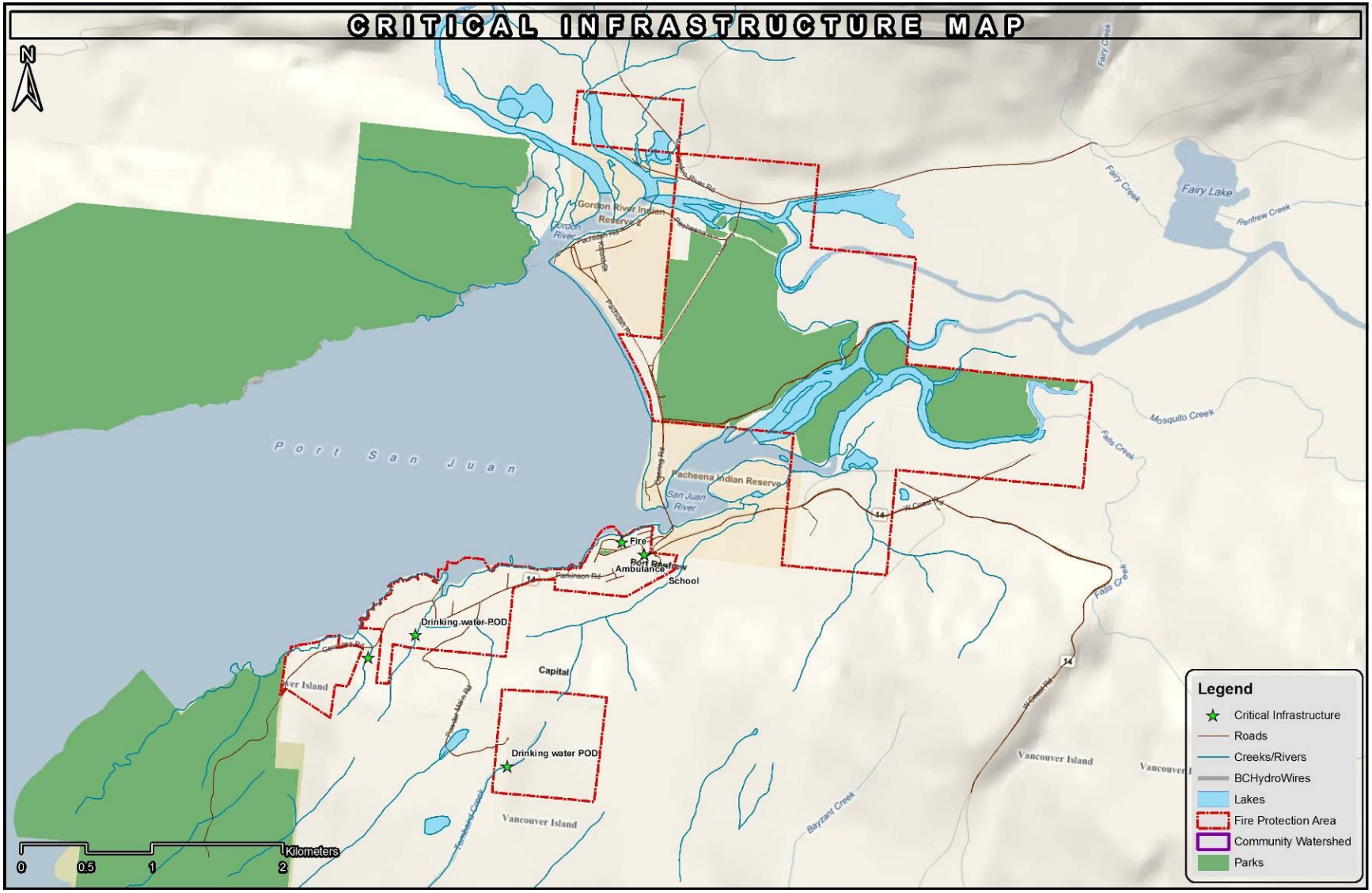
The Port Renfrew Fire Department provides the foundation for incident command and response during emergency fire events, and assists police and ambulance personnel (Figure 2 and Map 1). The location of the Fire Department has changed, which should be adjusted in the CRD spatial data file. There is also an elementary school in the town.

Figure 2. Port Renfrew Fire Station (left) and Ambulance Service (right).

The study area's water system is operated by the CRD Integrated Water Services and they provide drinking water to Beach Camp and Snuggery Cove, which are located on the south shore of San Juan Harbour. The Port Renfrew Water System obtains its water from a well. Well water is pumped to an aeration tower for treatment and stored in a reservoir above Beach Camp. The distribution system consists of a network of 150 mm and 100 mm water mains and the system provides drinking water to approximately 128 parcels[2].

Electrical service is received through a network of wood pole and metal transmission infrastructure supplied by BC Hydro. Fire could cause a disruption in power services either due to heat from the flames or fallen trees associated with a fire event.

[2] http://www.crd.bc.ca/jdf/water/renfrew.htm



Map 1. Critical Infrastructure within the Port Renfrew Fire Protection Area.

2.4 Environmental Values

The Biogeoclimatic Ecosystem Classification (BEC) system describes zones by vegetation, soils and climate. Regional subzones are derived from relative precipitation and temperature. The Port Renfrew study area is defined by the regional climate of the Coastal Western Hemlock southern very wet hypermaritime (CWHvh) and very wet maritime (CWHvm). The CWH is the most productive forest region in Canada. In general, the CWHvh is quite cool with fog, cloud and drizzle common throughout the year. The CWHvm is a wet, humid, mild, oceanic climate.

Sensitive Ecosystem Inventory data is not complete for rare species or species of concern for the study area. There are no records of red-listed species however there are three blue listed species which include Smith's fairybells, Red-legged frog and Warty jumping-slug. Records indicate that Trumpeter swans, pelicans and great blue herons hunt and nest in the area. The study area is important fish habitat and salmon spawning grounds, and hawks, bald eagles, vultures and bears feed on the spawning salmon[3].

3.0 Fire Environment

3.1 Fire Weather

The Canadian Forest Fire Danger Rating System (CFFDRS), developed by the Canadian Forest Service, is used to assess fire danger and potential fire behaviour. The Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) maintains a network of fire weather stations during the fire season that is used to determine fire danger on forestlands within the community. The information is commonly used by municipalities and regional governments to monitor fire weather information provided by the MFLNRO Protection Branch to determine hazard ratings and associated fire bans and closures within their respective municipalities. Key fire weather parameters summarized as part of the analysis include:

- Drought Code: The Drought Code represents the moisture in deep, compact organic matter with a nominal depth of about 18 cm and a dry fuel load of 25 kg/m^2. It is a measure of long-term drought as it relates to fire behaviour.

- Danger Class: The Danger Class Rating is derived from fire weather indices and has 5 classes: 1) Very Low Danger; 2) Low Danger; 3) Moderate Danger; 4) High Danger; and 5) Extreme Danger.

[3] http://www.crd.bc.ca/jdf/about.htm

The drought code provides some indication of seasonal drought effects on forest fuels. The higher the drought code, the drier the duff (layer of decomposing organic materials below the litter layer), indicating a prolonged period without adequate moisture input to wet the duff layer. This code also provides some indication of potential fire severity in terms of duff consumption; the drier the duff is, the more it will be consumed by fire. The depth of burn can result in greater tree mortality and seed bank consumption due to soil heating. Soil heating can also result in soil hydrophobicity, meaning the soil repels water, and this has been linked with increased erosion post-fire due to increased water run-off. Figure 3Figure 3 shows that the drought code tends to shift over the summer months and in to the fall from being predominantly very low in June, to moderate in July and August, and then back to very low in September. There are high and extreme days in August and September; however these occur less frequently and probably occur in unusually dry years.

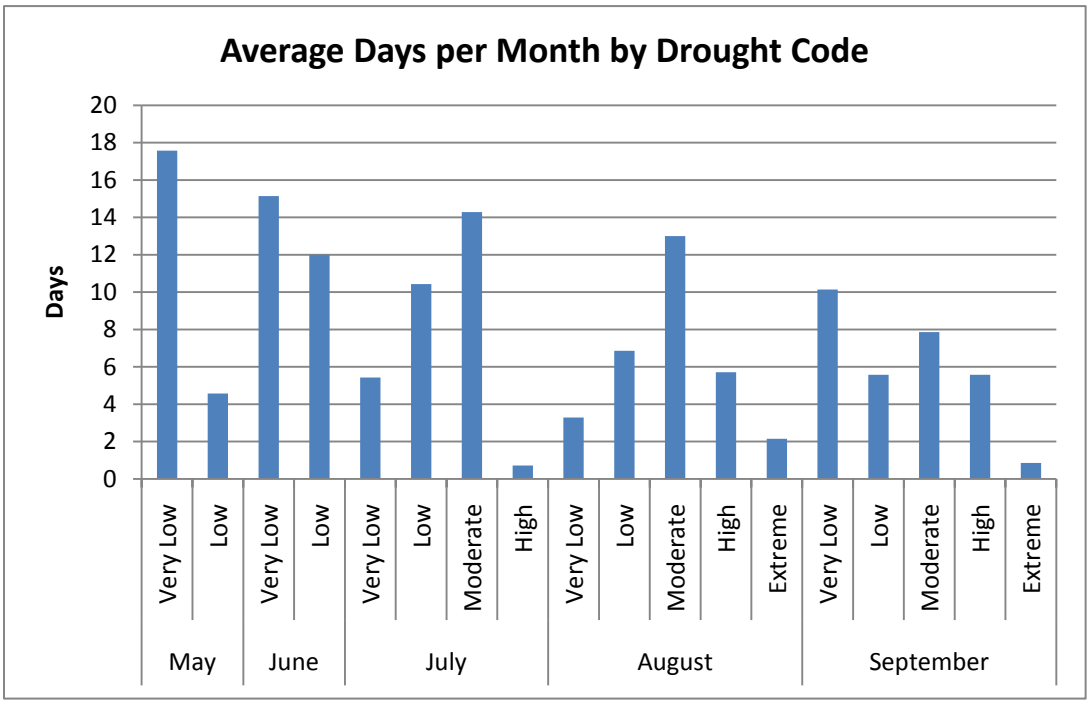


Figure 3. Drought code averaged for each month over a 10 year period (1988-1997) from the Renfrew, Darling and Loss Creek weather stations (Very low = 0-79; Low = 80-189; Moderate = 190-299; High = 300-424, Extreme = >425).

The Fire Danger Classes provide a relative index of how easy it is to ignite a fire and how difficult control is likely to be. The BC *Wildfire Act* [SBC 2004] and *Wildfire Regulation* [B.C. 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 (Low) – Fires likely to be self-extinguishing and new ignitions unlikely. Any existing fires limited to smouldering in deep, drier layers.

Class 2 (Moderate) – Creeping or gentle surface fires. Fires easily contained by ground crews with pumps and hand tools.

Class 3 (High) – Moderate to vigorous surface fire with intermittent crown involvement. Challenging for ground crews to handle; heavy equipment (bulldozers, tanker trucks, aircraft) often required to contain fire.

Class 4 (Very High) – High-intensity fire with partial to full crown involvement. Head fire conditions beyond the ability of ground crews; air attack with retardant required to effectively attack fire's head.

Class 5 (Extreme) – Fast-spreading, high-intensity crown fire. Very difficult to control. Suppression actions limited to flanks, with only indirect actions possible against the fire's head.

Figure 3 shows that the number of danger class days on average, for each month of the fire season is somewhat variable but that fire danger is predominantly low throughout the fire season. When days of high and very high occur, they tend to be in August and September.

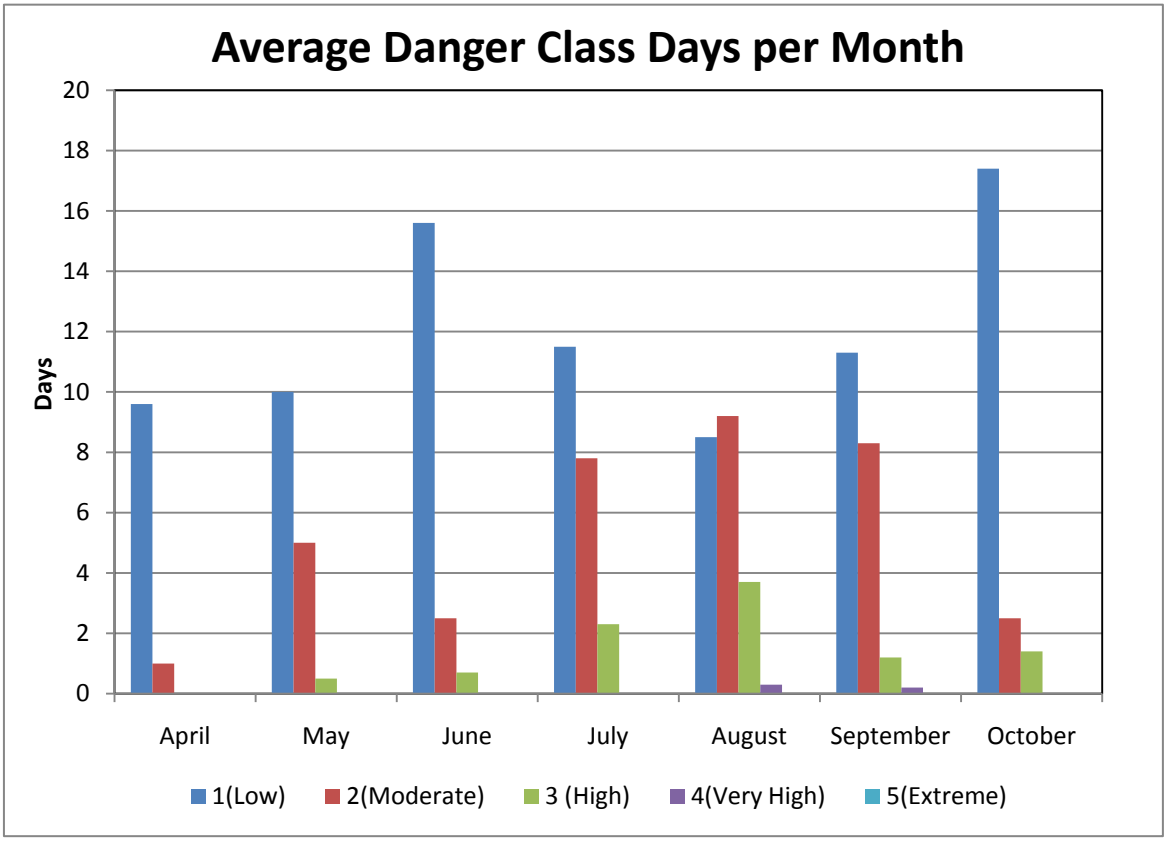


Figure 4. Fire Danger Class averaged for each month over a 10 year period (1988-1997) from the Renfrew, Darling and Loss Creek weather stations (the average number of days of record per month is not even).

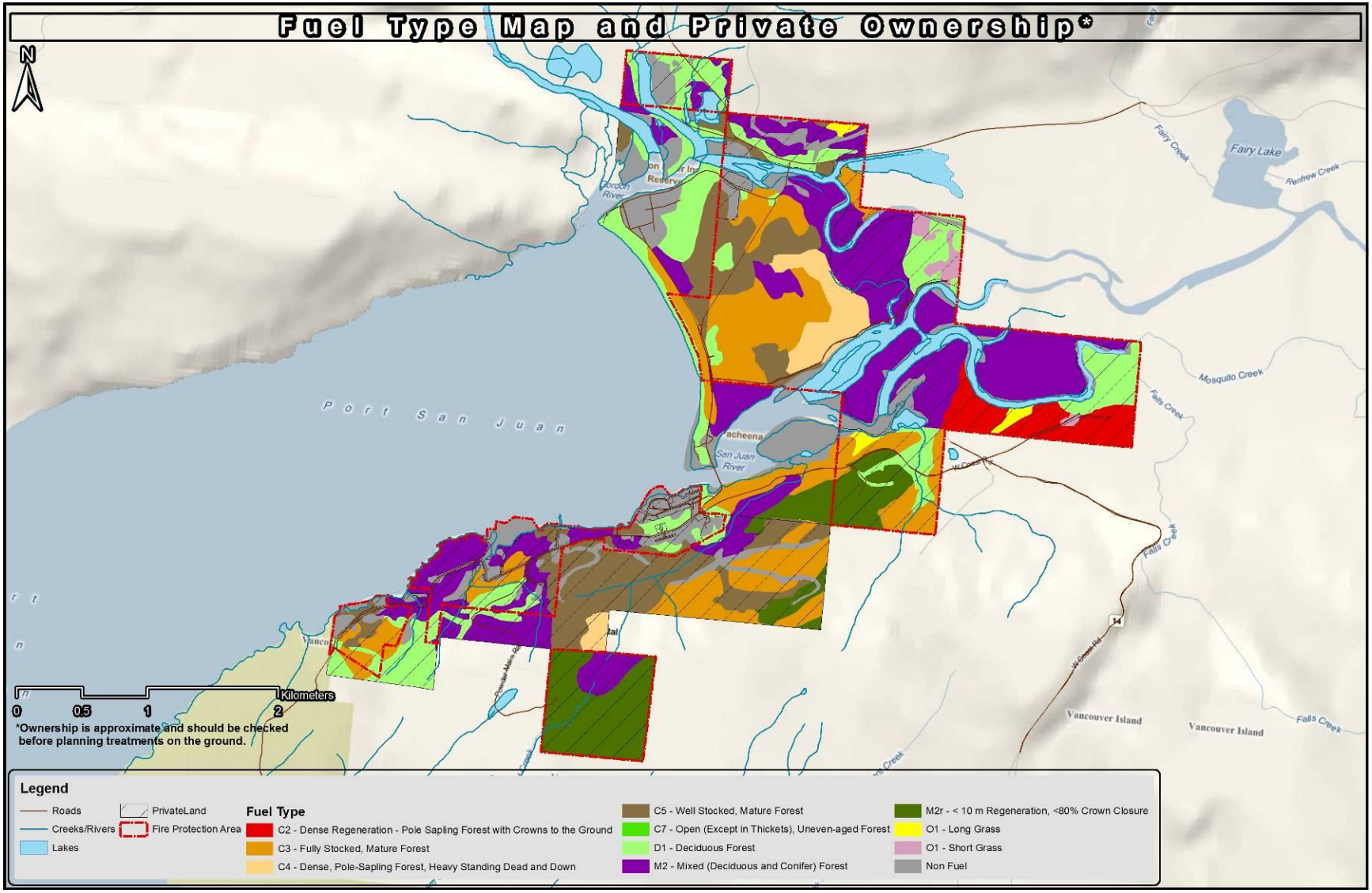
3.2 Fuels

The fuel typing used to develop the Provincial Strategic Threat analysis is not accurate at a local scale, therefore fuel types are generated spatially for the study area using an algorithm that assigns CFFDRS fuel types based on Vegetation Resource Inventory (VRI) data. The fuel types within the study area and the composition for each fuel type are outlined in Table 1. The algorithm uses BEC, species mix, crown closure, age, and non-forest descriptors to assign fuel type. Typically, the outputs require refinement and do not adequately describe the variation in fuels present within a given area, due to errors in VRI and adjustments required in the algorithm. For this reason, it is important to ground-truth fuel types in order to modify the algorithm and improve fuel type accuracy. The VRI-based fuel typing was improved upon and adjusted to incorporate local variation and is illustrated in Map 2.

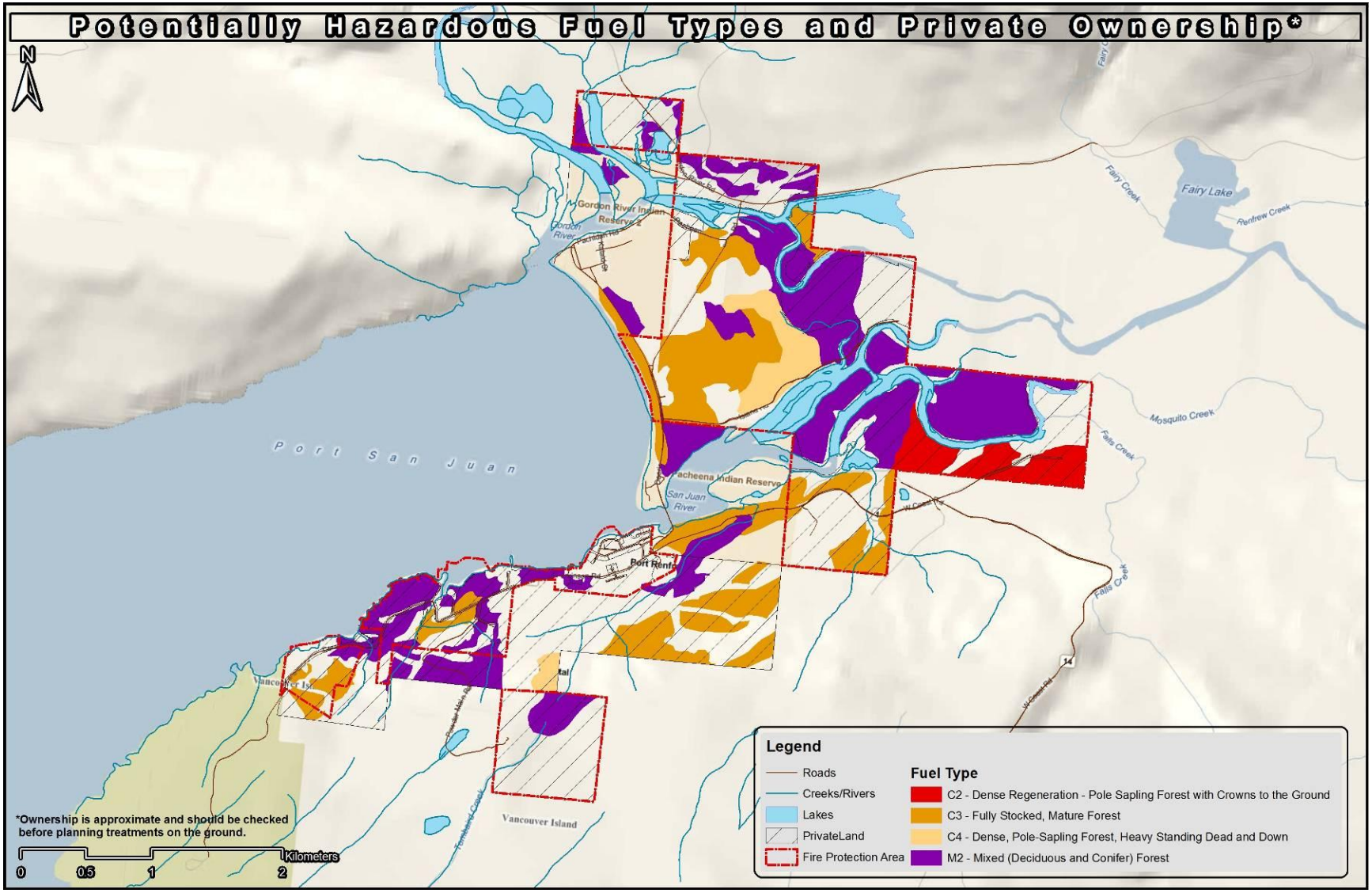
Table 1 summarizes the fuel types by general fire behaviour and total area for Port Renfrew. In general the fuel types considered hazardous in terms of dangerous fire behavior and spotting (lofting burning embers) are C2, C4, and C3. Fuel type M2 can sometimes be hazardous depending on the proportion of conifers within the forest stand. Hazardous fuel types are shown in Map 3.

Table 1. A summary of fuel types, associated hazard and areas within the Port Renfrew study area.

Fuel Type	Description	Wildfire Behaviour under High Wildfire Danger Level	Area (ha)	Percent (%)
C2	Dense regeneration to pole-sapling forest with crowns almost to the ground	Almost always **crown fire**, high to very high fire intensity and rate of spread	35.1	5.7
C3	Fully stocked, mature forest, crowns separated from ground	**Surface and crown fire**, low to very high fire intensity and rate of spread	105.0	17.0
C4	Dense, pole-sapling forest, heavy standing dead and down, dead woody fuel, continuous vertical crown fuel continuity	Almost always **crown fire**, high to very high fire intensity and rate of spread	28.1	4.6
C5	Well stocked, mature forest, crowns well separated from ground	Low to moderately fast spreading, low to moderate intensity **surface fire**	55.4	9.0
C7	Open, uneven-aged forest, crowns separated from ground except in conifer thickets, understory of discontinuous grasses, herbs	**Surface, torching, rarely crowning** (slopes > 30%), moderate to high intensity and rate of spread	0	0
D1	Moderately well-stocked deciduous stands	Always a **surface fire**, low to moderate rate of spread and fire intensity	90.4	14.6
M2	Moderately well-stocked mixed stand of conifers and deciduous species, low to moderate dead, down woody fuels, crowns nearly to the ground	**Surface, torching and crowning**, moderate to very high intensity and spread rate (depending on slope and percent conifer)	213.3	34.5
M2r	Moderately well-stocked mixed stand of conifers and deciduous species regeneration, crowns nearly to the ground	**Surface, torching and crowning**, moderate to very high intensity and spread rate(depending on slope and percent conifer)	75.5	12.2
O1 – Long	Continuous standing grass, fuel loading is 0.3 kg/m2, 90% cured	Rapid spreading, moderate to high intensity **surface fire**	6.3	1.0
O1 – Short	Continuous human modified short grass, fuel loading is 0.17 kg/m2, 90% cured	Rapid spreading, low to moderate intensity **surface fire**	8.4	1.4
		Total:	617.5	



Map 2. Fuel typing and private ownership for the Port Renfrew Fire Protection Service Area.



Map 3. Potentially hazardous fuel types within the Port Renfrew Fire Protection Service Area.

3.3 Historic Ignitions

Fire data are summarized by fire cause for the period of 1919 to 2009 with some gaps between years. Within the Port Renfrew Fire Protection Service Area, all historic ignitions have been human caused (Figure 5). Ignitions have occurred infrequently within the study area for the length of the historic record. There are no ignition records before 1959. This may be due to the area's isolation and a lack of recorded data prior to that time. However, given Port Renfrew's climate it is also reasonable that ignitions would be quite infrequent, with a very short window during the fire season when ignitions could result in wildfire.

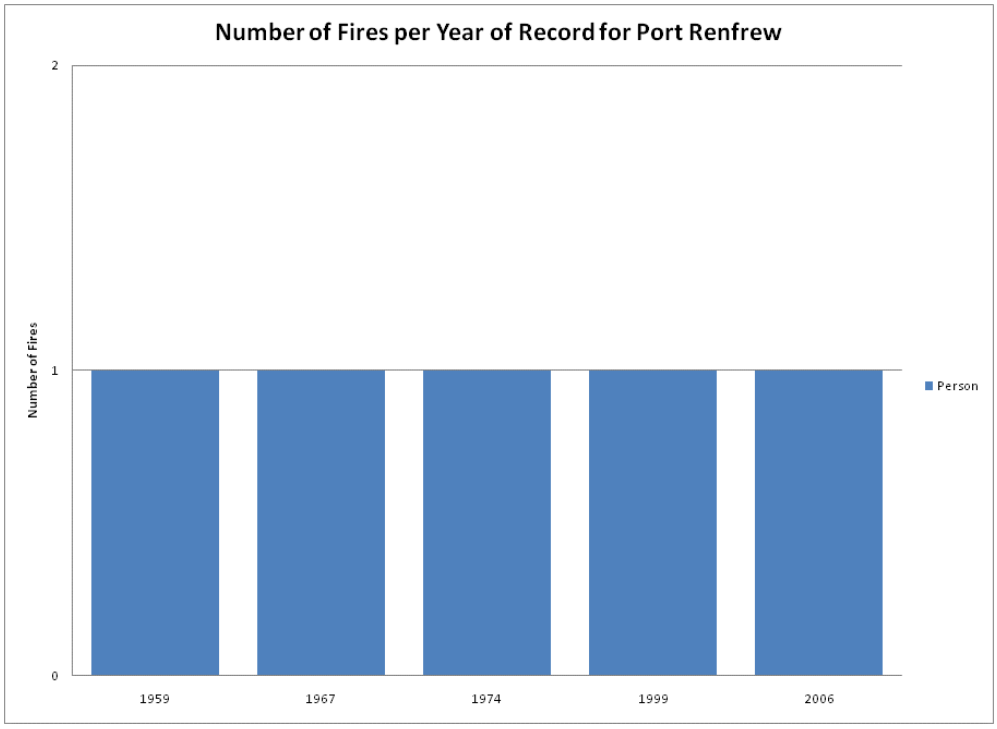


Figure 5. Number of fires per year between 1919 and 2009 within the Port Renfrew Fire Protection Service Area.

The number of hectares burned per year (Figure 6) shows that fires have tended to be small in the study area. The recorded fires have all occurred since the policy of active fire suppression was implemented in the 1950s, and the small fire size is likely explained by a combination of successful fire suppression and Port Renfrew's climate contributing to fires being extinguished at a small size. Given the infrequency of drought conditions and high fire danger in the CWHvh/vm, it is likely that the Port Renfrew area experiences large, landscape level fires very infrequently.

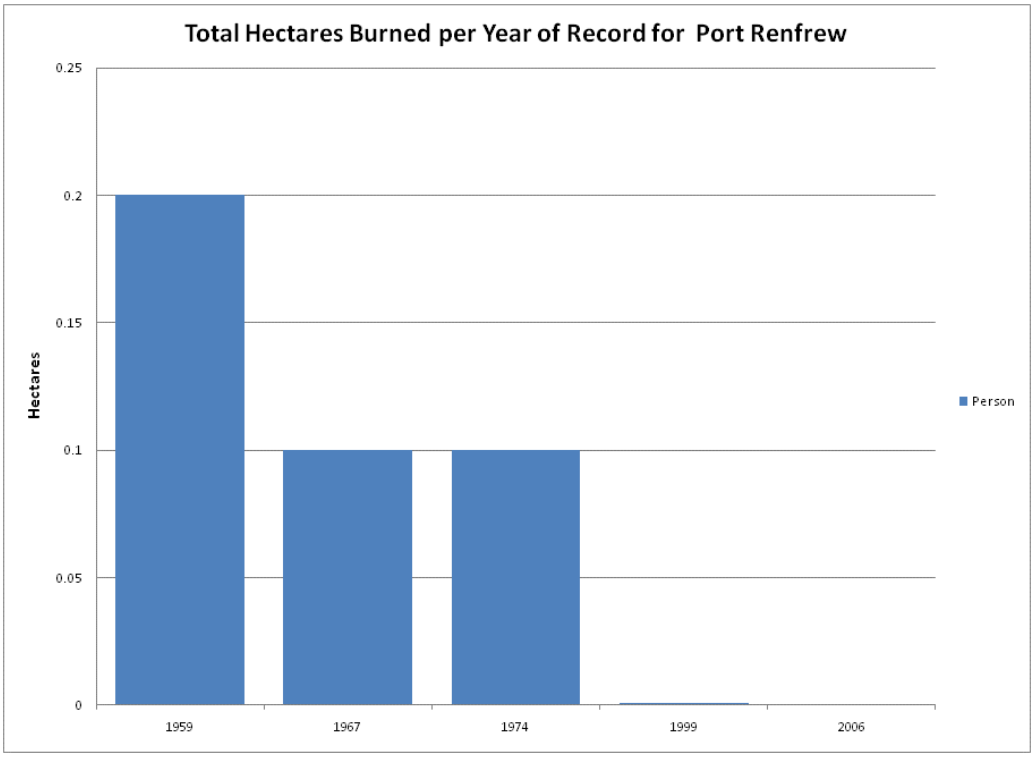
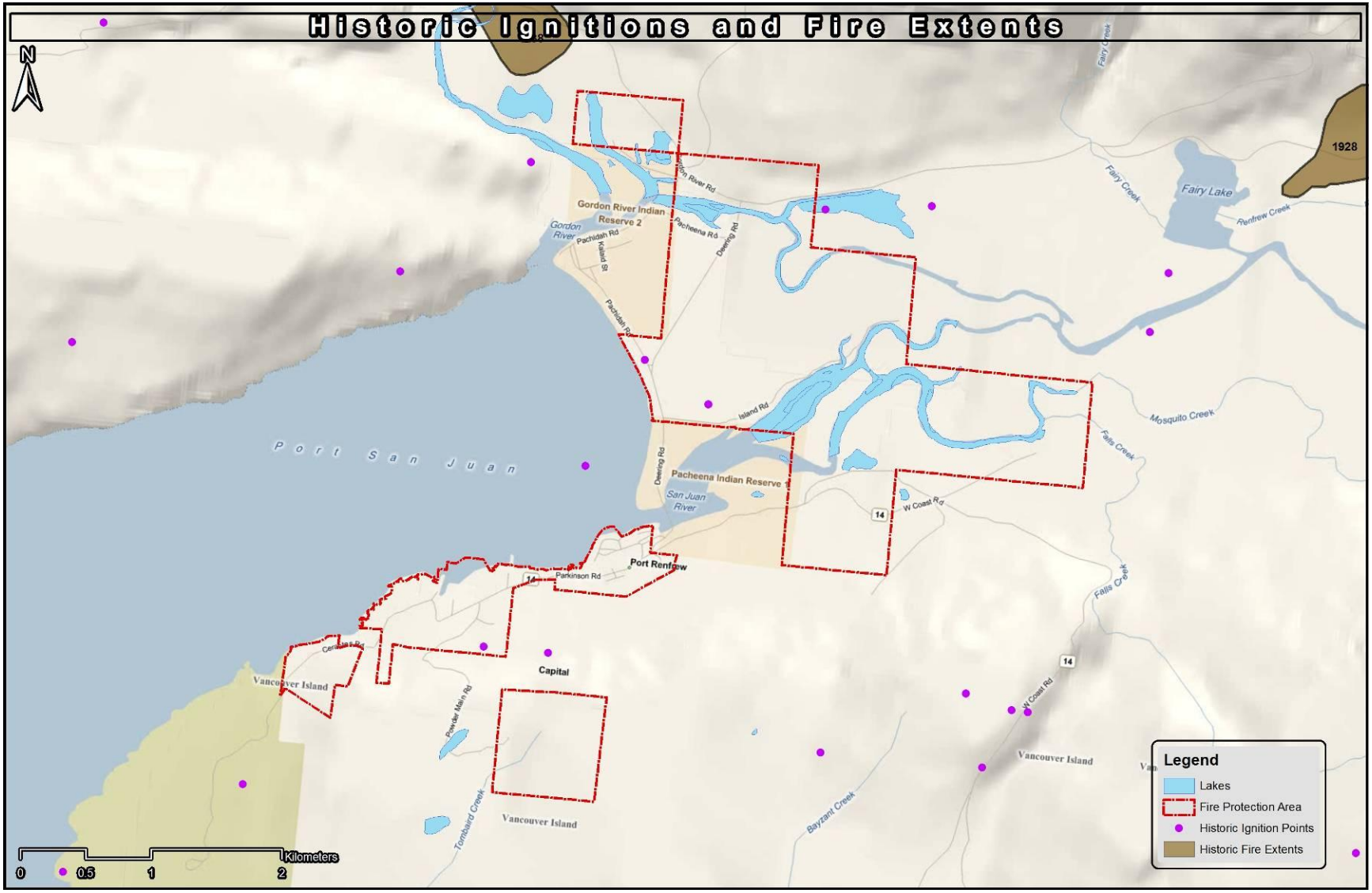


Figure 6. Number of hectares burned per year between 1919 and 2009 within the Port Renfrew Fire Protection Service Area.

The figures above and the fire history data presented in Map 4 indicate that Port Renfrew has experienced small and infrequent fire events for the length of the historic record. This is likely explained by the regional climate and effective fire suppression since the 1950s.

The point ignition data shown in Map 4 represents ignitions located, as per MFLNRO methodology, on a grid rather than the exact ignition location; therefore, some points are located in water and multiple points are often located on top of one another.



Map 4. Historic ignitions and fire extents from 1919 to 2009.

4.0 The Wildland Urban Interface

The classical definition of wildland urban interface (WUI) is the place where the forest meets the community. Other configurations of the WUI can be described as intermixed. Intermixed areas include smaller, more isolated developments that are embedded within the forest. An example of an intermixed interface is shown in Figure 7.

In each of these cases, 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. Within the Fire Protection Area, the probability of a fire moving out of the community and into the forest is equal or greater to the probability of fire moving from the forest into the community. 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 for interface fires.

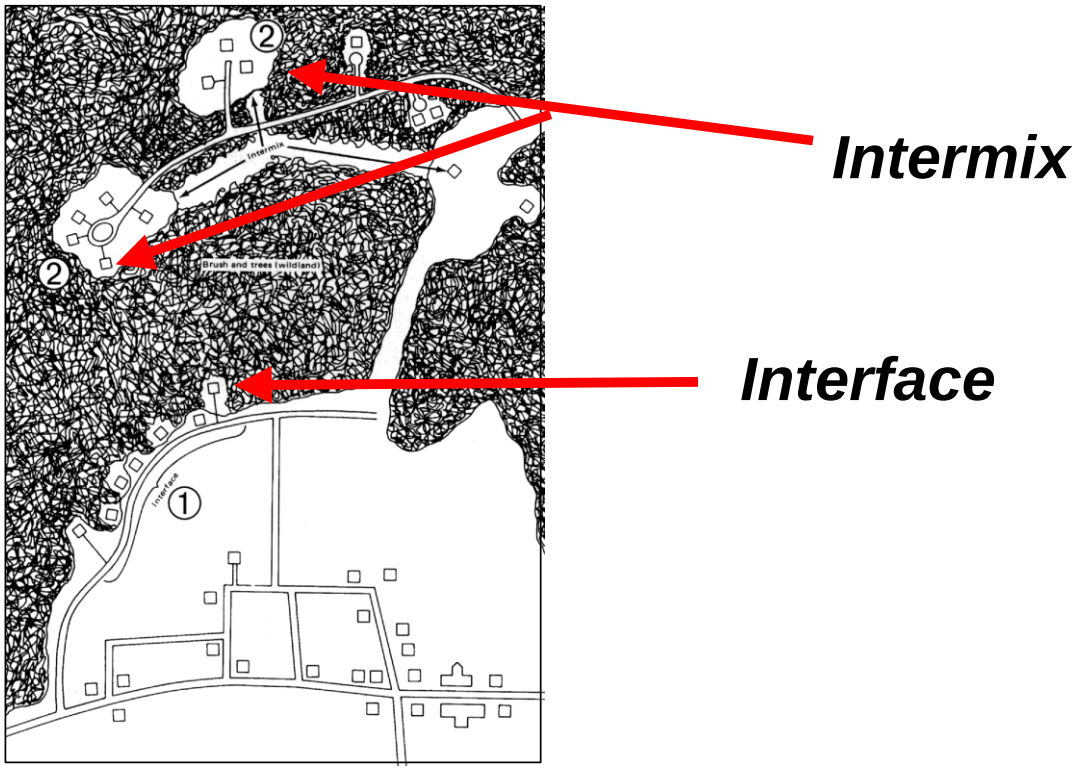
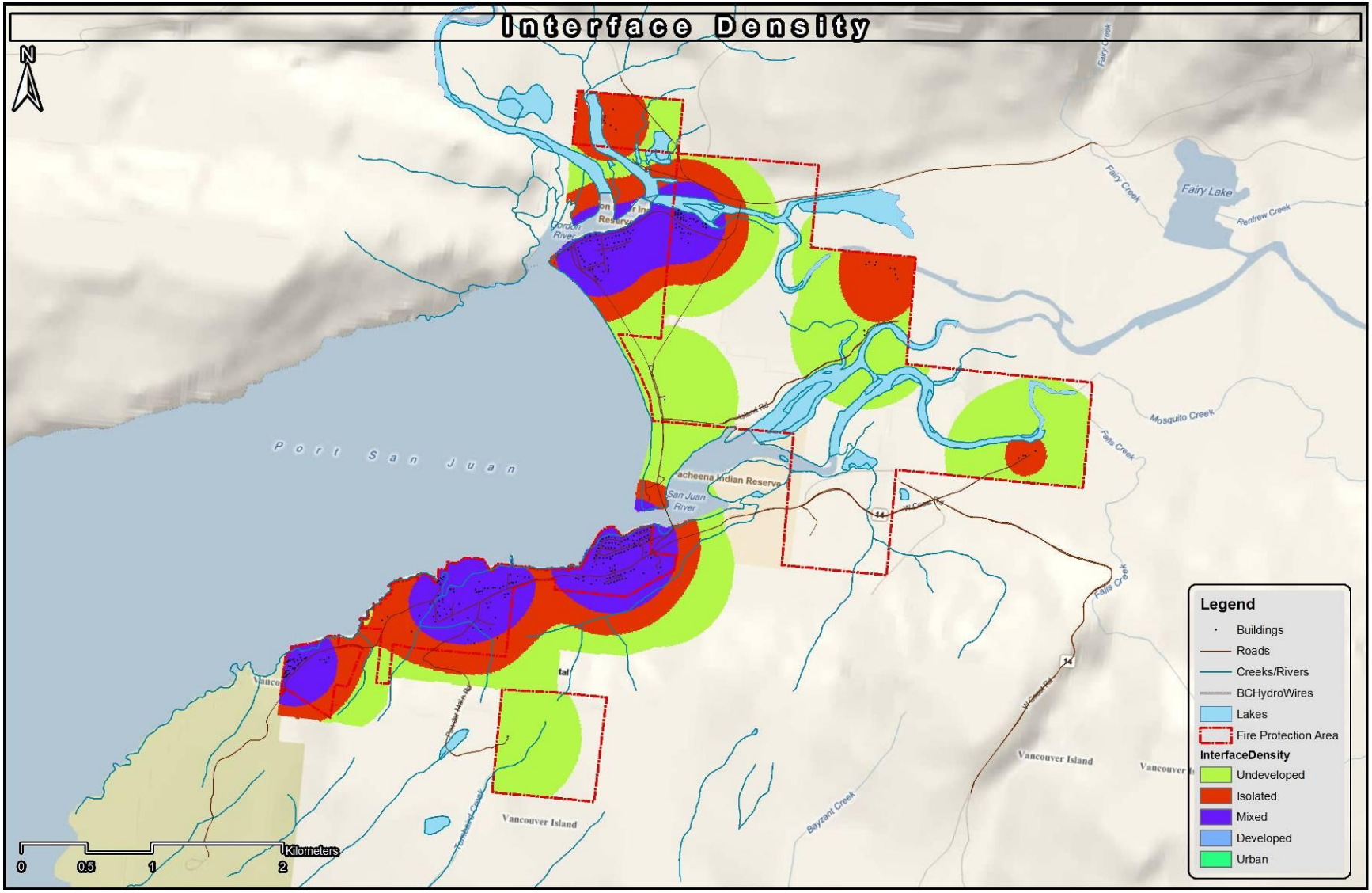


Figure 7. Graphical example showing variation in the definition of interface.

Map 5 shows the interface density classes mapped for the Fire Protection Area. Port Renfrew's developed areas are classed as 'Mixed' and 'Isolated', which predominantly look 'intermix' as defined in Figure 7.



Map 5. Interface density classes within the Port Renfrew Fire Protection Area and surrounding areas.

4.1 Vulnerability of the Wildland Urban Interface to Fire

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

1) From sparks or burning embers getting carried by the wind, or convection that starts new fires beyond the zone of direct ignition (main advancing fire front), and alight on vulnerable construction materials (*i.e.* roofing, siding, decks etc.) (Figure 8).

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 9).

Figure 8. Firebrand caused ignitions: burning embers are carried ahead of the fire front and alight on vulnerable building surfaces.

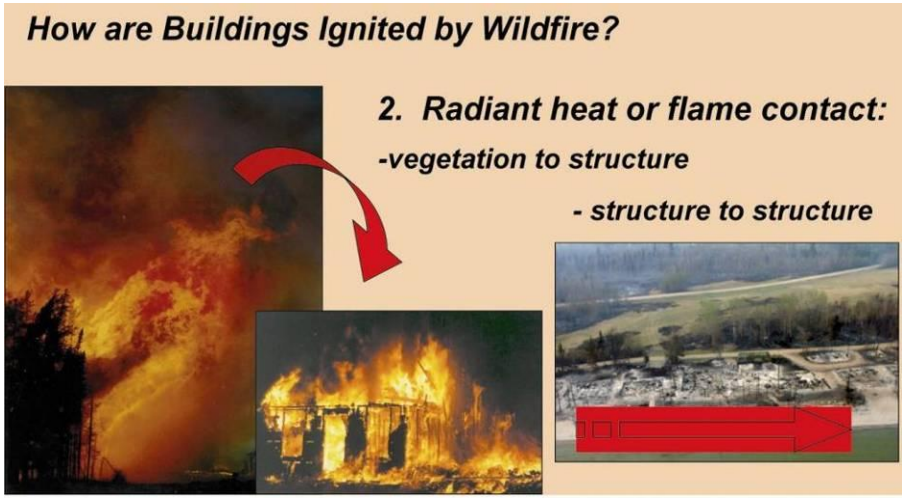


Figure 9. Radiant heat and flame contact allows fire to spread from vegetation to structure or from structure to structure.

5.0 Community Wildfire Protection Planning Process

The WUI continuum summarizes the main options available for addressing WUI fire risk in the CWPP process (Figure 10).

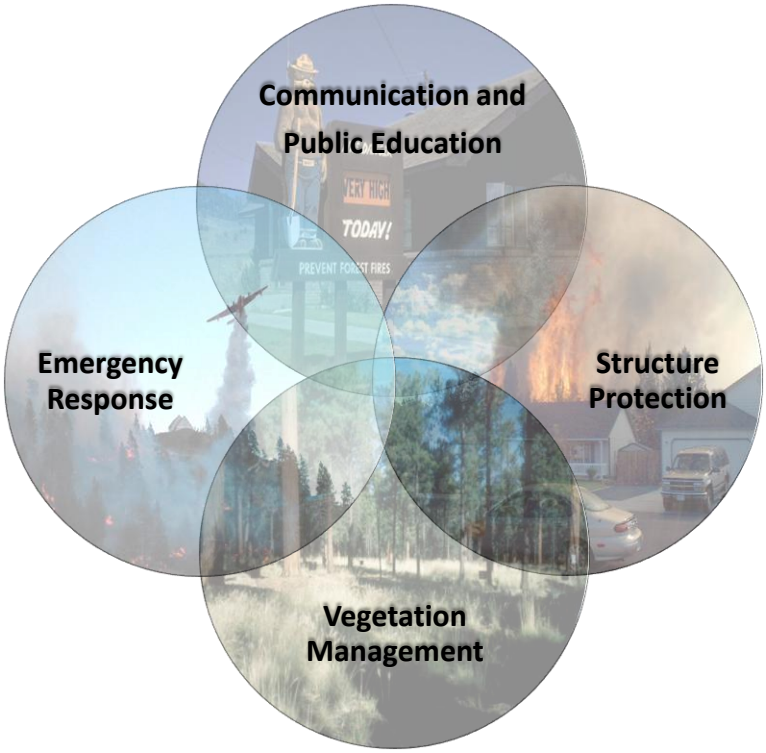


Figure 10. Wildland urban interface continuum summarizing the different options for addressing fire risk during the Community Wildfire Protection Plan process.

The recommended management response to a given wildfire risk profile is based on determining the appropriate combination and level of emphasis of the key elements shown in Figure 10:

- Communication and public education (e.g., signage, websites, advertising, communication planning, private owner structure protection and vegetation management)
- Structure protection (e.g., FireSmart principles for construction and vegetation management, National Fire Protection Association (NFPA) standards, subdivision design)
- Vegetation management (e.g., identifying hazardous fuel types, reducing crown and ladder fuels, landscape level fuel breaks)
- Emergency response (e.g., evacuation and access routes, firefighting capability, training, emergency response planning, post-fire rehabilitation planning)

Determining where effort for wildfire mitigation should be focused is based on an assessment

of risk, defined as the factors that contribute to the probability of fire and the values at risk (consequence) in the community. A variety of management responses are appropriate within a given community based on the Community Risk Profile presented in Section 6.0.

6.0 Community Risk Profile

Two parallel approaches were used to develop the risk profile for each community within the study area.

6.1 Stakeholder Workshop

The first part of the approach involved a workshop with participation from Fire Chiefs, emergency program coordinators and representatives, regional and municipal staff (planning, engineering, parks, water and building) and a representative from the MFLNRO (formerly the Ministry of Forests and Range) Protection Branch . The workshop used a Structured Decision Making approach as defined in Hammond *et al.* (1999)[4]. The decision problem was defined as:

> **In order to adequately improve community protection against a large wildfire event, which mitigation strategies make the most sense for implementation in CRD communities and Sooke?**

Prior to the workshop, key objectives were elicited from participants via an email questionnaire. At the workshops, participants went through a process of weighting those objectives and defining the 'best' alternatives for each community. We then used this information to look at the consequences and tradeoffs of each alternative on the defined objectives. This process enabled us to determine which mitigation strategies had the biggest impact on the objectives that matter to communities. Those objectives that we could not influence through our mitigation alternatives were removed from the analysis because they do not affect our decision.

Across all stakeholders, regardless of community representation, means objectives that supported the fundamental objective of protecting human life and well-being were consistently rated at the top. There was a lot more variability across the group on the fundamental objectives of protecting economic values and protecting environmental values. It is our interpretation that this variation is explained both by the stakeholder's perception of:

1. The impacts of wildfire on these objectives in the context of these specific communities; and,
2. The stakeholder's ability to influence the impact on objectives through their decision.

[4] Hammond, J., Keeney, R. And H. Raffia. 1999. Smart Choices: A Practical Guide to Making Better Decisions. Harvard Business School Press, Boston, Ma, USA.

In other words, the ranking of objectives is not necessarily a reflection of the objective's inherent value or importance, but a reflection of the objective's importance in relation to this specific decision.

Representatives of Port Renfrew generally agreed with the consistently moderate and high objectives shown in Table 2. However, minimizing habitat loss for fire vulnerable species was ranked more highly as an objective than in most other communities. This is likely due to the important natural area and wildlife values that form a key part of Port Renfrew's identity and tourism industry.

Objectives were assigned measurable metrics and this was used to compare alternatives relative to the status-quo (i.e., current practices). For Port Renfrew, a comparison of possible mitigation alternatives against objectives determined that the objectives most benefited by mitigation strategies were:

1. Improved public understanding of fire risk and personal responsibility;
2. Maintaining park/trail recreation;
3. Protecting homes/structures;
4. Reducing fire behaviour;
5. Minimizing habitat loss for fire vulnerable species;
6. Protecting critical infrastructure.

The order of the objectives in the list above reflects how much the mitigation alternatives defined in the workshop were able to impact our objective (i.e., 1. on the list was the objective most impacted by the mitigation alternative).

Interestingly, though the following objectives were important, our available alternatives did not impact the metrics we used to measure them in relation to the status-quo:

- Ignitions – the number of ignitions annually is already low, therefore alternatives may help to maintain this low number but are not expected to substantially change it.
- Suppression response – this was measured in terms of response time, which is currently quite good across the fire protection area and, given that adding additional fire response resources at this time is not warranted or feasible, response time will not be changed by our alternatives.
- Evacuation ease – evacuation is somewhat limited in the main Port Renfrew town site and beyond due to a long 1-way in and out access. However, it is not warranted or feasible to build a second access at this time so none of our alternatives will impact this objective. Water access will continue to be a back-up evacuation option for Port Renfrew.

The metrics used to measure impacts on objectives were not exhaustive and so were not the sole factor used to determine recommendations for each community. For example, there is more to improving suppression response than just improving response time and so we still consider other elements of suppression response. What this analysis does is provide direction on where

we should focus our efforts in wildfire mitigation by highlighting what is most important to consider and where we can likely make the biggest improvements.

Table 2. Fundamental and means objectives considered in the workshop, and colour coded objectives that were ranked consistently across groups. The objectives in unshaded cells were ranked low to moderate but varied between groups.

Fundamental Objectives	Means Objectives #1	Means Objectives #2
Human Life and Social Benefit/Well-Being	**Reduce Wildfire Threat**	**Ignitions**
		Suppression Response
		Fire Behaviour
	Protect Community Infrastructure	**Critical infrastructure**
		Homes /Structures
	Maximize Safety	**Evacuation Ease (Egress)**
	Minimize Health Impacts	Drinking water
		Air quality
	Maintain Recreation Quality/ Opportunity	**Maintain Park/Trail Recreation**
	Enable Effective Implementation	Cost of Implementation (incl. additional res.)
		Maximize Public Understanding of Fire Risk and Personal Responsibility
		Political acceptability
Economic	Commercial Assets	Timber Assets
	Residential Land Value	Visual Quality
Natural Environment	Biodiversity	Minimize Invasive Species Spread
		Minimize Habitat Loss for Fire Vulnerable Species
Consistently High		Consistently Moderate

6.2 Modelling Wildfire Risk

The second approach to developing the community risk profile was to use a geospatial wildfire risk model called the 'Wildfire Risk Management System' (WRMS). Individual polygons are weighted for each subcomponent (Figure 11). Using algorithms, the subcomponents are combined to produce component weightings which are then further processed to derive probability and consequence ratings.

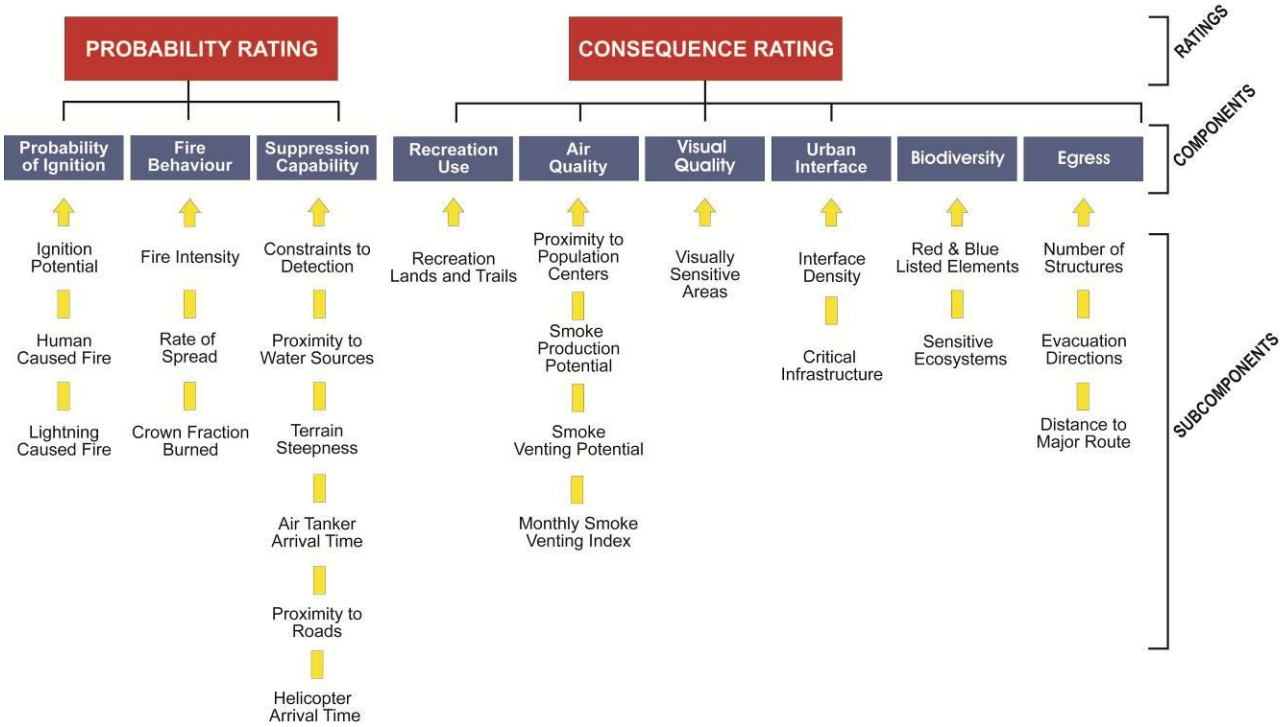


Figure 11. Illustration of the sub-components and components used to calculate the final probability and consequence ratings within the Wildfire Risk Management Structure for the CRD and Sooke. Note: Sensitive Ecosystems was excluded for Port Renfrew because there is no inventory.

The weightings used for the CRD and Sooke communities WRMS were determined using the ranking of objectives derived during the stakeholder workshop. Component weightings were as follows:

- Probability Rating
  - Probability of Ignition: 35%
  - Potential Fire Behaviour: 30%
  - Suppression Capability: 35%
- Consequence Rating
  - Urban Interface: 49%
  - Egress (Evacuation Ease): 20%
  - Recreation: 10%
  - Biodiversity: 7%
  - Visual Quality: 7%
  - Air Quality: 7%

6.2.1 The Base Case

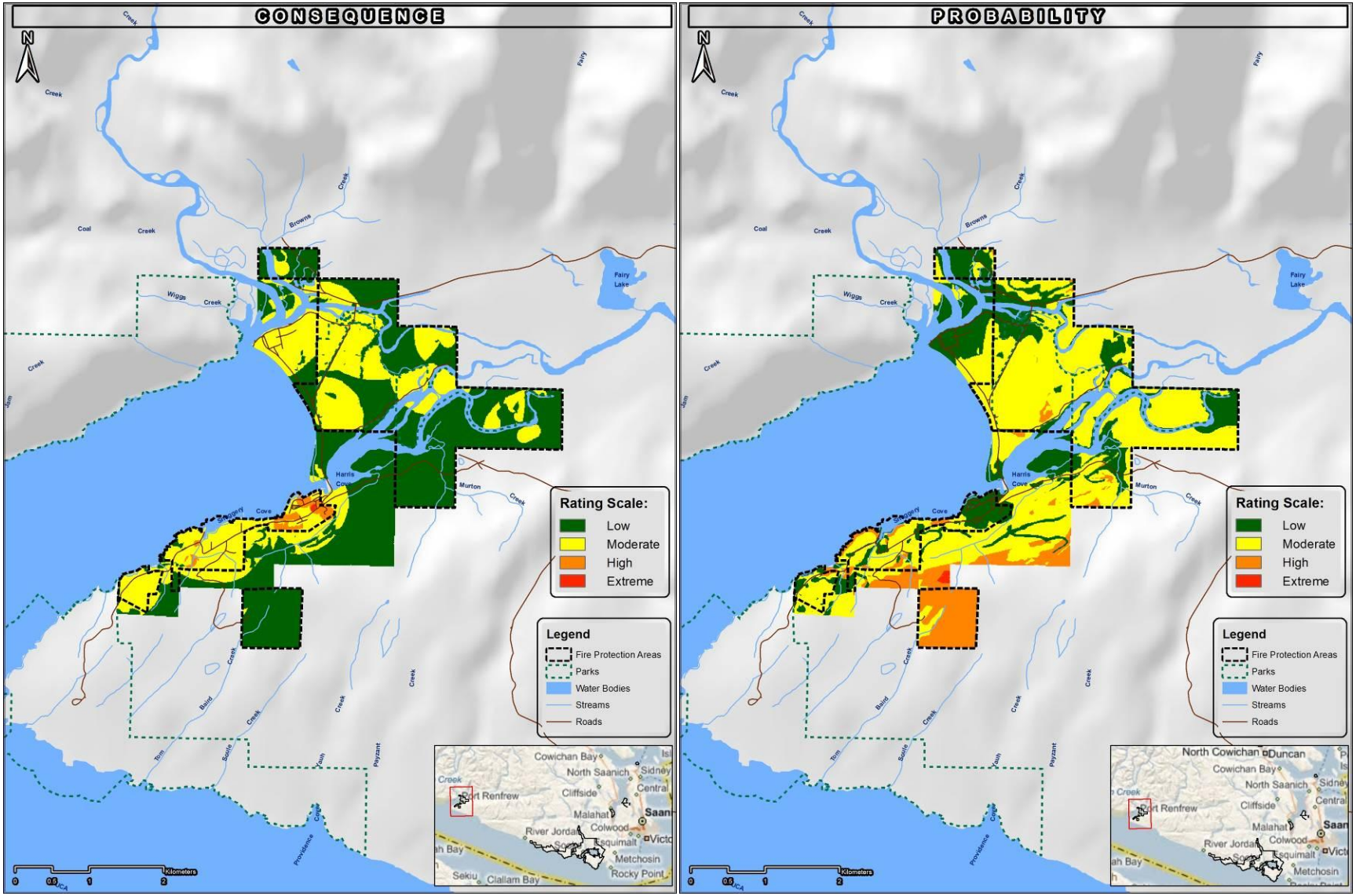
The base case WRMS reflects current conditions for each of the subcomponents, components and ratings shown in Figure 11 according using data available from the Province, the CRD and data collected in the field. All map outputs for the WRMS are provided in Appendix 1.

The probability of fire within Port Renfrew is predominantly moderate based on expected fire behaviour, ignition and suppression capability (Map 6). There are some areas of high that correspond with the transition in to CWHvm, which is drier than the CWHvh during the fire season and can support more extreme fire weather conditions more frequently. The consequence of wildfire is predominantly moderate (Map 6) driven primarily by critical infrastructure, interface density and evacuation. The area of extreme consequence is due to the fire department, valued as critical infrastructure during a wildfire emergency.

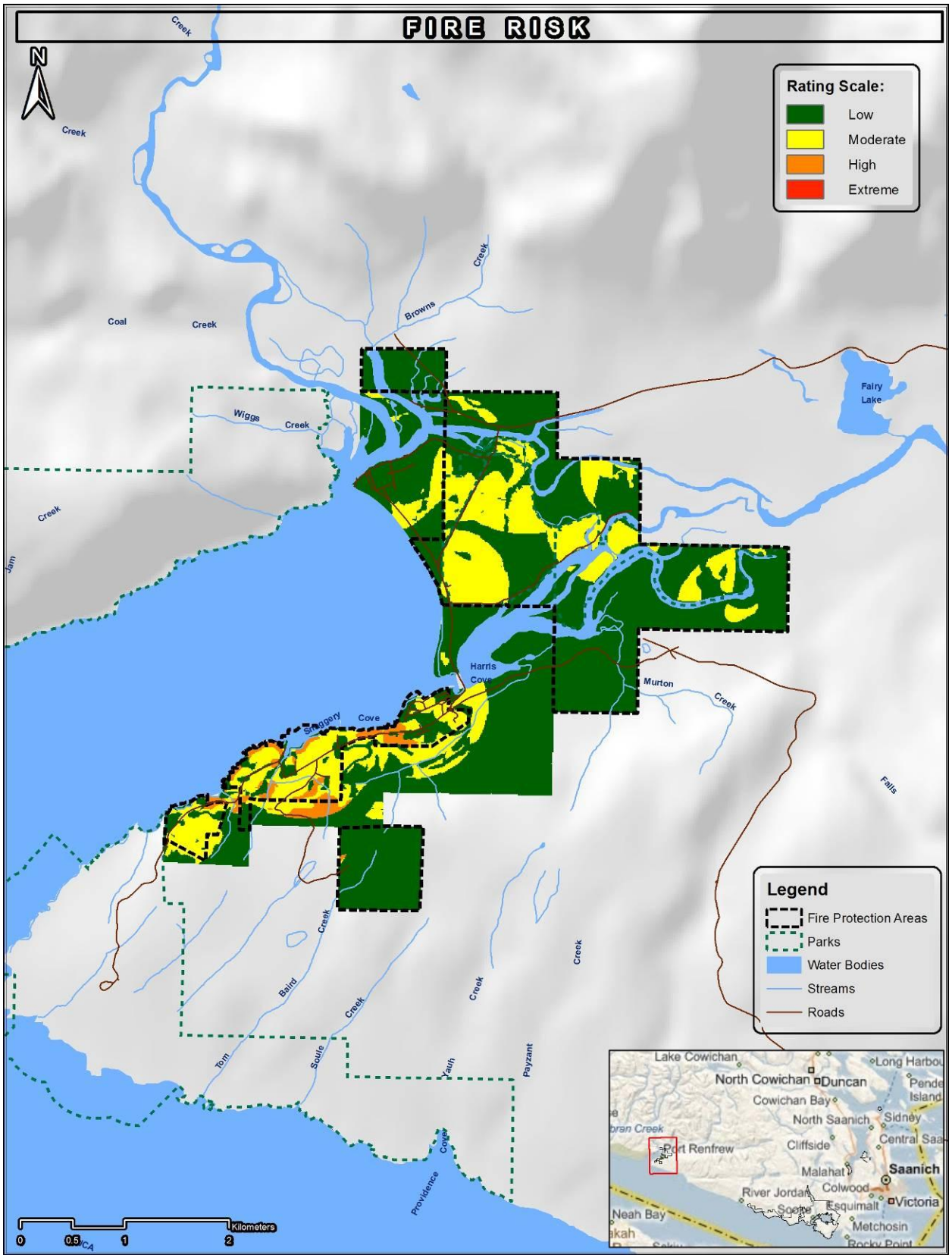
Fire risk (Map 7) represents the overall fire risk as a combination of probability and consequence defined as follows:

Fire Risk Matrix

		PROBABILITY>>>>			
		Low	**Moderate**	**High**	**Extreme**
CONSEQUENCE>>>>	**Low**	Low	Low	Low	Moderate
	Moderate	Low	Moderate	High	High
	High	Moderate	High	High	Extreme
	Extreme	Moderate	High	Extreme	Extreme



Map 6. Probability of wildfire (left) and consequence of wildfire (right) from the Wildfire Risk Management System.



Map 7. Port Renfrew Fire Risk from the Wildfire Risk Management System.

6.2.2 WRMS Re-Runs

Based on the objectives rated as consistently high from the stakeholder workshop, we identified four hypothetical mitigation scenarios. These were used to re-run the WRMS in order to see their impact spatially on overall wildfire risk. The four scenarios were:

1. Reducing human ignitions by 50% (reducing ignitions objective).
2. Improving suppression capability by adding water sources in locations that were poorly serviced (improving suppression response objective).
3. Modifying fuels in priority areas across the study area (i.e., 100 m around homes, critical infrastructure and several select fuel treatment areas on Crown land adjacent to structures) (reducing fire behavior, protecting critical infrastructure and homes/structures).
4. Improving egress (evacuation ease) by adding 2-way access in specific subdivisions across the study area (evacuation ease objective).

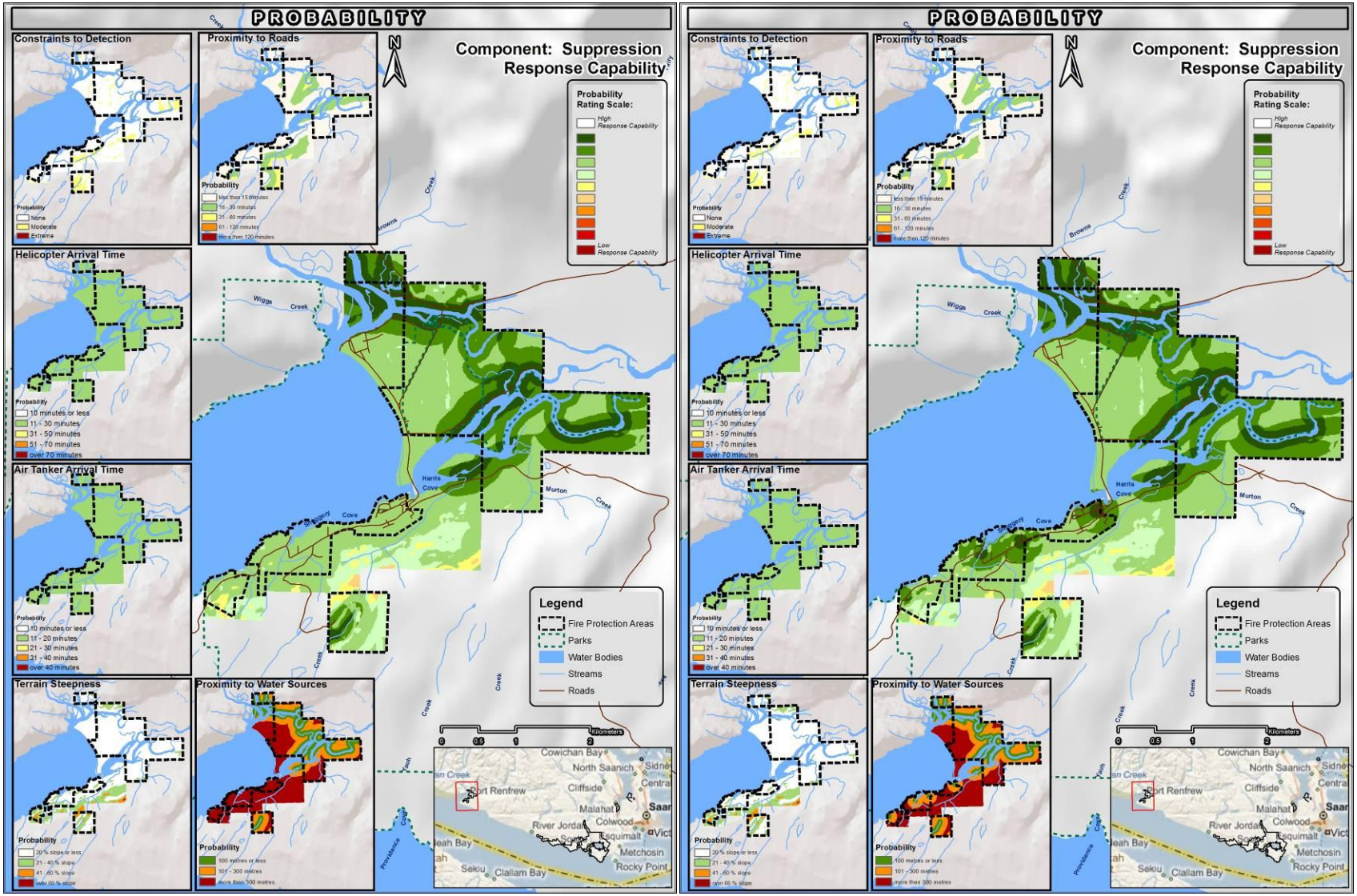
Because alternatives did not impact human ignitions or improving egress, only re-run 2 (improving suppression capability) and re-run 3 (modifying fuels) were modeled. The following maps show the comparison of the relevant component of the WRMS from the base-case to the re-runs described in points 2 and 3 above.

Map 8 shows the comparison from the base case to re-run 2, additional water sources to improve suppression capability. There is localized change to suppression capability from strategically adding water sources within the Fire Protection Area. The change due to adding water storage in and around the town site is noticeable but relatively small because Port Renfrew already has quite good suppression capability in accessible areas.

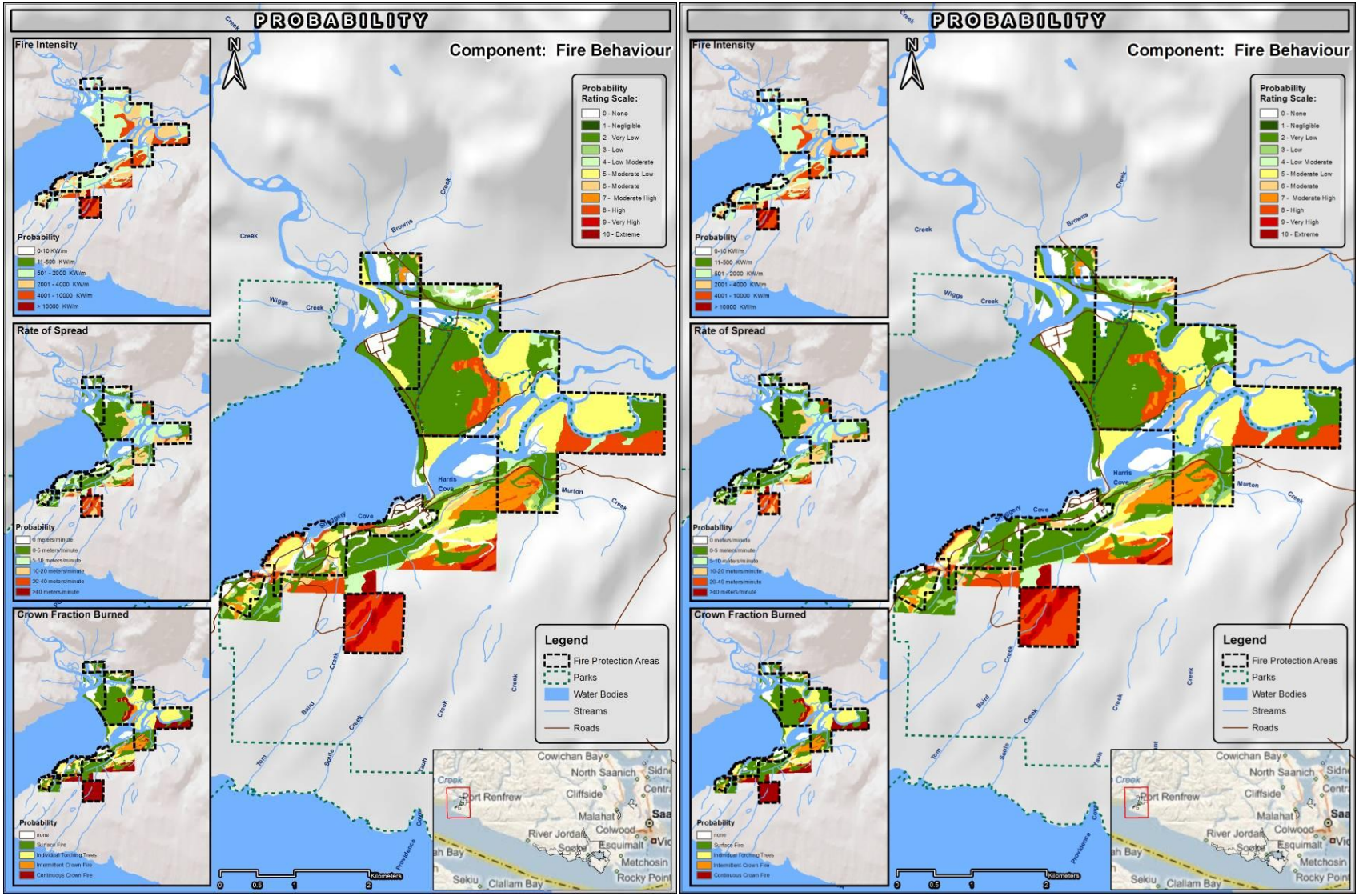
Map 9 shows the comparison from the base case to re-run 3, FireSmarting around homes and critical infrastructure to reduce fire behaviour. While the differences in fire probability due to fuel treatments are localized around homes, there is a notable reduction in the probability of extreme fire behaviour (from moderate to low) around the town site. There are also other impacts of FireSmarting, including improved protection of homes and critical infrastructure that would provide substantial value not captured in the WRMS model. In Port Renfrew, it is not appropriate to implement the very large fuel treatments necessary to show widespread change in the fire behavior layer of the model. This is primarily because ecosystems in the CWH biogeoclimatic zone do not generally require restoration due to fire exclusion and forests are adapted to infrequent, stand-replacing or mixed severity fire so fuel treatments would have limited effectiveness over time and would not usually meet broader ecosystem management objectives. Therefore, the focus of any fuel modification should be to improve structure or infrastructure protection and to reduce fire severity in developed areas.

In summary, the mitigation alternatives modeled in the WRMS show that localized impacts are seen by FireSmarting around homes and structures and improving water access.

As with the stakeholder workshop analysis, the metrics used to measure changes in these alternatives are not exhaustive and so are not the sole factors we use when determining recommendations for each community. The WRMS does show which of our alternatives has the largest spatial impact. We can use this information to further prioritize objectives and to explicitly identify the locations where changes would be most beneficial.



Map 8. Comparison of suppression response capability from WRMS base case (left) to improving water access (Re-Run 2).



Map 9. Comparison of fire behaviour from WRMS base case (left) to FireSmarting around homes and critical infrastructure (Re-Run 3).

7.0 Action Plan

The Action Plan consists of the key elements of the WUI continuum and provides recommendations to address each element. In general, recommendations have relevance to more than one key CWPP element (e.g., education recommendations have relevance to structure protection and vegetation management) but we discuss them here under the most applicable topic.

7.1 Communication and Education

7.1.1 Objectives

The objectives for communication and education are:

- To improve public understanding of fire risk and personal responsibility by making residents aware that their communities are interface communities and by educating them on actions they can take to reduce fire risk on private property.
- To establish a sense of homeowner responsibility for reducing fire hazards.
- To raise the awareness of elected officials to the resources required and the risk that wildfires pose to communities.
- To continue to work diligently to prevent ignitions during periods of high fire danger.
- To educate residents outside Fire Protection Areas about their level of fire protection and, where appropriate, to encourage their participation in Fire Protection Areas.

7.1.2 Current Status

The community within Port Renfrew has some awareness of fire risk, burn bans and local regulations through educational outreach undertaken by the Fire Department. Signage on major routes and at the Fire Departments is very good. The community is not generally FireSmart with fire vulnerable materials used in new construction and flammable vegetation often too close to structures, individual homeowners could do more to limit the possibility of fire spreading to or from their homes to the forest.

The Juan de Fuca Electoral Area has an emergency program that plans and manages emergency response for the entire Electoral Area. This plan was created in response to the Emergency Program Act. Program activities include the coordination of communication among area response agencies, and direct the Emergency Coordinator.

7.1.3 Recommendations

Recommendation 1: The CRD should consider implementing a multi-media education program that maximizes efforts during the wildfire season, and during and after high profile wildfire events, in order to take advantage of heightened public interest during those periods. In addition to those methods already used, the CRD could:
- Upgrade the Juan de Fuca Electoral Areas website to display or link wildfire prevention information more prominently and to display real time information on fire bans and high fire danger (http://www.bcforestfireinfo.gov.bc.ca/).
- Review and update wildfire preparedness education in primary schools.
- Utilize social media such as Facebook and Twitter to communicate fire bans, high fire danger days, wildfire prevention initiatives and other real time information.
- Provide FireSmart education materials at the point of issuing building permits so that people know the fire hazard where they are building and what they can do to reduce those hazards.
- Use fridge magnet lists to communicate evacuation tips and the essentials needed.

High Priority - Estimated cost: see Recommendation 2.

Recommendation 2: The CRD should consider employing a Fire Prevention Officer to deliver education programs to Electoral Area communities.
High Priority - Estimated cost: $70,000 annual.

Recommendation 3: To target visitors and park/trail users, the CRD should consider posting signage with details of how to report ignitions (911) and reckless behaviour (e.g., throwing cigarette butts) both on trails and on roadways to encourage reporting. Trail signage should include location identifiers so that users can identify the location of the report. Notably, signage should be installed on:
- The Pacific Marine Circle Route
- The Juan de Fuca Marine Trail
- The West Coast Trail
- BC Provincial and National Parks

High Priority - Estimated cost: $ 3,000 + maintenance.

Recommendation 4: The CRD should consider educating property owners who live outside Fire Protection Areas of their status and ensure they are informed of the ways in which they are and are not protected in the event of structural fire and/or wildfire. Where practical, residents should be encouraged to join existing Fire Protection Areas given the protection benefit this provides both to those residents from fighting structural fires and the greater population through preventing wildfire ignitions from structural fires.
High Priority – Estimated cost: see Recommendation 2.

Recommendation 5: The CRD should consider enhancing existing communications planning for emergency administration, community members and the media. For each Electoral Area community, the plan should identify who is responsible for delivering reliable and timely information during disasters and how this would be achieved if power and telephone communication were unavailable. The plan should also identify contacts for any local, unofficial individuals or groups that would be helpful during an emergency. **High Priority** – Estimated cost to be within current operations.

7.2 Structure Protection

7.2.1 Objectives

The objectives for structure protection are:

- To improve public understanding of fire risk and personal responsibility.
- To protect homes/structures and critical infrastructure.
- To develop policy tools to adopt FireSmart standards over the next five years and to encourage private homeowners to voluntarily adopt FireSmart on their properties.

7.2.2 Current Status

Homes within Port Renfrew vary in terms of whether they meet FireSmart standards for construction or vegetation around homes. Most homes do have rated roofs, however a number of homes are very close to flammable vegetation or are constructed with fire vulnerable siding (Figure 12). Fire research indicates that roofing, adjacent burnable materials and landscaping play the greatest role in structure ignitability. There is currently no wildfire vulnerability standard for building materials used in the CRD. There are two main avenues for FireSmarting a structure: 1) change the vegetation type, density, and setback from the structure (addressed in Section 7.4); and, 2) change the structure to reduce vulnerability to fire and reduce the potential for fire to spread to or from a structure (addressed here).


Figure 12. Homes with coniferous vegetation within 10 m and fire vulnerable siding.

The results of fire behaviour modeling under extreme weather conditions indicated that fuel types in and around the Port Renfrew town site will generally support fire intensities < 4,000 kw/m^2, which we can assume would cause minor damage to structures in the absence of successful fire suppression. However, forests within 2 km of the town site are likely to support more extreme fire behaviour such as crown fire throwing burning embers, which means that structures within the town could be impacted by spotting (mass ember attack). Spotting is a more common cause of structure ignition than direct flame contact during a wildfire. While the likelihood of a wildfire impacting homes within Port Renfrew is low-moderate, particularly in the CWHvh, Port Renfrew's limited firefighting capacity, intermix interface condition and isolation from assistance does warrant some attempt to reduce structure ignitibility. These efforts would also better protect the community from a house fire potentially igniting adjacent structures. The Fire Chief does review subdivision plans prior to their approval, which is a positive step towards enhancing fire protection within new subdivisions but FireSmart and NFPA standards design could be further supported in Regional bylaw.

7.2.3 Recommendations

Recommendation 6: Consider changes to CRD policy that would improve the FireSmart conditions and suppression access for interface areas. There are several ways in which this can be achieved through different bylaws and guidelines; however it is recommended that NFPA 1142 (Water Supplies for Suburban and Rural Fire Fighting) and 1144 (Protection of Life from Wildfire) standards be used to develop specifications. Current wildfire hazard mapping delineated in OCPs (risk mapping sourced from the province) should be updated based on the protection plan fire risk mapping). An example of how such changes could be incorporated is through the:
- **Official Community Plan**: Statement of support for initiatives, Development Permit Exemptions, Wildfire Hazard Development Permit Area Guidelines (with checklist and requirement for a professional report assessing developments for FireSmart vegetation and access/egress).
- Section 219 Covenants in Wildfire DP Areas.
- Subdivision Servicing Specifications: Fire flows/water delivery system, fire protection water storage systems and access/egress. New subdivisions should be developed with multiple access points that are suitable for evacuation and the movement of emergency response equipment based on threshold densities of houses and vehicles within the subdivisions. Consideration should be given to requiring roadways to be placed adjacent to forested lands, rather than homes (e.g., ring roads).
- Sprinkler Bylaw: Sprinklers.
- Zoning Bylaw: Siting of structures in Wildfire Hazard DP Areas (including critical infrastructure).
- Building Bylaw: Roofing, building materials in Wildfire Hazard DP Areas.
Moderate-High Priority: Estimated cost to be within current operations.

7.3 Emergency Response

7.3.1 Objectives

The objectives for emergency response are:

- To further develop communication and cooperation between Port Renfrew, the Regional District and the MFLNRO.
- To build interface fire capacity for fire department volunteers.
- To maximize community resilience to a wildfire event.

7.3.2 Current Status

Port Renfrew is a volunteer fire department with approximately 12 volunteers. The department serves both the residents of Port Renfrew and the Pacheedaht First Nation. The fire department

has not had any interface fire fighting experience and interface training and equipment is limited. Response times across Port Renfrew are approximately 15 minutes and a mutual aid agreement is in place with the Shirley/ Jordan River Volunteer Fire Department.

There are several hydrants in the Snuggery Cove area but most homes do not have hydrant coverage. The water system uses well water as the source. The Fire Department could potentially access creeks to draw water. The existing water system location is potentially vulnerable to wildfire and lacks a back-up power generation system. However, this infrastructure is likely to be relocated and upgraded by 3 Point Properties as part of the Wild Coast Cottages project.

Access and evacuation ease within Port Renfrew is variable. The main town site is relatively close to Highway 14 but is the beginning of a long, 1-way in and out road accessing a number of homes. Access in to private forested land surrounding Port Renfrew is limited. Port Renfrew does have an evacuation plan and has had to evacuate for a Tsunami warning.

Port Renfrew is isolated and is often impacted by storms that affect telecommunications, particularly the Telus microwave tower on Mount Demers. In the past, communications have gone down resulting in community members being unable to contact emergency services. Under these circumstances, fire department radios had been distributed to different parts of the community to provide communication. Two satellite phones are also in the community. Recently, a local phone switch was installed meaning that residents should still have contact with Port Renfrew emergency services and each other when outside communication is cut; however this is still in the final testing stages. South Island Cable Systems, which provides service to some residents, was able to maintain phone and internet service by switching to a satellite backup when the microwave tower went down.

7.3.3 Recommendations

Recommendation 7: The Port Renfrew Fire Department, supported by the CRD, and in cooperation with local landowners should consider acquiring keys to access forestry roads or private property that is gated.
Moderate Priority: Estimated cost to be within current operations.

Recommendation 8: The Port Renfrew Fire Department, supported by the CRD, should consider options to improve access to existing water sources (e.g., installing dry hydrants), and for adding water sources where there are none. Developers or homeowners should be encouraged to install hydrant systems or water storage tanks for fire protection.
Moderate Priority: Dry hydrant/s $2,000 plus.

Recommendation 9: The Port Renfrew Fire Department should consider the following training: 1) S100 course training; 2) S215 course training for Fire Chiefs and Deputies; and, 4) Incident Command System training for Fire Chiefs and Deputies. If it proves too difficult for all members to access formal S100 training, then informal training and self study are preferred to no training.
Moderate Priority: Estimated cost to be within current operations.

Recommendation 10: The CRD should consider reviewing the Evacuation Plan for Port Renfrew from a wildfire evacuation perspective to ensure that it identifies:
- Individuals requiring assistance.
- The location of any large pets or livestock requiring evacuation and where they can be evacuated to.
- Potential locations of evacuation centres in adjacent communities, and where and how services would be provided to evacuees.
- Water evacuation options.
- Volunteers or volunteer organizations that can assist during and/or after evacuation.

Moderate Priority: Estimated costs to be within current operations.

Recommendation 11: The CRD should consider ensuring that the existing water system, or if that is to be replaced in the near future, the new water system has adequate back-up power generators to power pump stations in the event that the regular power supply is interrupted.
Moderate Priority: Cost to developer.

Recommendation 12: The CRD should consider establishing an integrated 'Wildfire Suppression Group', consisting of representatives from each Juan de Fuca community Volunteer Fire Department, the Sooke Fire Department, mutual aid municipal departments, Wildfire Protection Branch, CRD Water and CRD Parks Suppression Crews to meet annually to establish the compatibility of equipment, identify opportunities for sharing resources, establishing equipment caches to fill gaps, and to plan joint training exercises.
Moderate Priority: Estimated cost to be within current operations.

Recommendation 13: The CRD should develop annual or biannual communications system training program for volunteer fire departments to ensure that members know how to properly use the radio system during a major emergency situation.
Moderate Priority: Estimated cost to be within current operations.

Recommendation 14: The CRD should consider establishing a sub-regional mobile cache of wildland firefighting equipment for Juan de Fuca communities. This would reduce the cost of purchasing and maintaining additional interface equipment for each Fire Department. Personal Protective Equipment and basic tools for interface fire fighting should still be maintained within each Fire Department.
Moderate Priority: Estimated cost $10,000 - $15,000.

Recommendation 15: The CRD should continue to work with telecommunications providers to ensure that the local telephone switch is functional and, if possible, to improve the consistency of telecommunication service in the long-term.
Moderate Priority: Estimated cost to be within current operations.

7.4 Vegetation (Fuel) Management

Vegetation or fuel management is generally considered a key element of the FireSmart approach. Fuel management is the planned manipulation and/or reduction of living and dead forest fuels for land management objectives (*e.g.,* hazard reduction). The purpose of altering vegetation for fire protection must be evaluated against the other key CWPP elements outlined above to determine its necessity.

Within Port Renfrew, the outcomes of the stakeholder workshop and the WRMS modelling indicate that modifying fire behaviour through vegetation management could be worthwhile where it contributes to home and critical infrastructure protection.

Fuel management can be undertaken with a very minimal negative or even positive impact on the aesthetic or ecological quality of the surrounding forest and does not mean removing most of the trees. The focus for fuel management in the interface is not necessarily to stop fire, but to ensure that fire severity is low enough that the fire's damage is limited. For example, treating around your home may prevent structure ignition due to direct flame contact – then the home's ability to survive the fire would come down to whether construction materials can survive ember attack. Reducing surface and ladder fuels in the forest around your home may mean that some of the larger, more fire-resistant trees can survive the fire. The intent of these fuel modification treatments is not to stop the fire, but to reduce fire severity.

7.4.1 Objectives

The vegetation management objectives are:

- To proactively reduce potential fire behaviour thereby minimizing adverse impacts on structures.
- To FireSmart vegetation within 100 m of homes and structures.

7.4.2 Current Status

Port Renfrew fuels predominantly consist of M2, C3 and C5 (Map 2 and

Table 1). There are scattered hazardous C2/ C4 fuel types (Map 3 and

Table 1). As previously mentioned, landscape level fuel breaks are not likely to be ecologically appropriate or cost effective in Port Renfrew's Coastal Western Hemlock ecosystems. However, a FireSmart approach to vegetation management within 100 m of structures is considered beneficial in order to improve defensible space around structures, and to reduce the likelihood that a house fire could spread to adjacent forest or homes. Given the current state of Port Renfrew forests, very limited treatment would be needed to implement FireSmart vegetation management.

Coniferous (and mixed) forest fuels within 100 m of structures were identified throughout Port Renfrew and prioritized for FireSmart fuel treatment. The majority of area identified is on private land. All coniferous and mixed fuels were identified and prioritized regardless of current hazard condition because fuel conditions change over time and FireSmart requires ongoing maintenance. **Given that much of the C5 and M2 stands (**

Table 1) will already be in a FireSmart condition, the actual area requiring action is likely to be smaller than that indicated on Map 10. Ground truthing will be required prior to acting on any treatment priority areas.

Map 10 defines priority treatments. Treatment priority was defined on a regional basis and so Port Renfrew does not have treatments in all priority classes. Each treatment is either a 'C' for Crown, or 'P' for private and only C3 and P2 priorities are relevant to Port Renfrew. Priority is defined as follows:

C1: Priority 1 treatments on Crown land to FireSmart around critical infrastructure.

C2: Priority 2 treatments on Crown land to implement fuel breaks in continuous forestland adjacent to structures.

C3: Priority 3 treatments on Crown land to enhance FireSmart treatments adjacent to private land.

P1: Priority 1 treatments on private land to FireSmart around critical infrastructure.

P2: Priority 2 treatments on private land to FireSmart around private structures.

FireSmart proposes the following zones for vegetation modification (Figure 13):

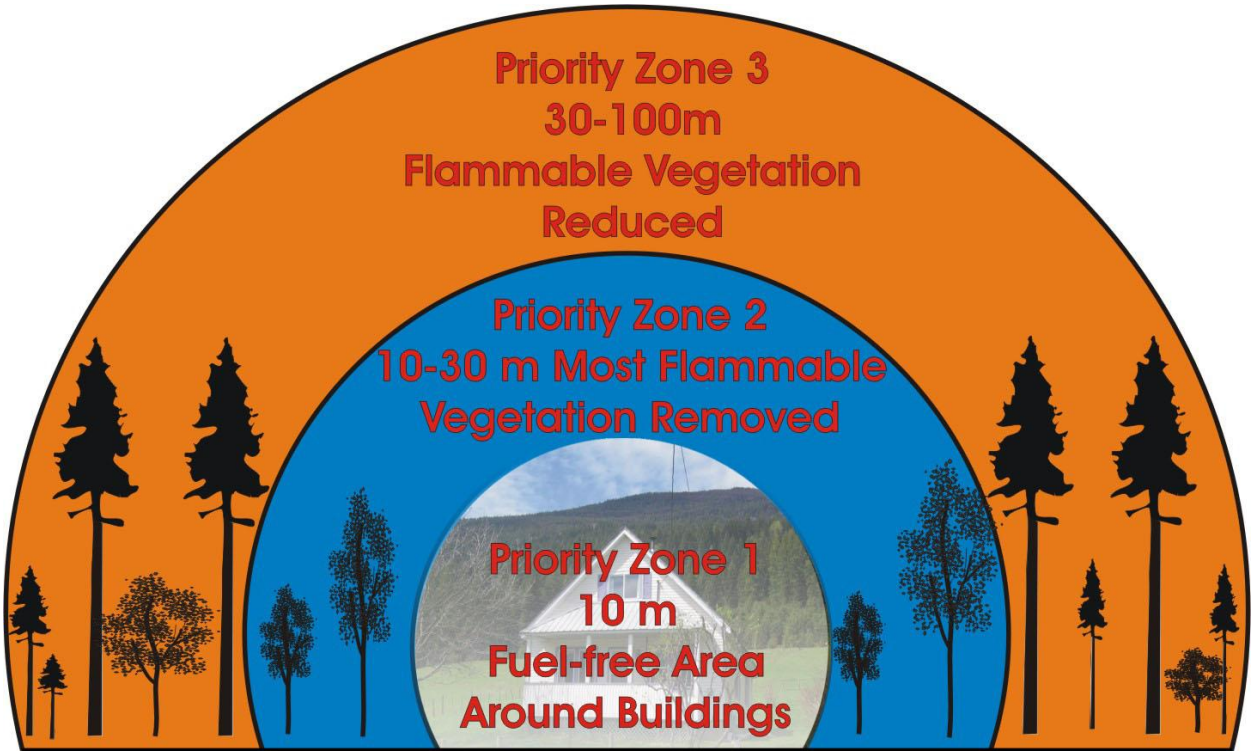
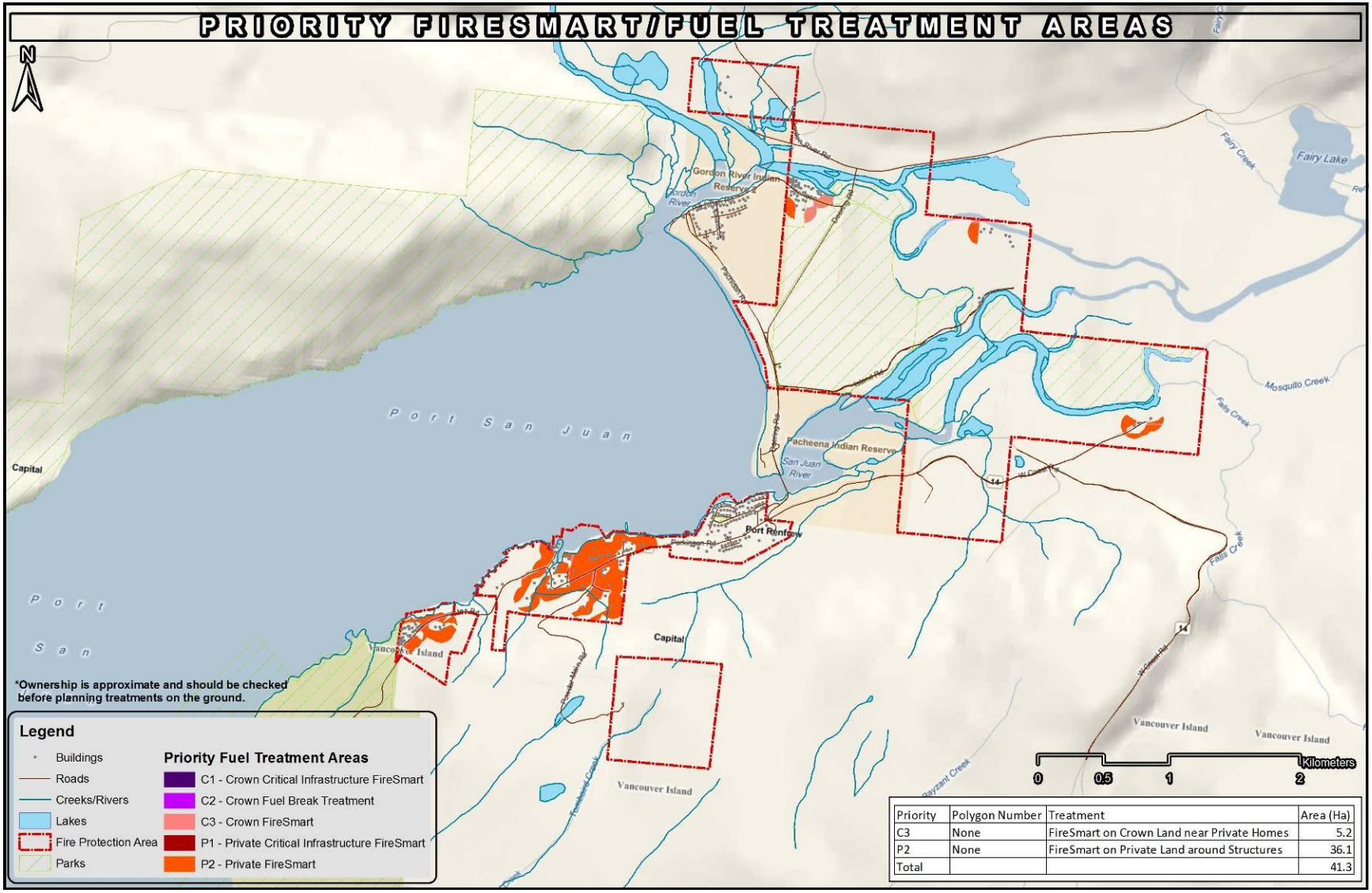


Figure 13. FireSmart Priority Zones

1. **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 radiant 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 bushes, herbs and other species with low flammability. Coniferous vegetation such as juniper or cedar bushes and hedges should be avoided, as these are highly flammable. Try to keep any vegetation in this zone widely spaced and well setback from the house.

2. **Priority Zone 2** extends from 10-30 m from the structure. In this zone, trees should be widely spaced 5-10 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 especially where long limbs extend towards buildings. This helps 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.

3. **Priority Zone 3** extends from 30-100 meters 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 the threat, cleanup of surface fuels as well as pruning and spacing of trees should be completed in this zone.



Priority	Polygon Number	Treatment	Area (Ha)
C3	None	FireSmart on Crown Land near Private Homes	5.2
P2	None	FireSmart on Private Land around Structures	36.1
Total			41.3

Map 10. Prioritized fuel treatment areas for Port Renfrew.

7.4.3 Recommendations

Recommendation 16: The CRD should consider reviewing critical infrastructure not in the spatial data provided for Port Renfrew, such as pump stations and communication towers, and include them as a treatment priority.
Low-Moderate Priority: Estimated cost $2,000 /ha- $12,000/ha.

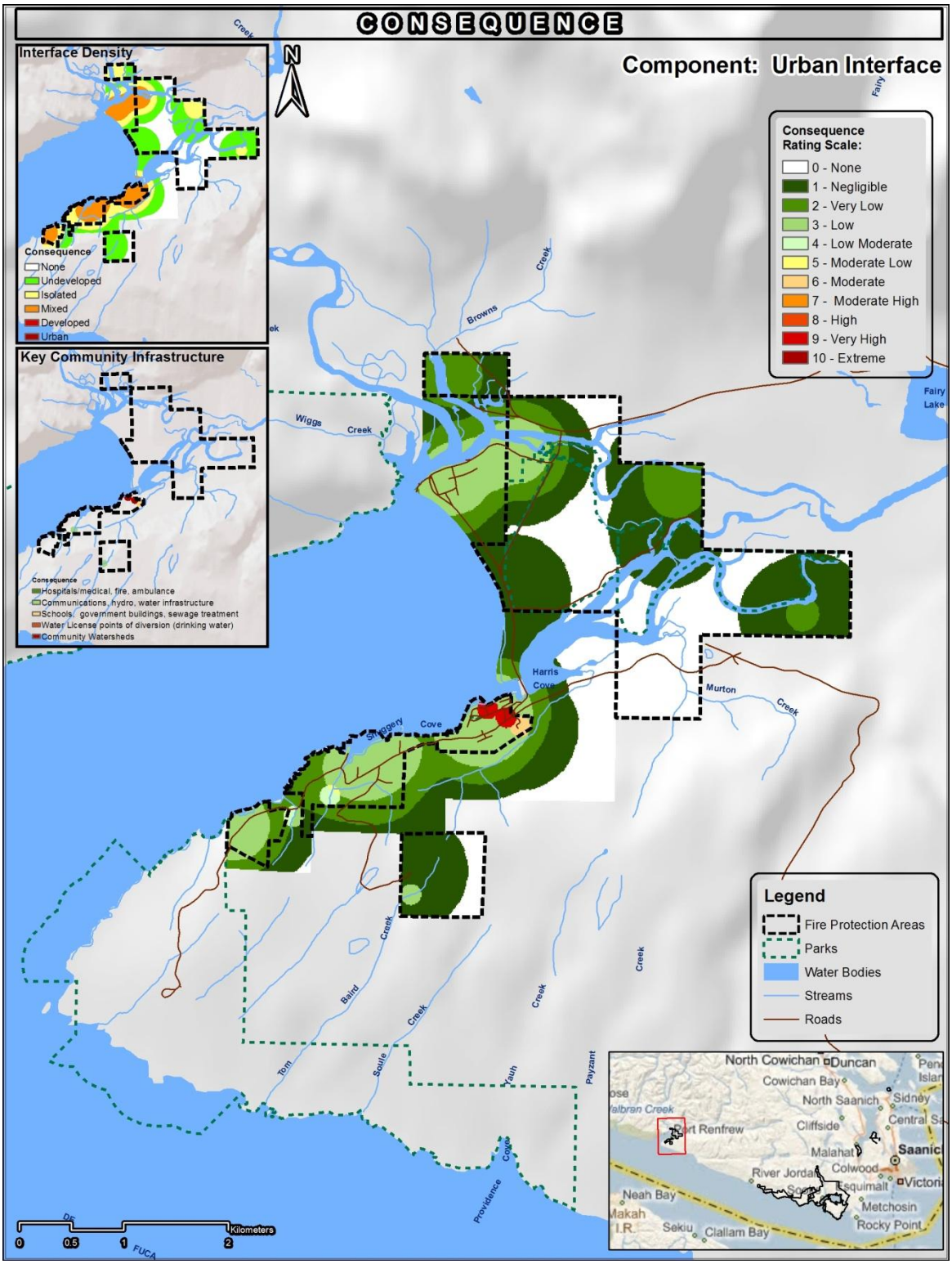
Recommendation 17: The CRD should consider implementing FireSmart treatments identified as Priority C3 if private landowners implement FireSmart on adjacent Priority P2 polygons. This treatment should be repeated every 10 – 15 years unless forests are converted to a deciduous type.
Low-Moderate Priority: Estimated cost $2,000 - $12,000/ha.

Recommendation 18: The CRD should consider encouraging residents, through education initiatives outlined in Recommendation 1, to implement FireSmart treatments identified as Priority P2.
High Priority: Costs borne by private parties.

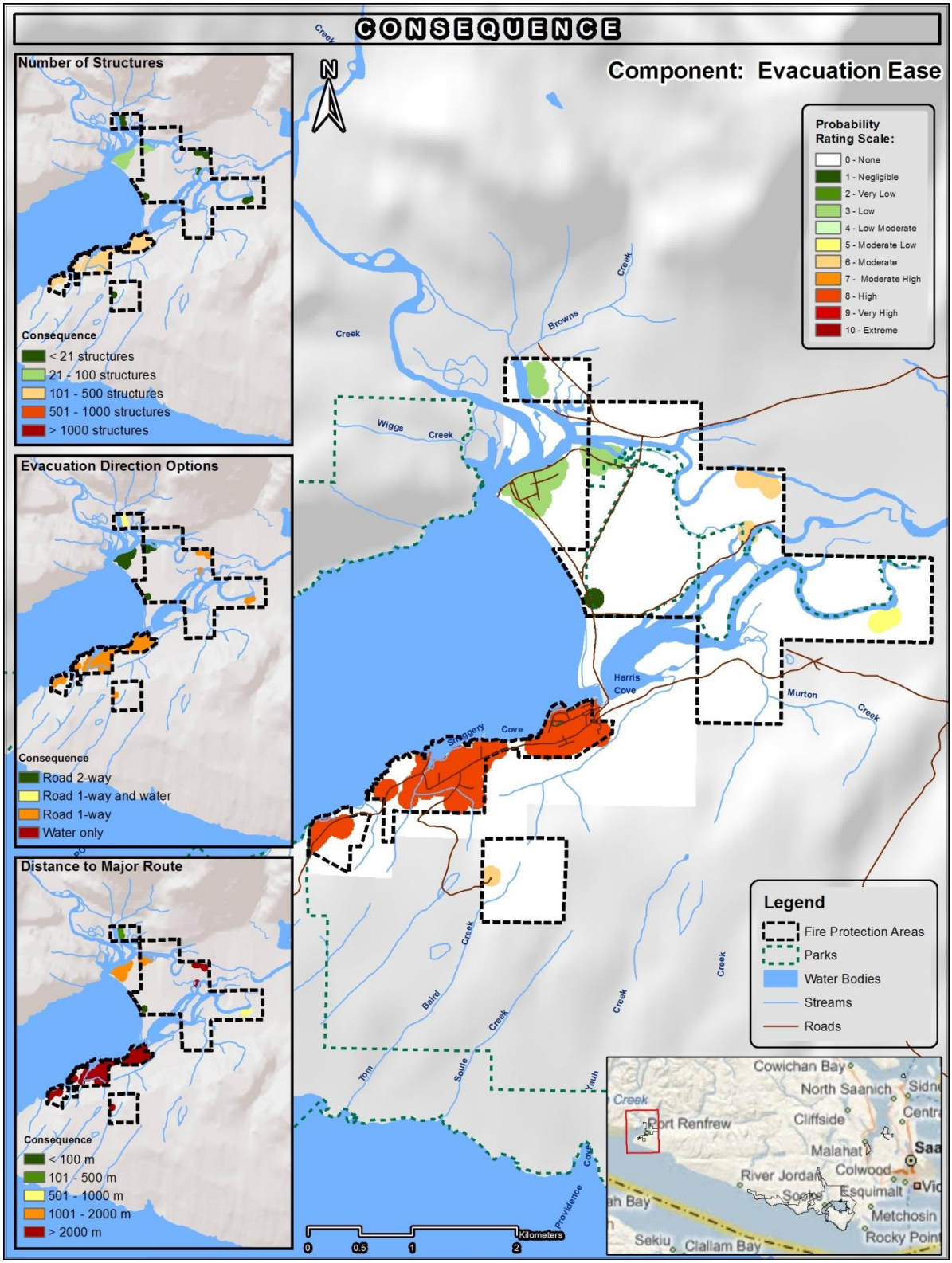
Recommendation 19: The CRD should consider, through initiatives outlined in Recommendation 5, requiring developers to undertake FireSmart vegetation treatments of subdivisions prior to construction, including any forested parcels to be given to the CRD as park or greenspace. FireSmart should not be interpreted as cleared land by developers.
Moderate Priority: Costs borne by outside parties.

Appendix 1 – Wildfire Risk Management System Outputs

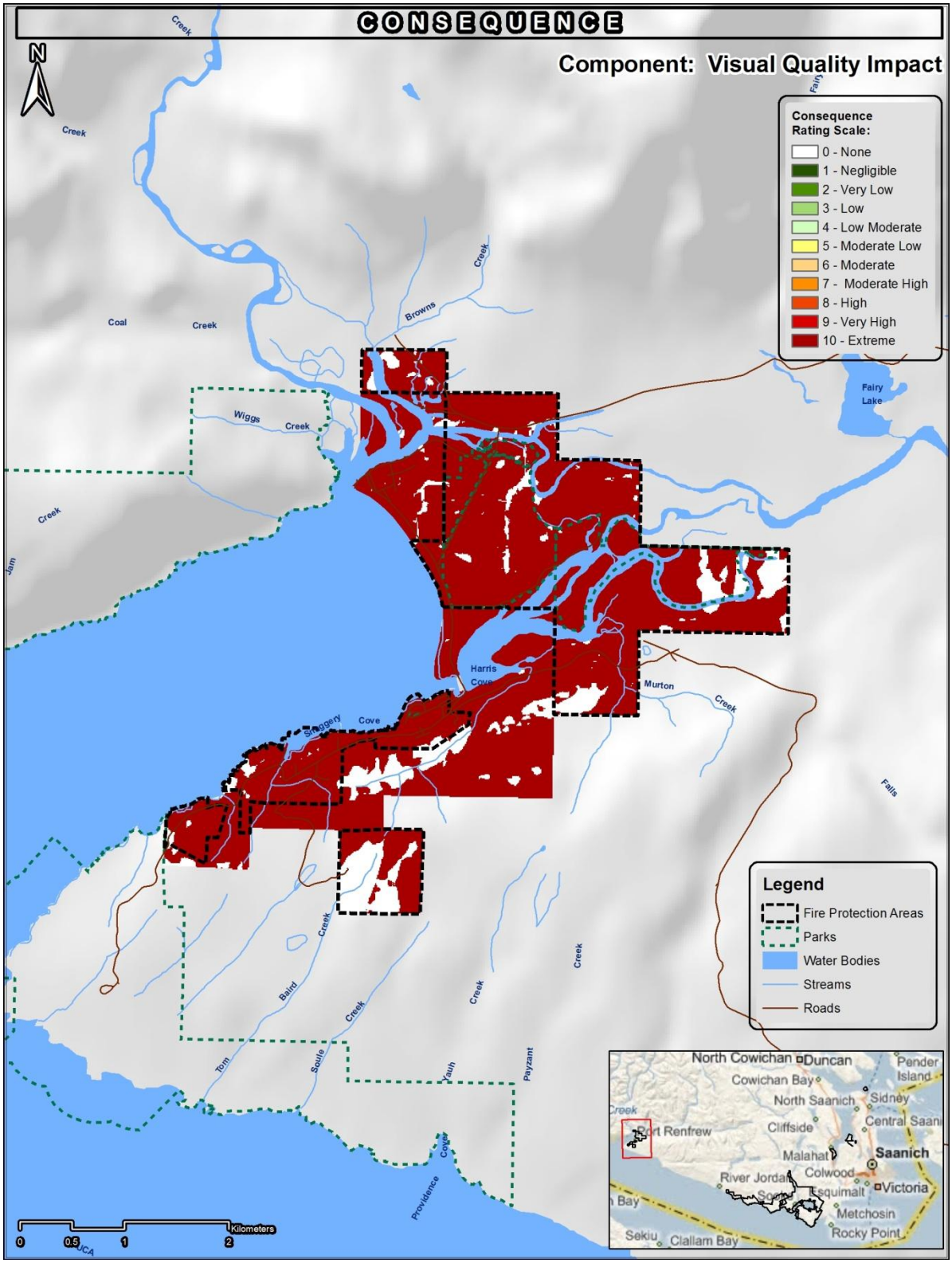
Urban Interface (Consequence)



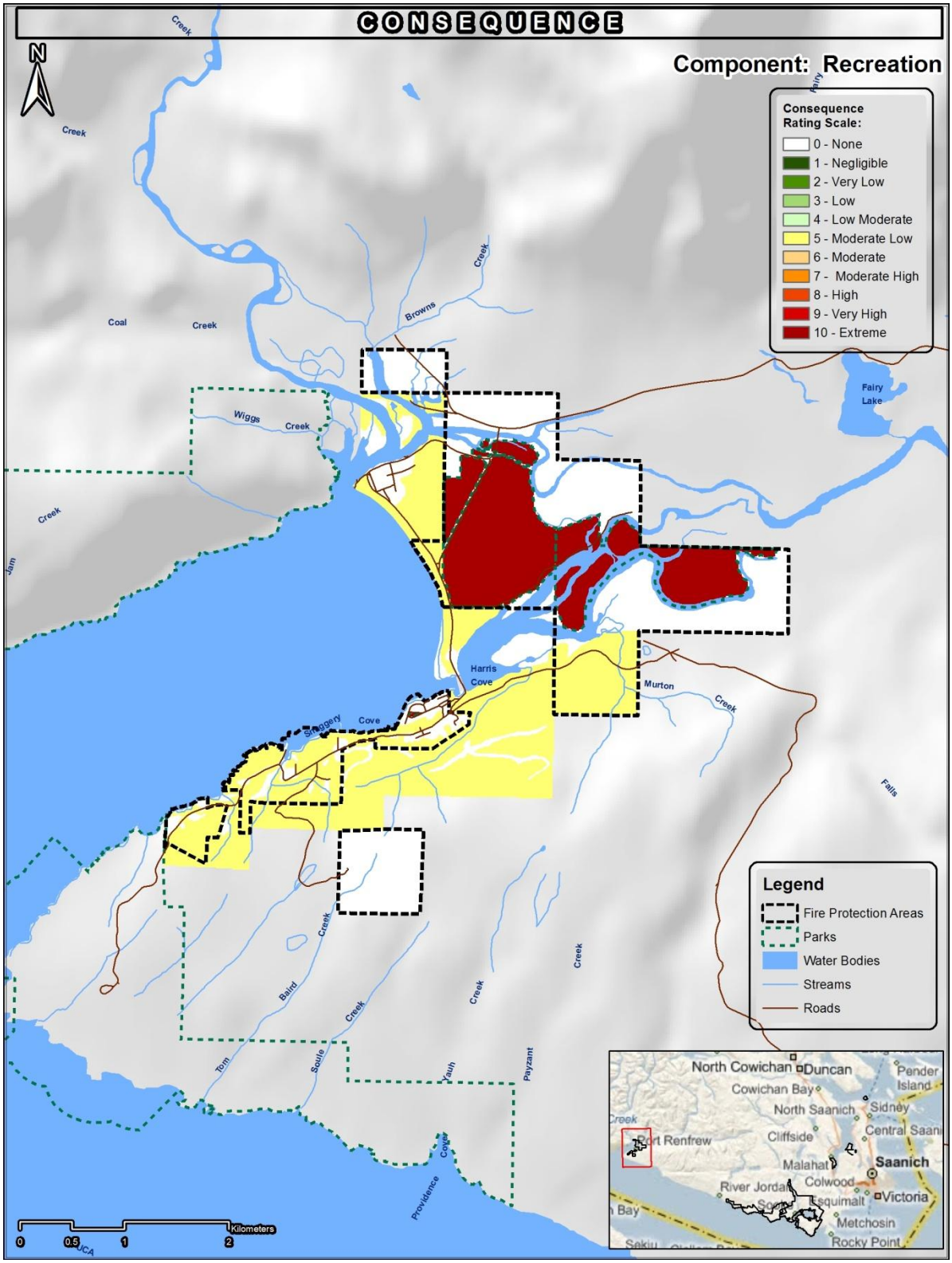
Evacuation Ease (Consequence)



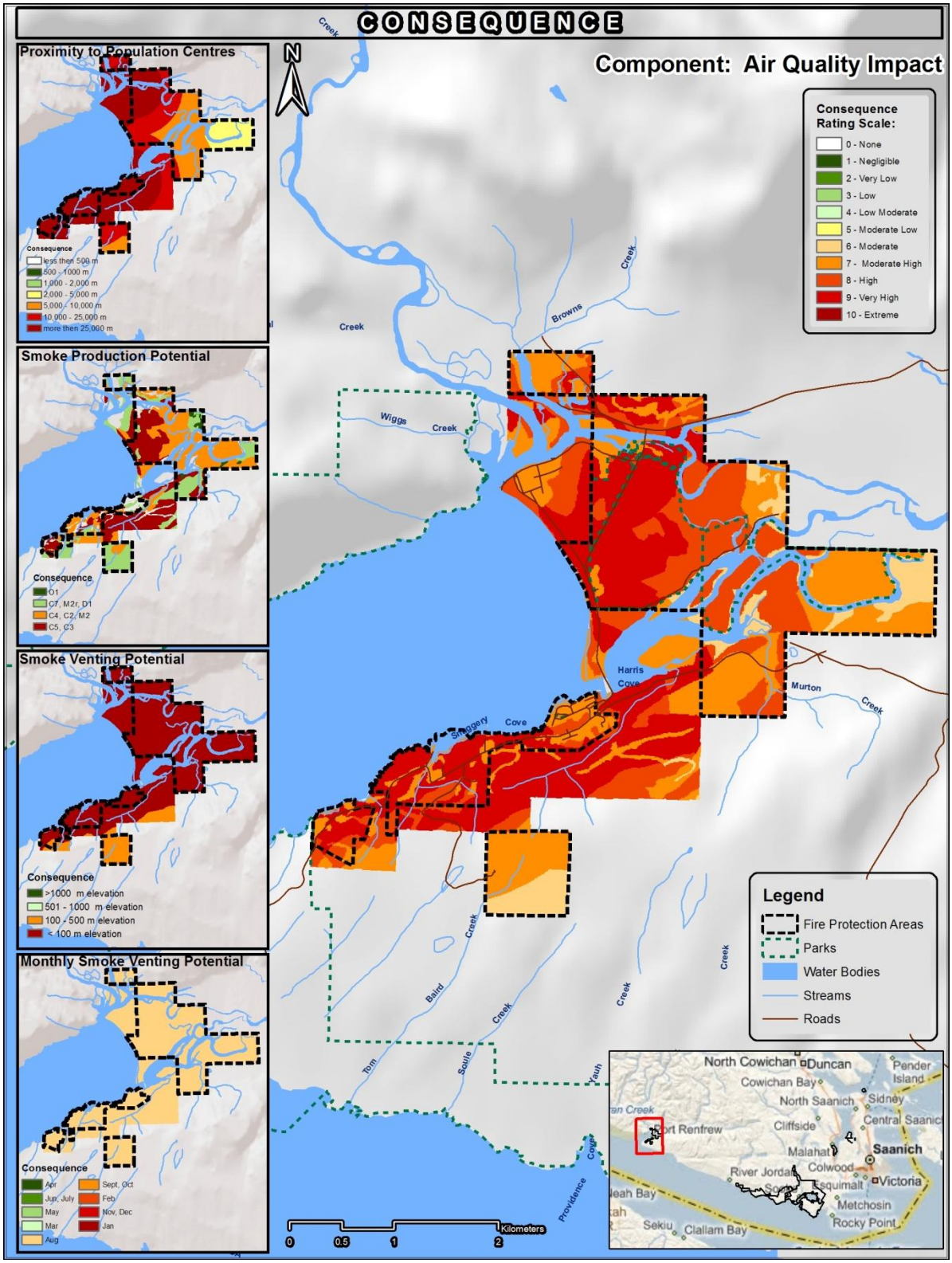
Visual Quality Impact (Consequence)



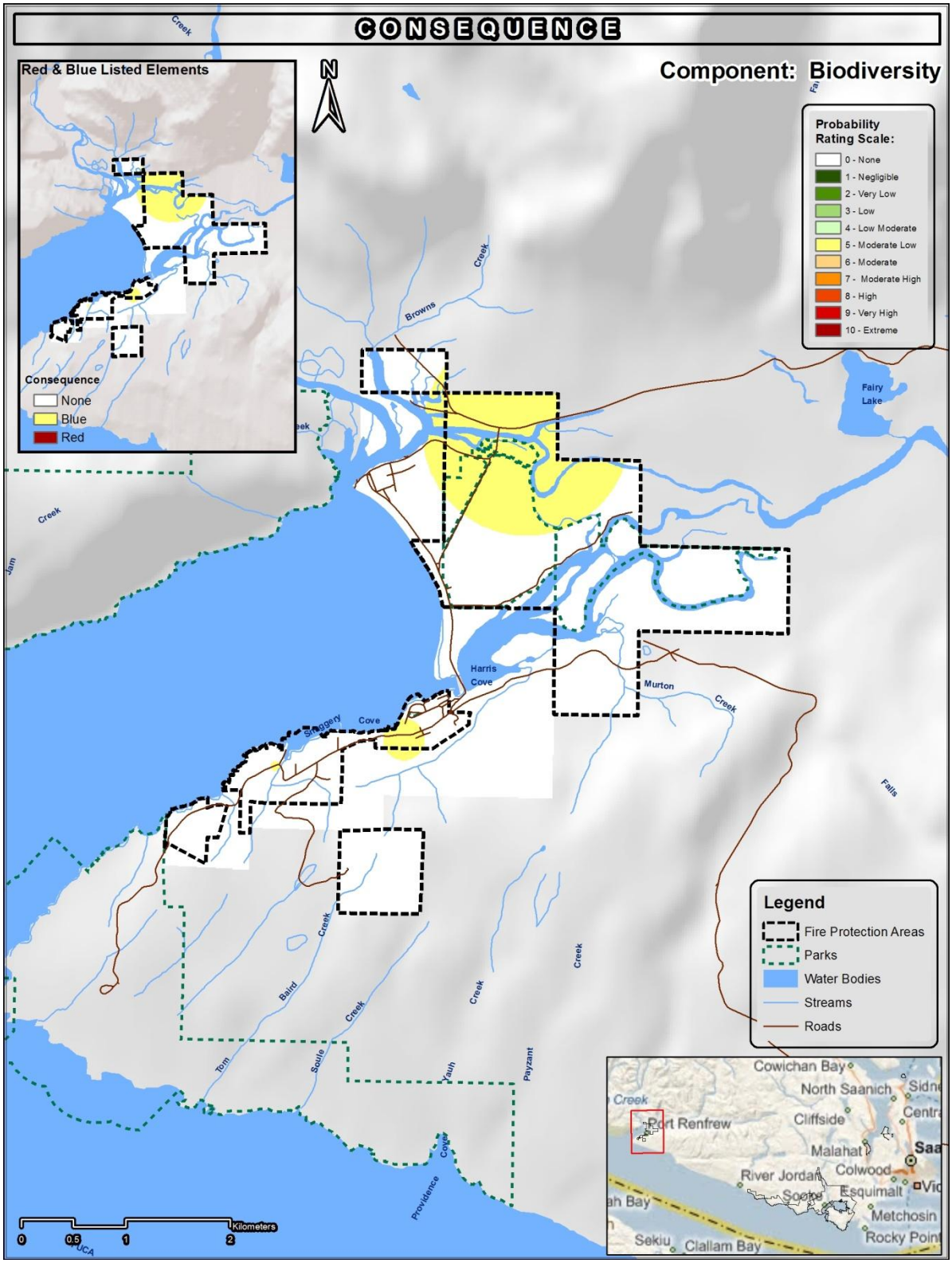
Recreation (Consequence)



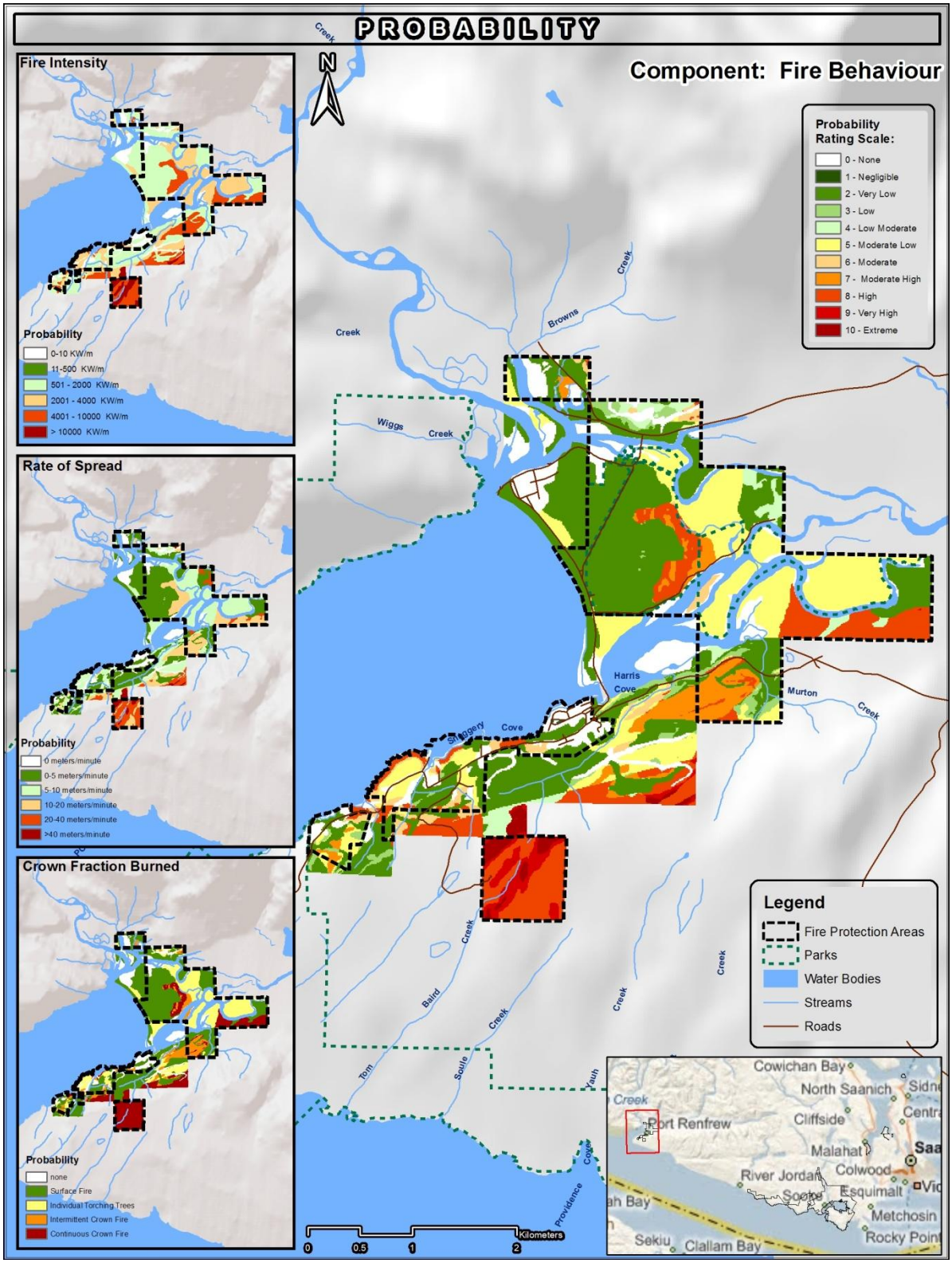
Air Quality Impact (Consequence)



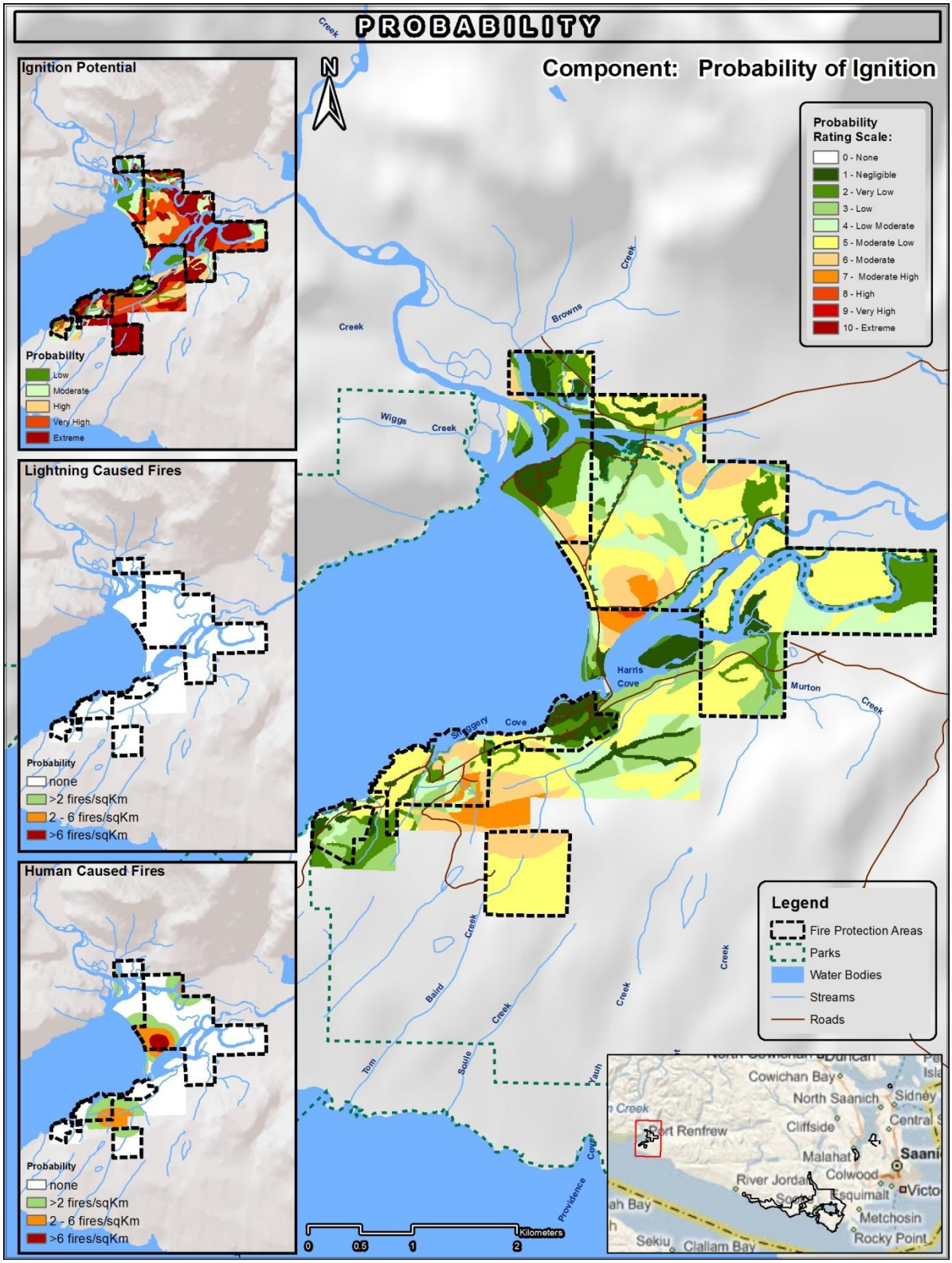
Biodiversity (Consequence)



Fire Behaviour (Probability)



Probability of Ignition (Probability)



Suppression Response Capability (Probability)