Community Wildfire Protection Plan

Community of Piers Island

Considerations for Wildland Urban Interface Management

PIERS ISLAND

COMMUNITY WILDFIRE PROTECTION PLAN

Considerations for Wildland Urban Interface Management for Piers Island, British Columbia

Submitted by:

Amelia Needoba
Bruce Blackwell & Babita Bains
B.A. Blackwell and Associates Ltd.
3087 Hoskins Road
North Vancouver, B.C.
V7J 3B5

Submitted to:

Travis Whiting
Senior Manager, Protective Services
Capital Regional District
625 Fisgard St., Victoria, BC, V8W 2S6

B.A. Blackwell & Associates Ltd.

RPF PRINTED NAME		Registered Professional Foresters Signature and Seal
Bruce A. Blackwell	RPF 2073	
DATE SIGNED		
I certify that I have reviewed this document and I have determined that this work has been done to standards acceptable of a Registered Professional Forester.		

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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 the Sooke, the Juan de Fuca Electoral Area communities and Piers Island. 'FireSmart – Protecting Your Community from Wildfire' (Partners in Protection 2004) was used to guide the protection planning process. For Piers Island 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, more recently, the 2009 fire seasons emphasize the need for greater consideration and continuing diligence in regard to managing 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 within that community. The probability of fire on Piers Island is low to moderate but, because of the island's small size (101.6 ha), the consequences of any wildfire, even one as small as 10 ha, are likely to be significant considering the proximity of homes.

This CWPP will provide Piers Island with a framework to assess the Island's fire risk. Additionally, the information contained in this report will help to guide the mitigation strategies that will best address wildfire risk on the Island.

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.

2.0 Piers Island

2.1 Study Area

Piers Island is located on Satellite Channel between the north end of the Saanich Peninsula and Saltspring Island and is approximately 1 km north of the Swartz Bay ferry terminal. The only public access is the CRD dock which is west of Wilhelm Point. There are approximately 129 lots along the perimeter of the island with 3 inset properties on the northeast section of the Island. The Island has one road, McKenzie Crescent, which runs the circumference of the Island and is 3.2 km in length. There are no cars on the Island and residents commute with golf carts. The road is the only publicly owned land and the center of the Island is owned equally among the Island residents (Figure 1). The center of the island has been preserved as a forested community area and covers 59 ha (147 acres). There are 125 homes and Island infrastructure includes a fire hall on the north side of the Island, two reservoirs and a water tower on the west side (Figure 2,Figure 3, Map 1).

Figure 1. Piers Island public road (left) and central meadow (right).

Figure 2. Piers Island Fire Hall.

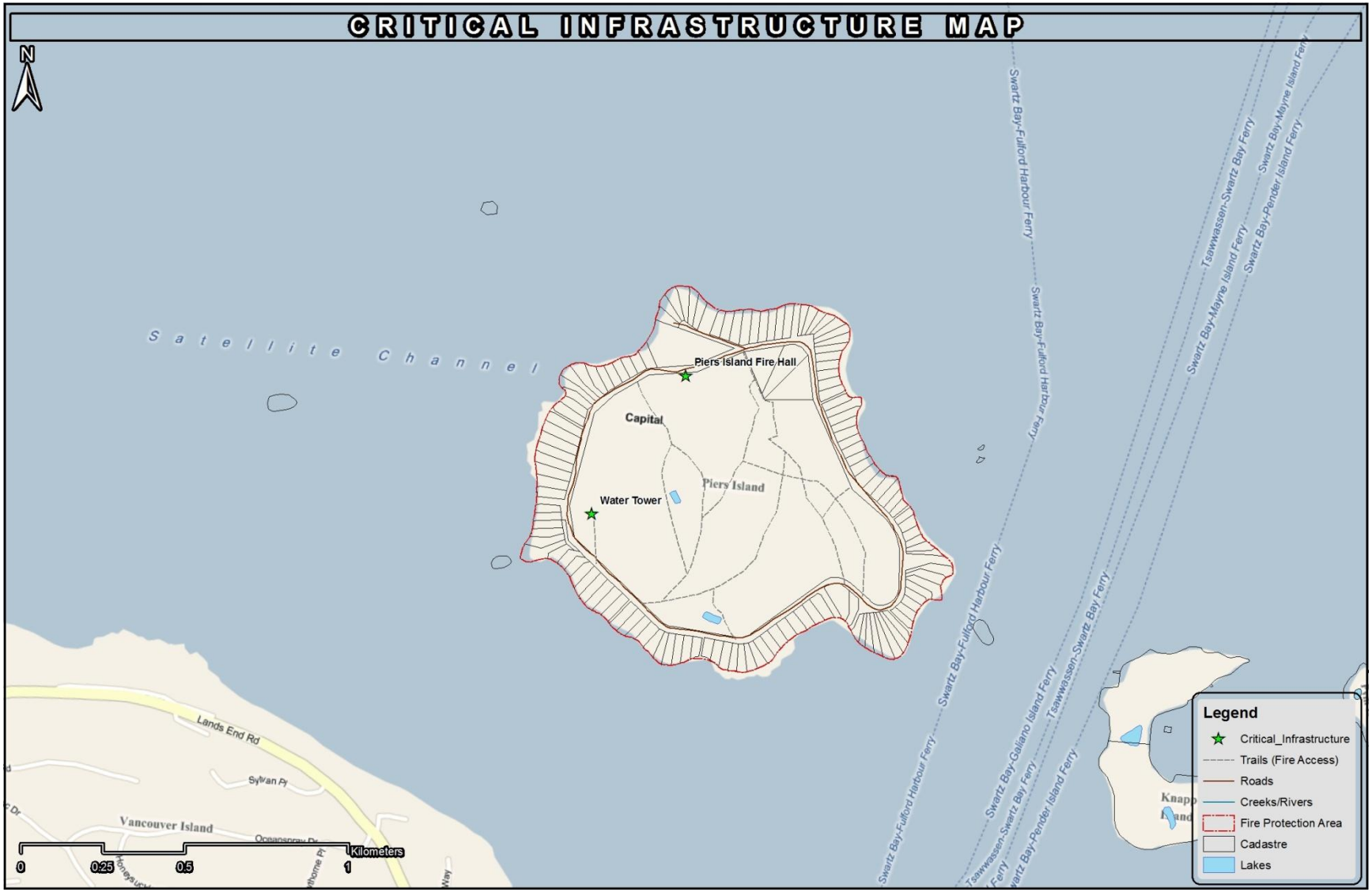
Figure 3. Water tower and central reservoir.

The terrain of Piers Island is gently rolling. The highest point is approximately 57 m, which is located on the south-east side of the Island's forested community area.

Figure 4. Elevational change across Piers Island shown in 20 m contour intervals.

2.2 Population

The Piers Island permanent population consists of approximately 64 primarily retired or semi-retired people. Many of the homes are owned by seasonal residents and the population can increase to approximately 300 during the summer months. Considering there is a limited capacity for development, the population will likely be relatively stable. There are no commercial businesses on the Island and all the dwellings are private residences.



Map 1. Piers Island study area.

2.3 Infrastructure

The Piers Island Fire Department provides the foundation for incident command and response during emergency or fire events. There are no hospitals or health centers on the Island and the nearest major hospital across the water is the Saanich Peninsula Hospital (13 km south of Swartz Bay) or Victoria General Hospital (29 km south of Swartz Bay). One of the dock floats, located west of Wilhelm Point, includes an emergency zone that is reserved for emergency vessels, water taxis and private loading/off-loading use. There is a large meadow in the north of the Island that can be used for helicopter landings if required.

Water infrastructure and water supply are relatively good for Piers. The Island is connected to municipal water via a pipe from Vancouver Island. Water is pumped (Figure 5) through the pipe and up in to the water tower (Figure 3) located on the west side of the Island. The pumphouse has an independent backup power system in case electricity fails. There are standpipes connected to municipal water located along the perimeter of McKenzie Road. Additionally, the Island has two reservoirs (formerly the Island's primary water supply): main reservoir (south Island) and upper reservoir (central Island) (Map 1). The water tower is constructed of wood and embedded in the forested portion of the Island (though trees have been cleared around it) therefore it is vulnerable to fire. However, there is a bypass option that would enable water to be pumped directly from the pump house to homes and standpipes.

Electrical service is delivered through wood pole distribution infrastructure supplied by BC Hydro (Figure 5). Telephone lines are located on the same poles. Fire could cause a disruption in power and phone services either due to heat from the flames or fallen trees associated with a fire event. However, the water system and fire hall have back-up power generators, as do many residents. Cell phone coverage on the island is also reliable.

Figure 5. Pumphouse for municipal water (left) and wood distribution poles for power and telephone (right).

2.4 Environmental and Cultural Values

The Biogeoclimatic Ecosystem Classification (BEC) system describes zones by vegetation, soils and climate. Regional subzones are derived from relative precipitation and temperature. Piers Island is defined by the regional climate of the Coastal Douglas-fir moist maritime subzone (CDFmm). The CDFmm is restricted to a small part of southeastern Vancouver Island, the Gulf Islands and the perimeter of mainland along the Georgia Straight. This zone is in the rain shadow of Vancouver Island and the Olympic Mountains; hence summers are typically warm and dry, and the winters are mild and wet. The mean annual precipitation for the CDFmm typically varies between 647 and 1,263 mm, primarily in the form of rain. The mean annual temperature ranges from 9.2 – 10.5^{0}C with temperatures rarely falling below freezing.

There are various environmental and cultural values that are significant in the CDFmm. Vegetation within the CDFmm accounts for approximately 50 rare species, which occur only in this zone. Encroaching urban development throughout most of the zone and invasion of Scotch broom are threatening these important and unique ecosystems[1]. On Piers Island, intensive browsing of the understory by deer, and invasive species including Scotch broom, gorse and Himalayan blackberry, are threats to the Island's ecosystem integrity.

3.0 Fire Environment

3.1 Fire Weather

The Canadian Forestry Service developed the Canadian Forest Fire Danger Rating System (CFFDRS) to assess fire danger and potential fire behaviour. A network of fire weather stations during the fire season are maintained by the Ministry of Forests and Range (MOFR) and are used to determine fire danger on forestlands within a community. The information can be obtained from the MOFR Protection Branch and is most commonly utilized by municipalities and regional districts to monitor fire weather, and to determine hazard ratings, associated fire bans and closures. The Salt Spring Island weather station was used to summarize fire weather for Piers Island. The key fire weather parameters summarized are:

- 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.

[1] http://www.for.gov.bc.ca/hfd/pubs/docs/Srs/Srs06/chap5.pdf

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 give some indication of likely fire severity in terms of duff consumption – the drier the duff, the more will be consumed by the 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 6 shows that the drought code tends to shift over the summer months and in to the fall from being predominantly moderate in June, to high in July and then extreme in August and September.

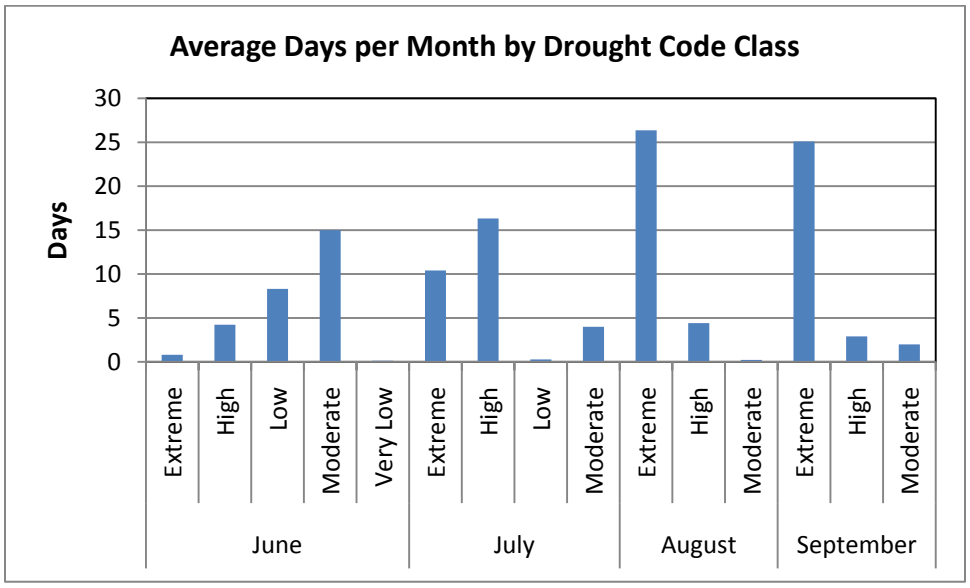


Figure 6. Drought code averaged for each month over a 22 year period from the Salt Spring Island weather station (Very low = 0-79; Low = 80-189; Moderate = 190-299; High = 300-424, Extreme = >425).

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, 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 7 shows that the number of danger class days on average for each month of the fire season is highly variable but that the number of high, very high and extreme danger class days tends to be highest from July through to September.

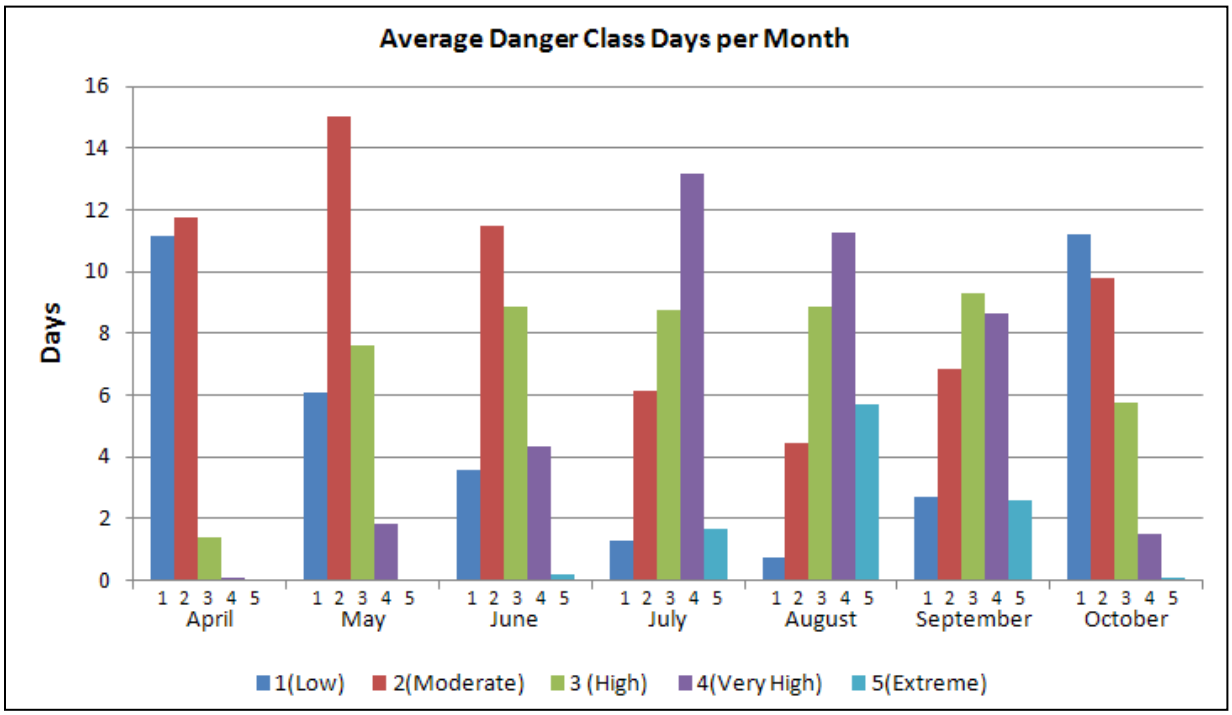


Figure 7. Fire Danger Class averaged for each month over a 22 year period from the Salt Spring Island weather station.

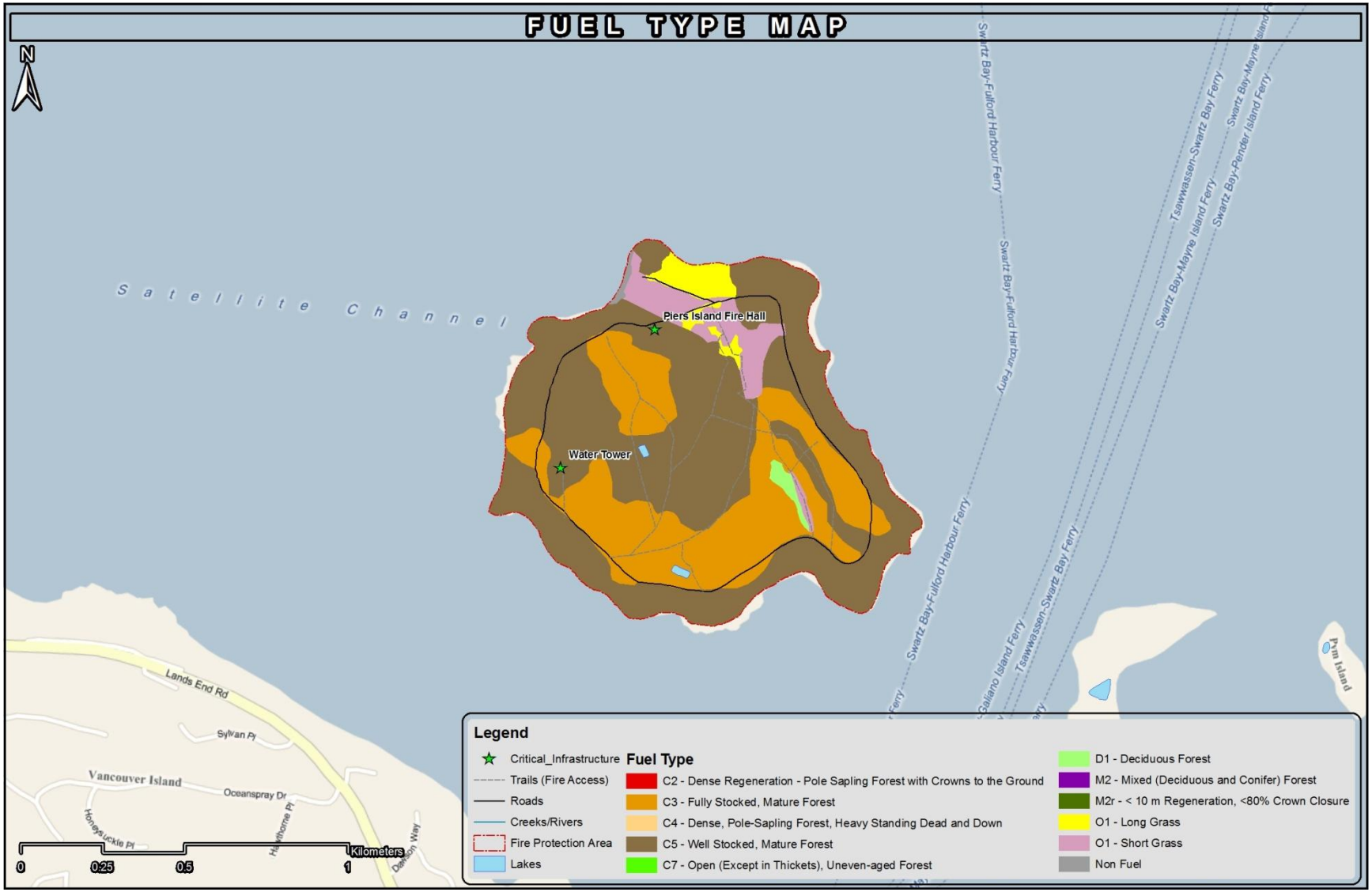
3.2 Fuels

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 Piers Island. In general the fuel types considered hazardous in terms of dangerous fire behavior and spotting (lofting burning embers) are C2, C4, and C3.

Table 1. Fuel types, associated hazard, and areas in the 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	0.0	0
C3	Fully stocked, mature forest, crowns separated from ground	**Surface and crown fire**, low to very high fire intensity and rate of spread	30.6	30%
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	0.0	0
C5	Well stocked, mature forest, crowns well separated from ground	Low to moderately fast spreading, low to moderate intensity **surface fire**	61.1	60%
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	0
D1	Moderately well-stocked deciduous stands	Always a **surface fire**, low to moderate rate of spread and fire intensity	0.7	1%
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)	0.0	0
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)	0.0	0
O1 – Long	Continuous standing grass, fuel loading is 0.3 kg/m2, 90% cured	Rapid spreading, moderate to high intensity **surface fire**	3.1	3%
O1 – Short	Continuous human modified short grass, fuel loading is 0.17 kg/m2, 90% cured	Rapid spreading, low to moderate intensity **surface fire**	5.7	6%
		Total:	101.6	



Map 2. Fuel typing for the Piers Island study area.

3.3 Historic Ignitions

There is no historic ignition data for Piers Island. However, there is evidence on trees that fire has occurred in the past. Human ignitions that did not result in wildfires have occurred. Fire cause on Piers Island is most likely to be human (lighting is rare and would generally accompanied by precipitation). Likely ignition sources on the Island are trees contacting BC Hydro distribution lines, open burning (though there is a total fire ban from April through October) and house fires.

4.0 The Wildland Urban Interface

The classical definition of wildland urban interface (WUI) is 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 8. Piers Island would be defined as an intermix WUI.

In each of these cases, fire has the ability to spread from the forest into homes, or from the home out into the forest. Although these two scenarios are quite different, they are of equal importance when considering interface fire risk. On Piers Island, the probability of a fire moving from a home into the forest is equal or greater to the probability of fire moving from the forest into homes.

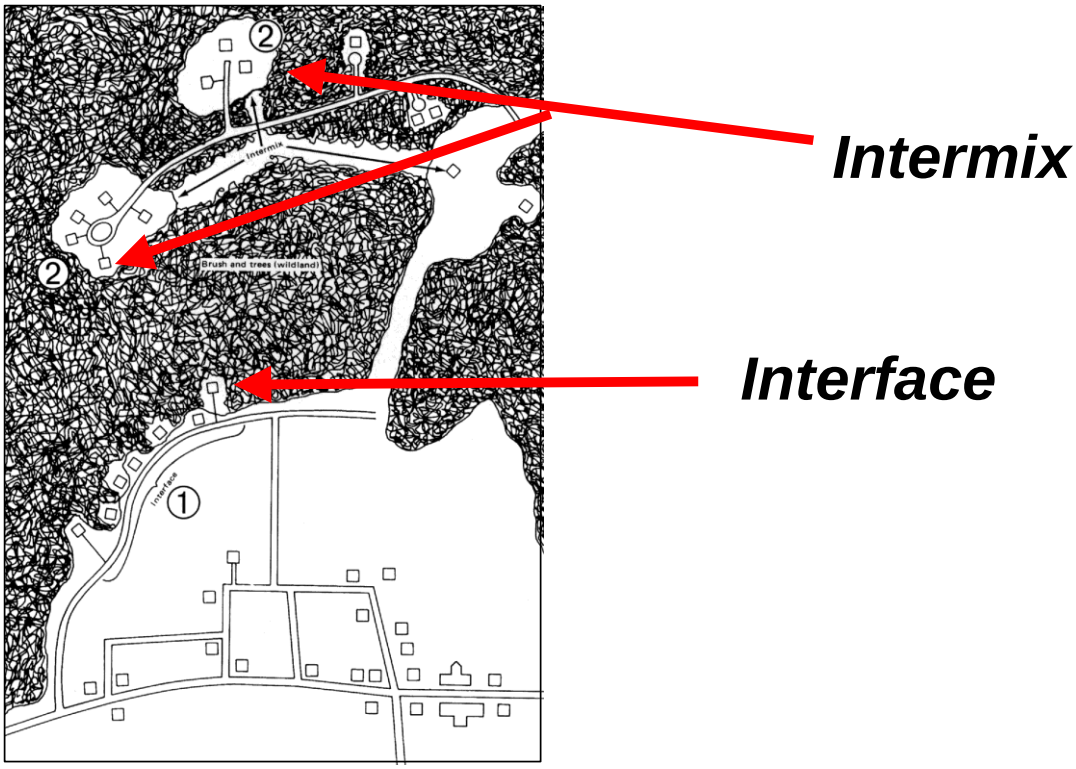


Figure 8. Graphical example showing variation in the definition of interface.

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 9).

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 10).

Figure 9. Firebrand caused ignitions: burning embers are carried ahead of the fire front and alight on vulnerable building surfaces.

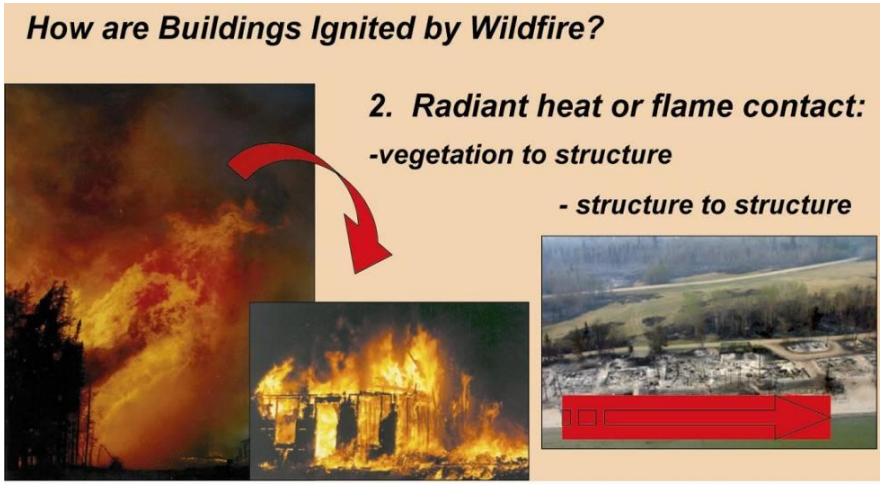


Figure 10. Radiant heat and flame contact allows fire to spread from vegetation to structure or from structure to structure.

5.0 Community Wildfire Protection Planning Process

The WUI continuum describes the key areas through which WUI fire risk is addressed in the CWPP process (Figure 11).

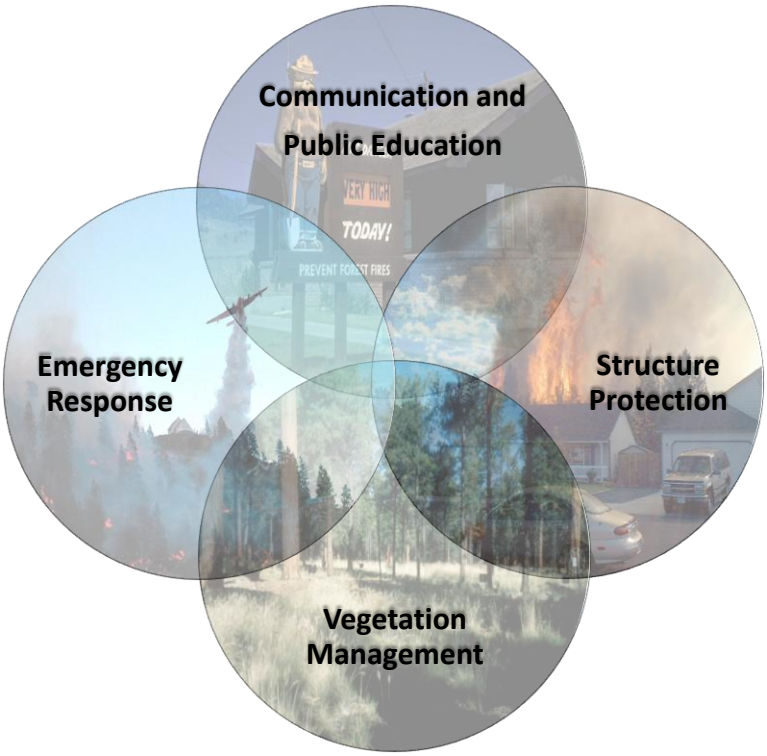


Figure 11. Wildland urban interface continuum.

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 11:

- 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 Ministry of Natural Resource Operations (formerly the Ministry of Forests and Range) Protection Branch . The workshop used a Structured Decision Making approach as defined in Hammond *et al.* (1999)[2]. 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 (objectives that help you meet your fundamental objective) 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:

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

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.

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.

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

Specifically for Piers Island, other than the consistently moderate and high objectives shown in

Table 2, maintaining visual quality and timber values were ranked more highly than for other communities. This makes sense given that all residents have ownership in the central, forested community area so it has a direct economic relationship to Piers Island land values.

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

1. Reduced fire behaviour;
2. Protected timber assets;
3. Protected visual quality;
4. Protected critical infrastructure;
5. Protected homes/structures;
6. Maintained recreation quality/opportunity;
7. Improved public understanding of fire risk and personal responsibility;
8. Politically acceptable;
9. Minimized the spread of invasive species; and,
10. Protect drinking water.

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 - historic ignitions are 0 and the strategies in place are already aimed at maintaining this.
- Suppression response – this was measured in terms of response time, which is currently excellent in the community.
- Evacuation ease – this was measured in terms of number of homes with 1-way in-out access. Water is the only evacuation option from Piers Island and this cannot be materially changed so evacuation will be an ongoing management issue for the Island.

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 suppression response an important objective. 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.

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 12). Using algorithms, the subcomponents are combined to produce component weightings which are then further processed to derive probability and consequence ratings.

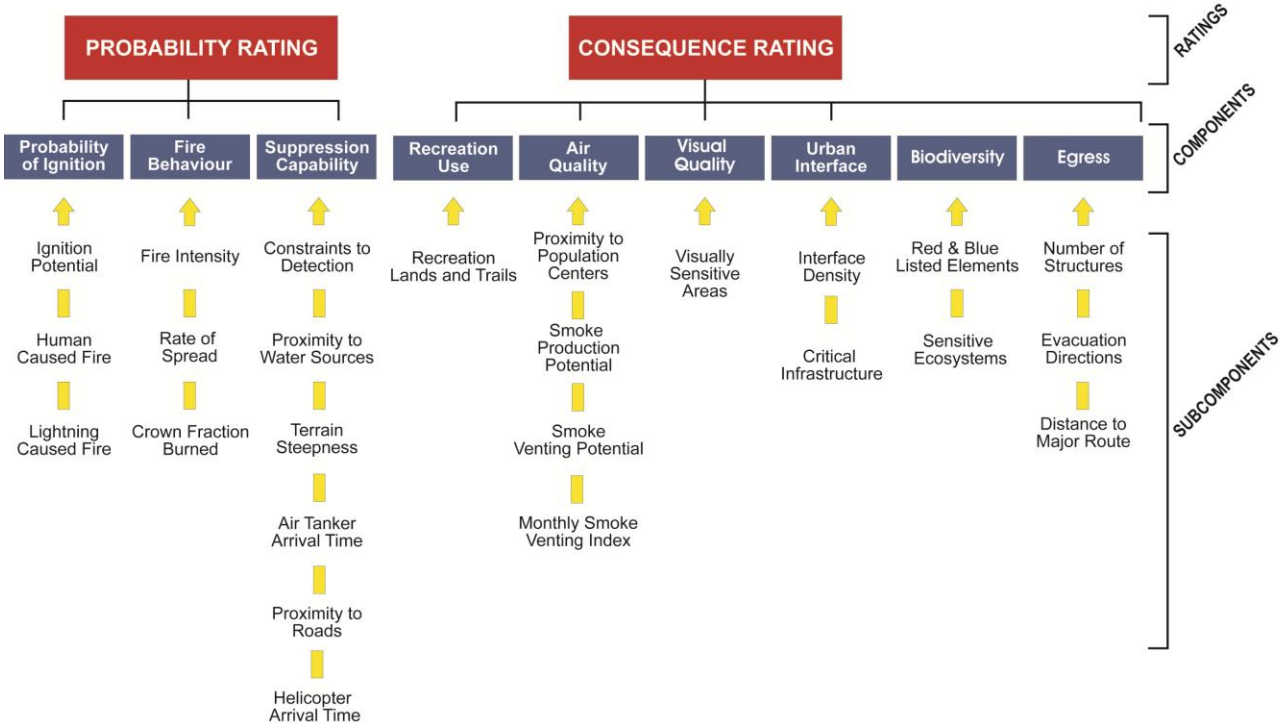


Figure 12. Illustration of the sub-components and components used to calculate the final probability and consequence ratings within the Wildfire Risk Management Structure for the CRD and Sooke.

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

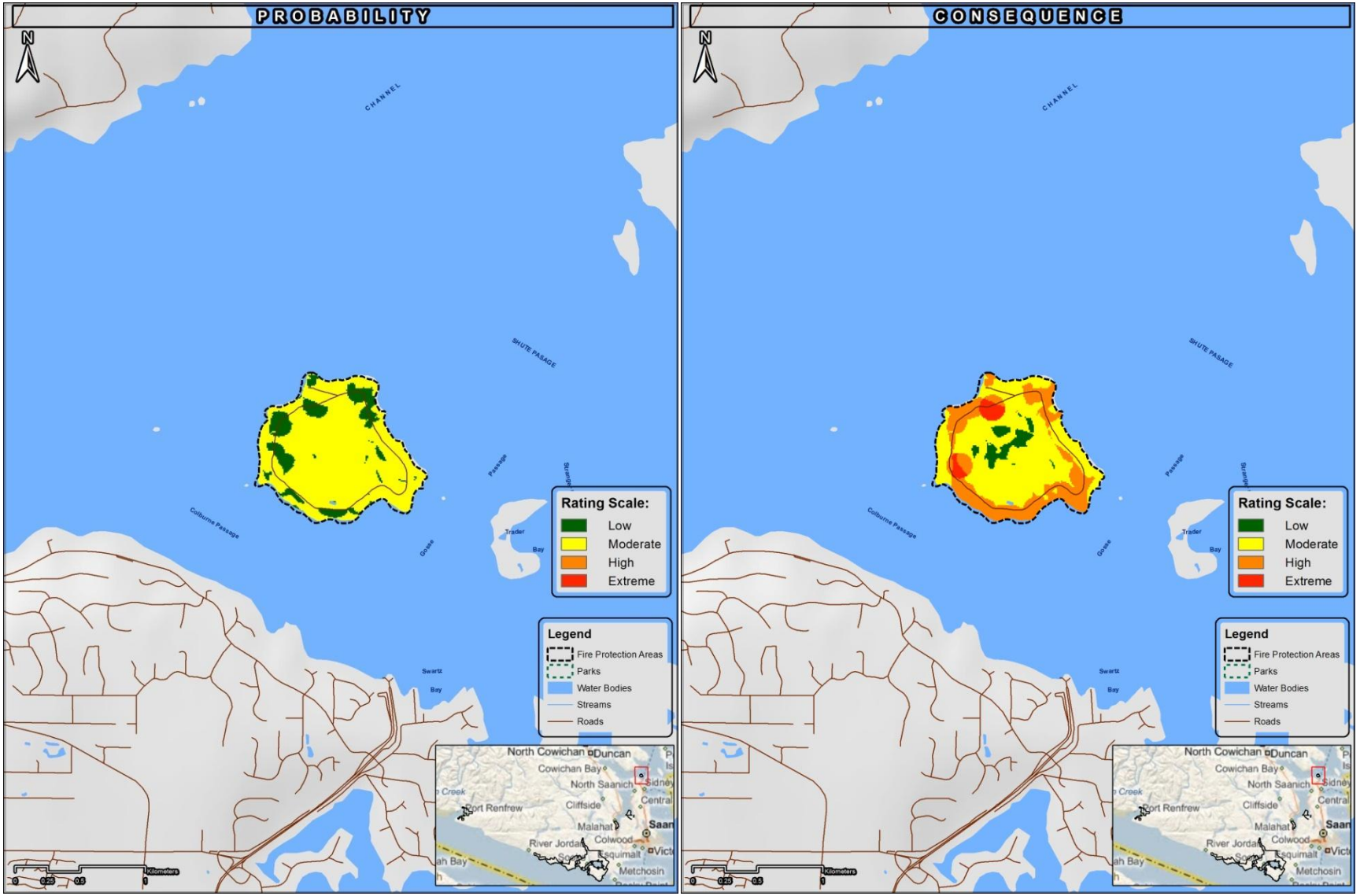
The base case WRMS reflects current conditions for each of the subcomponents, components and ratings shown in Figure 12 according using data available from the Province, the CRD, the District of Sooke and data collected in the field.

The probability of fire on Piers Island is low to moderate based on expected fire behaviour, ignition and suppression (Map 3). The suppression layer appears to be having the greatest impact on driving down the probability component due to Piers Island's excellent proximity to water sources and roads. The consequence of wildfire is predominantly moderate with areas of high and extreme (Map 3). The high and extreme areas reflect the locations of critical infrastructure, interface density and areas of high visibility. All map outputs for the WRMS are provided in Appendix 1.

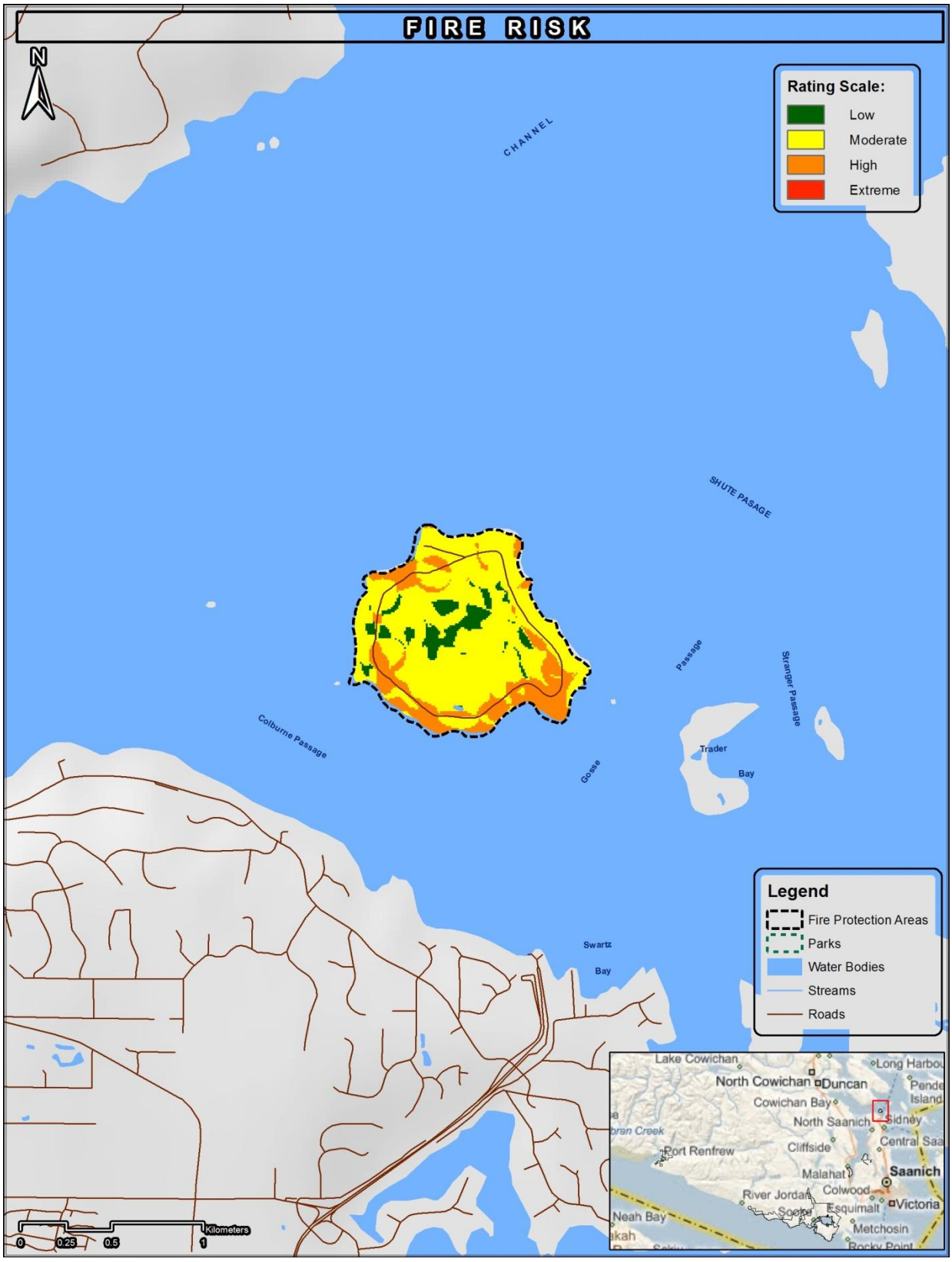
Fire risk (Map 4) represents the overall fire risk as a combination of probability and consequence defined as follows:

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



Map 4. Piers Island 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).

On Piers Island, the only change in fire risk due to modeled scenarios was through modifying fuels in priority areas. This is because ignition reduction, suppression capability and evacuation ease are not changed from the status-quo under the alternatives considered for community wildfire protection planning on the Island. This is considered an accurate reflection of the community's current capacity and the steps they are already taking to address wildfire risk.

Map 5 shows the comparison of the fire behavior component of the WRMS from the base-case to the re-run described in point 3 above (modifying fuels). A reduction in fire behavior can be seen. This corresponds to a reduction in the overall probability rating and a decrease in fire risk.

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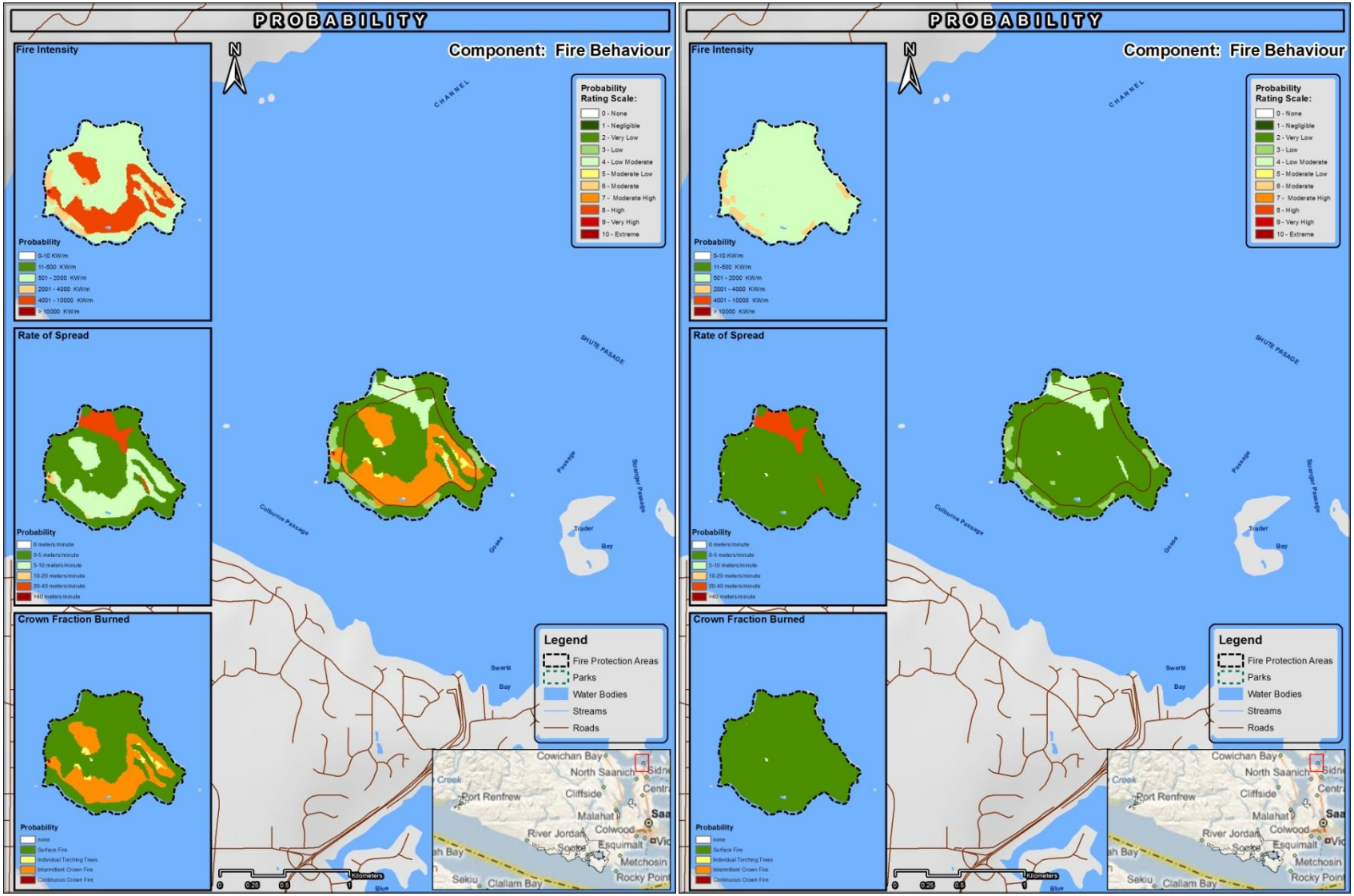


Map 5. Base case WRMS Fire Behaviour component (left) and re-run WRMS Fire Behaviour component (right) assuming implementation of Priority 1-3 fuel treatments.

7.0 Action Plan

The Action Plan consists of the key elements of 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 Public Education

7.1.1 Objectives

The communication and education objectives 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 increase awareness of the limitation of local and Provincial fire fighting resources to encourage proactive and self-reliant attitudes.
- To continue to work diligently to prevent ignitions during periods of high fire danger.

7.1.2 Current Status

The community on Piers Island is vigilant regarding ignitions and actively monitors and enforces fire bans and smoking bans during the fire season. Signage across the island is excellent. There is an awareness of fire hazard and the fact that fire protection on island is limited. Due to its isolation from larger urban centres and associated services, the community does have an established attitude of self-reliance. However, the community is not FireSmart and individual homeowners could do more to limit the possibility of fire spreading to or from their homes to the forest.

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 Southern Gulf Islands electoral area website.
- Utilize social media such as Facebook and Twitter to communicate fire bans, high fire danger days, wildfire prevention initiatives and other real time information.
- Use magnets printed with information, such as tips on FireSmart information and tips on essentials for evacuation, for residents to have in their homes. FireSmart information and magnets could be sent out with tax notices.
- Provide materials at the point of issuing building permits so that people know the hazard where they are building and what they can do to reduce those hazards.

Recommendation 2: The CRD should consider employing a Fire Prevention Officer to coordinate and deliver education programs across the Region. If a full time position is not justified, consider options to share the cost of this resource with other municipalities, or for creating a position that provides integrated emergency preparedness education.

7.2 Structure Protection

7.2.1 Objectives

The structure protection objectives 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.
- To protect municipal water supply.

7.2.2 Current Status

Piers Island homes do not, in general, meet FireSmart standards for construction or vegetation around homes. Fire research indicates that roofing, adjacent burnable materials and landscaping play the greatest role in structure ignitability. There is currently no fire vulnerability standard for building materials used in the CRD. Adjacent vegetation is often in contact with roofs, roof surfaces are often covered with litter fall and leaves from nearby trees, open decks are common and combustible materials are often stored within 10 m of residences (Figure 13). Additionally, the Fire Hall and water tower are both critical infrastructure and would be vulnerable to fire in their current condition (Figure 2 and Figure 3). 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.

Figure 13. Propane tank adjacent to central ring road (left), structure with surrounding vegetation within 10 m (right)

The results of fire behaviour modeling under extreme weather conditions indicated that fuel types on Piers island could support fire intensities > 4,000 kw/m^2 and, potentially crown fire throwing burning embers, which we can assume would cause major damage to structures in the absence of successful fire suppression. The small size of the island does reduce the probability of extreme fire behaviour because there is no opportunity for a large fire to come in to the area from outside, and a fire starting on the island would not be able to build as much momentum as a landscape level fire. However, limited firefighting capacity and lack of FireSmart structures also reduce the probability of successful suppression so it is considered prudent for residents to address structure ignitability.

7.2.3 Recommendations

Recommendation 3: Consider changes to Islands Trust policy and CRD policy that would improve the FireSmart conditions and emergency response access on Piers Island. There are several ways in which this can be achieved through different bylaws and guidelines; however it is recommended that National Fire Protection Association (NFPA) standards be used to develop specifications. Bylaw and policy changes should apply to new building projects and retrofits (including re-roofing). 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
Land Use Bylaws: Fire flows/water delivery system, access, siting of structures in Wildfire DP Areas (setbacks from hazardous fuels)
Sprinkler Bylaw: Sprinklers
Building Bylaw: Roofing, building materials in Wildfire DP Areas

Recommendation 4: Piers Island residents should consider ensuring that firewood piles and propane storage tanks are stored at least 10 m away from structures and access roads where possible, both for structure protection and the safety of firefighters.

Recommendation 5: Piers Island residents should consider ensuring that chimneys are cleaned annually and inspected periodically by Wood Energy Technical Training (WETT) program, Fireplace Investigation Research & Education (FIRE) and Chimney Safety Institute of America (CSIA) certified inspectors to reduce the probability of chimney fires.

Recommendation 6: Piers Islands should consider phasing out use of the existing wood water tower and transferring the supply to a fire resistant storage tank. This would protect the water supply in the event of a wildfire. Siting and building materials of future infrastructure investments should be considered to minimize fire vulnerability.

7.3 Emergency Response

7.3.1 Objectives

- To improve driveway access to properties on Piers Island for structural fire fighting.
- To maximize community resilience to a wildfire event.
- To continue to work with BC Hydro to maintain safety of distribution lines by regular hazard tree removal.

7.3.2 Current Status

Piers Island is an isolated community reliant on emergency response from its volunteer fire department and it does not have opportunities to form mutual aid agreements with other fire departments. The island has back-up power systems, a thorough and practiced evacuation plan, a strong community spirit and an attitude of self-reliance. The community commonly works together to solve problems and individuals seem to have a strong sense of Island identity, which suggests that residents would work well together and help each other under an emergency scenario. Residents have been proactive in disaster planning and are vigilant regarding ignition prevention, fire bans and reporting. However, the volunteer fire department has limited capacity to fight wildfire, limited opportunity to improve that capacity at this time, and would be reliant on outside assistance for firefighting if a wildfire occurred. Emergency foot access to properties from the Island's central ring road is difficult and sometimes hazardous for firefighters; this could hamper efforts to control house fires before they spread to the surrounding forest.

7.3.3 Recommendations

Recommendation 7: Piers Island residents should continue to practice evacuation on a regular basis and ensure that the plan is updated if there are changes in island access (e.g., if a shared marina is constructed to replace private docks).

Recommendation 8: Piers Island residents should consider improving access to their properties to ensure that fire department members can safely enter on foot without obstructions or safety hazards. Hydro connections are a particular concern if hanging low or in contact with vegetation and residents are responsible for maintenance of these lines. The Fire Department should notify residents whose properties are difficult or unsafe to access.

Recommendation 9: Piers Island residents should consider ensuring that they have adequate levels of insurance both to replace property losses incurred due to wildfire, and to cover the potential cost of any forest fire suppression provided by outside parties such as the Province's Protection Branch.

Recommendation 10: The Piers Island fire department should continue informal training for interface fire fighting. In the event that the makeup of the volunteer force changes over time to support the number of individuals and fitness level required to improve interface firefighting capacity, then S100, S185 and S215 training should be formalized and further investment in interface firefighting equipment should be considered.

Recommendation 11: The Piers Island fire department should continue to work with BC Hydro to ensure that hazard trees are regularly assessed and removed adjacent to distribution lines to prevent ignitions due to fallen trees.

Recommendation 12: The CRD should consider developing an 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.

Recommendation 13: The CRD should consider establishing an integrated 'Wildfire Suppression Group', consisting of representatives from each Southern Gulf Islands Volunteer Fire Department and Wildfire Protection Branch 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.

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. On Piers Island, the outcomes of the stakeholder workshop and the WRMS modelling indicate that modifying fire behaviour through vegetation management would be a worthwhile activity on the Island.

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. Section 7.4.4 outlines the FireSmart vegetation modification guidelines and some recommendations for managing fuels in Pier's Island central forested community area.

7.4.1 Objectives

- To proactively reduce potential fire behaviour, thereby increasing the probability of successful suppression and minimizing adverse impacts on structures, timber assets, visual quality and recreation quality/opportunity.
- To convert C3 fuels found on the Island to C5 fuels (Map 2).
- To reduce the area of infestation by Scotch broom, gorse and Himalayan blackberry, and to reduce the potential for the infestation to spread post-fire.

7.4.2 Current Status

The Piers Island forest is predominantly classified as a C5 fuel type with some areas of higher hazard C3 (Figure 14, Table 1 and Map 2). In general, surface fuel loading is quite low, though a few sections were noticed with higher than desirable fine (<7 cm diameter) fuel loads and weed infestations in some cases pose a significant surface fire fuel hazard (Figure 15). Currently, the meadows are mown in summer to keep grass short, which maintains them in a lower hazard state.

Dramatic modification of the forest fuels on the island is not considered necessary but FireSmart fuel treatments around structures and some targeted removals of surface fuels, weeds and smaller understory trees would reduce the potential severity of fire on the Island. Piers Island is in a unique position in that ownership of the large forested area in the centre of the Island is

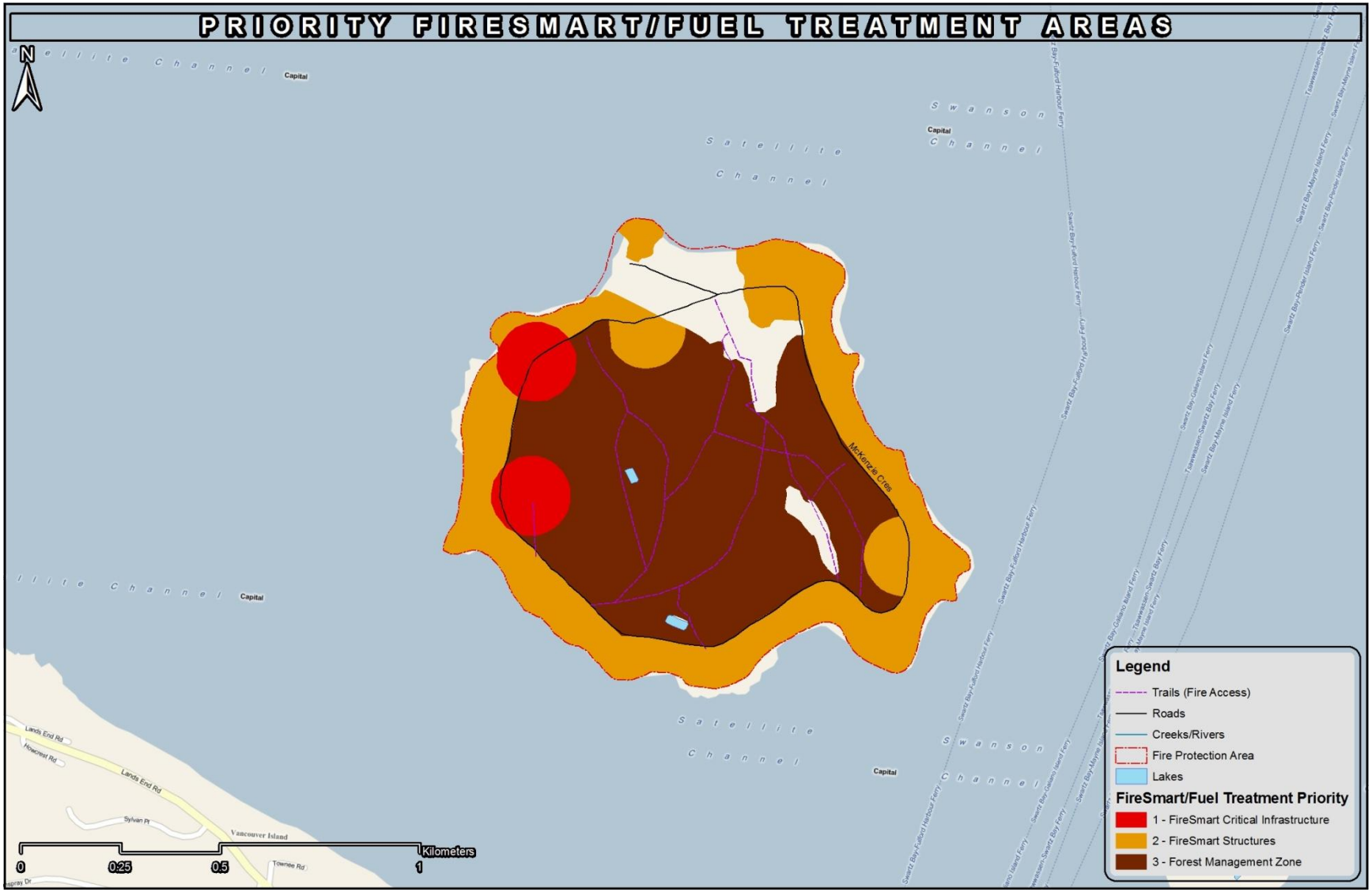
shared by all residents. This means that residents have management control over the forest through the resident formed Forest Management Group. Appendix 1 provides some guidelines on fuel management that could be applied in the higher hazard portions of the forest.

Figure 14. Photos of the higher density fuels classified as C3 (left) versus the more widely spaced C5 fuels (right) on Piers Island.

Figure 15. Infestations of Himalayan blackberry, gorse and Scotch Broome adjacent to roads and forested areas on Piers Island.

Piers Island has been divided in to three areas for prioritized fuel management (Map 6). The island is entirely private; therefore current opportunities for funding sources are virtually nonexistent. There is a public road right-of-way, therefore any work within that footprint may be eligible for UBCM/Province of BC funding if the fuel management program is renewed.

On Map 6, priority reflects order of importance for implementation as supported by the consequence map outputs from the WRMS (Map 3). Priority 1 – FireSmart Critical Infrastructure refers to the area around critical infrastructure that should be managed to FireSmart standards outlined in Section 7.4.4. Priority 2 – FireSmart Structures refers to the area around homes and structures that should be managed to FireSmart standards outlined in Appendix 1. Priority 3 – Forest Management Zone refers to the central forest community area that should be managed to the Forest Fuel Management standards outlined in Section 7.4.4. These areas do not reflect total area requiring treatment as much of the vegetation will already be in acceptable condition and require no modification.



Map 6. Prioritized fuel treatment areas for Piers Island.

7.4.3 Recommendations

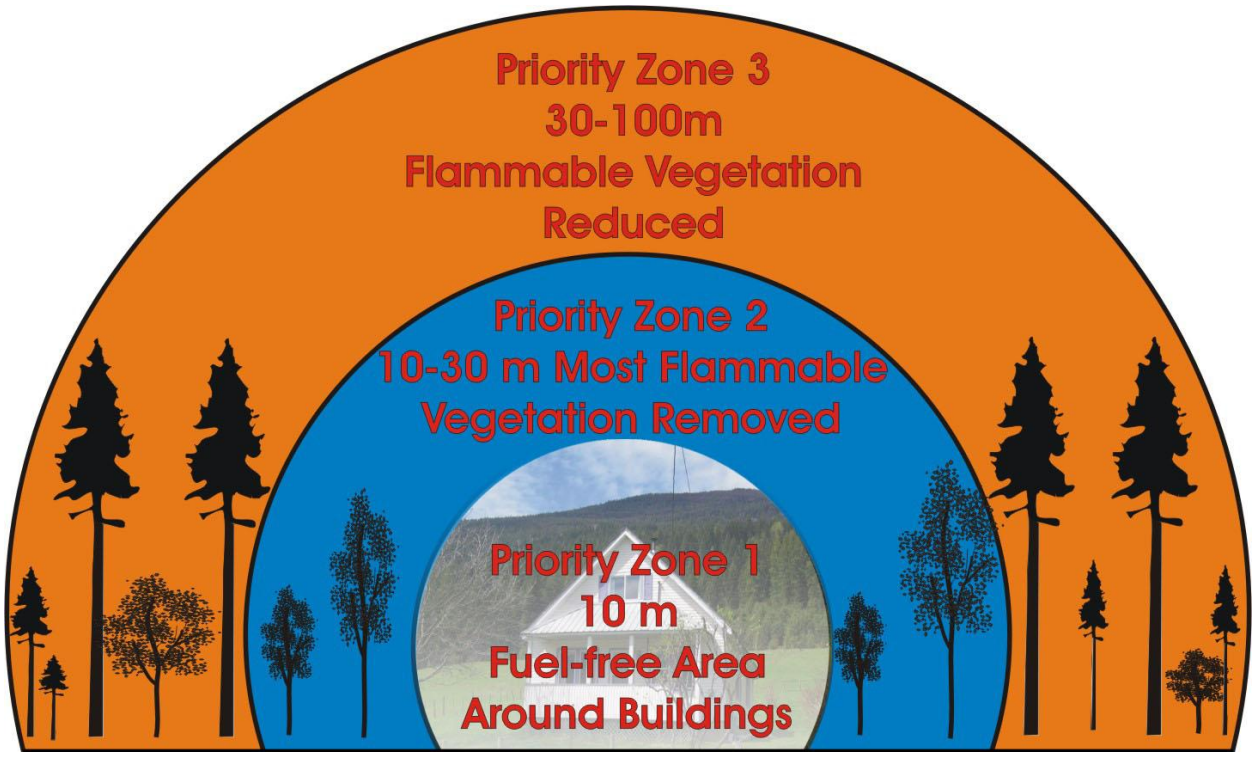
Recommendation 14: Piers Island residents should maintain Priority 1 and Priority 2 areas to the FireSmart standards outlined in Appendix 1. Priority 1 should be dealt with first both because it is focused on protecting critical infrastructure, and so it can serve as an example for how residents can treat their own properties. The municipal water pump house should also be considered a Priority 1 area (it was not in the spatial data inventory for this analysis, therefore may not be mapped).

Recommendation 15: The Piers Island Forest Management Group should consider maintaining Priority 3 areas to the Forest Fuel Management standards outlined in Appendix 1. It is proposed that residents review firewood needs to determine if it would be possible to meet those needs by selectively removing small trees in high density C3 fuels on an annual basis. The objective is to convert the C3 fuels to C5 fuels. In any area where surface fuel loads exceed recommended levels, burning those accumulations in small piles is recommended. Appropriate implementation should not result in loss of visual quality, habitat, timber value or recreation quality.

Recommendation 16: The Piers Island residents should consider continuing development of their volunteer driven weed management strategy to reduce current infestation levels and to prevent opportunities for weeds to spread into a burned area if fire does occur. Best management practices for removal of Himalayan blackberry, gorse and Scotch broom should be followed. These will likely include a combination of hand pulling and repeated mowing, though grazing by goats is also known to be effective for regrowth and young plants. Himalayan blackberry is a noxious weed and a fire hazard but if residents decide that retaining some thickets for berry production is desired, then patches should be isolated, surrounded by short grass and at least 10 m away from roads, fences and structures.

7.4.4 FireSmart and Forest Fuel Management Standards

FireSmart (Partners in Protection 2002) proposes the following zones for vegetation modification:



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.

Forest fuel management standards are similar to those described above in Priority Zone 3. Ideally, the forest should have trees variably spaced 5 – 10 m apart (much of the natural area currently has that spacing) with 3 m separation of the bottom of the crown to the top of the understory. Within the forest, encouraging the growth of native deciduous shrubs and herbs with low flammability would be beneficial for slowing the depletion of fuel moisture in surface fuels during the fire season, and potentially reducing fire spread rates.

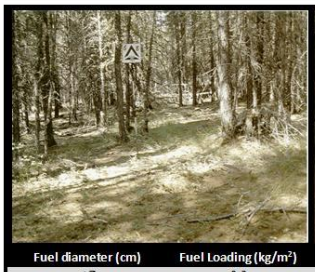
When selecting trees to remove in order to meet spacing targets, use the thin from below approach to ensure that the very smallest trees are removed in preference to larger trees. Trees and snags with wildlife qualities should be retained unless they are considered dangerous to people walking.

Coarse woody debris should be retained on site for biodiversity. Target retention of 15 to 30 pieces/ha > 12 cm diameter and > 3 m in length distributed randomly throughout the area. Of the CWD retained, approximately 2/3 should lie flat to the forest floor and 1/3 can be elevated.

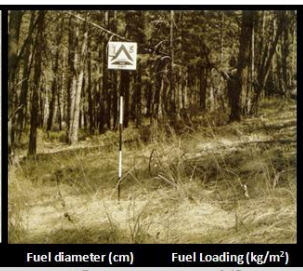
Of all fuels < 12 cm in diameter:

1. Fuels > 7 cm should not exceed 2.5 kg/m^2 (25 tonnes/ha)
2. Fuels < 7 cm should not exceed 0.5 kg/m2 (5 tonnes/ha)

Total Fuels ≤ 5 kg/m^2

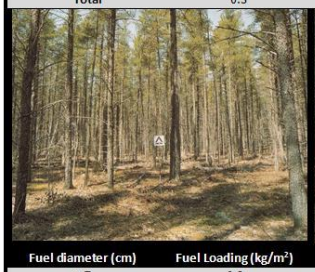


Fuel diameter (cm)	Fuel Loading (kg/m^2)
< 7	0.3
> 7	0
Total	0.3

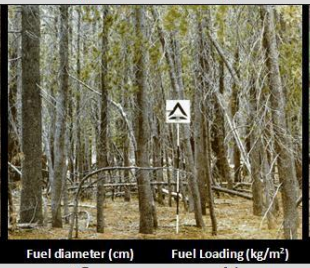


Fuel diameter (cm)	Fuel Loading (kg/m^2)
< 7	0.45
> 7	0.25
Total	0.7

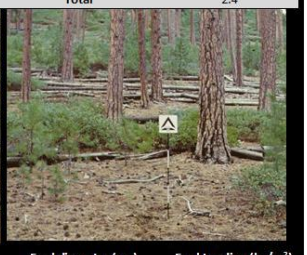
Fuel diameter (cm)	Fuel Loading (kg/m^2)
< 7	0.3
> 7	2.1
Total	2.4



Fuel diameter (cm)	Fuel Loading (kg/m^2)
< 7	0.3
> 7	2.3
Total	2.6



Fuel diameter (cm)	Fuel Loading (kg/m^2)
< 7	0.4
> 7	2.5
Total	2.9

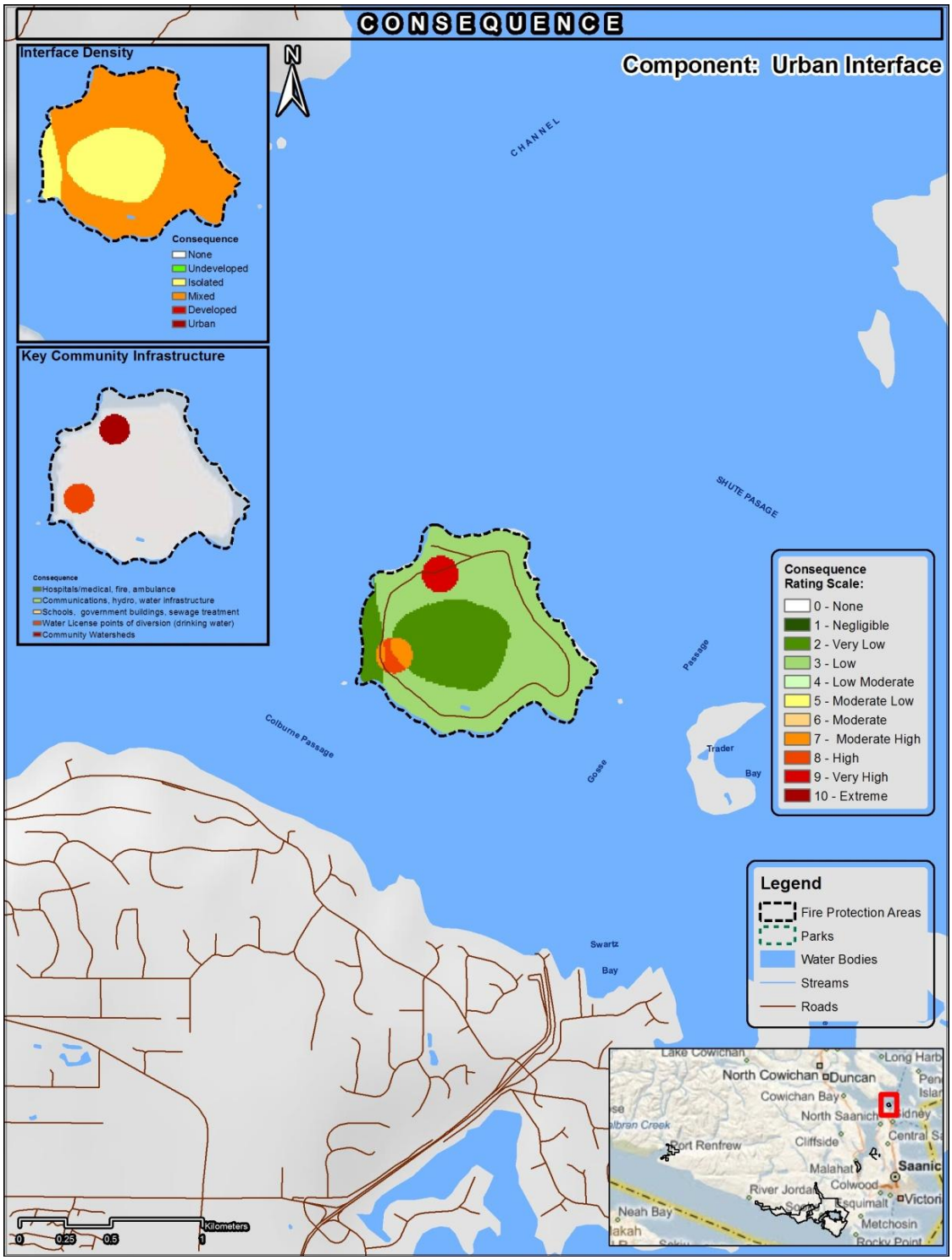


Fuel diameter (cm)	Fuel Loading (kg/m^2)
< 7	0.3
> 7	4.7
Total	5.0

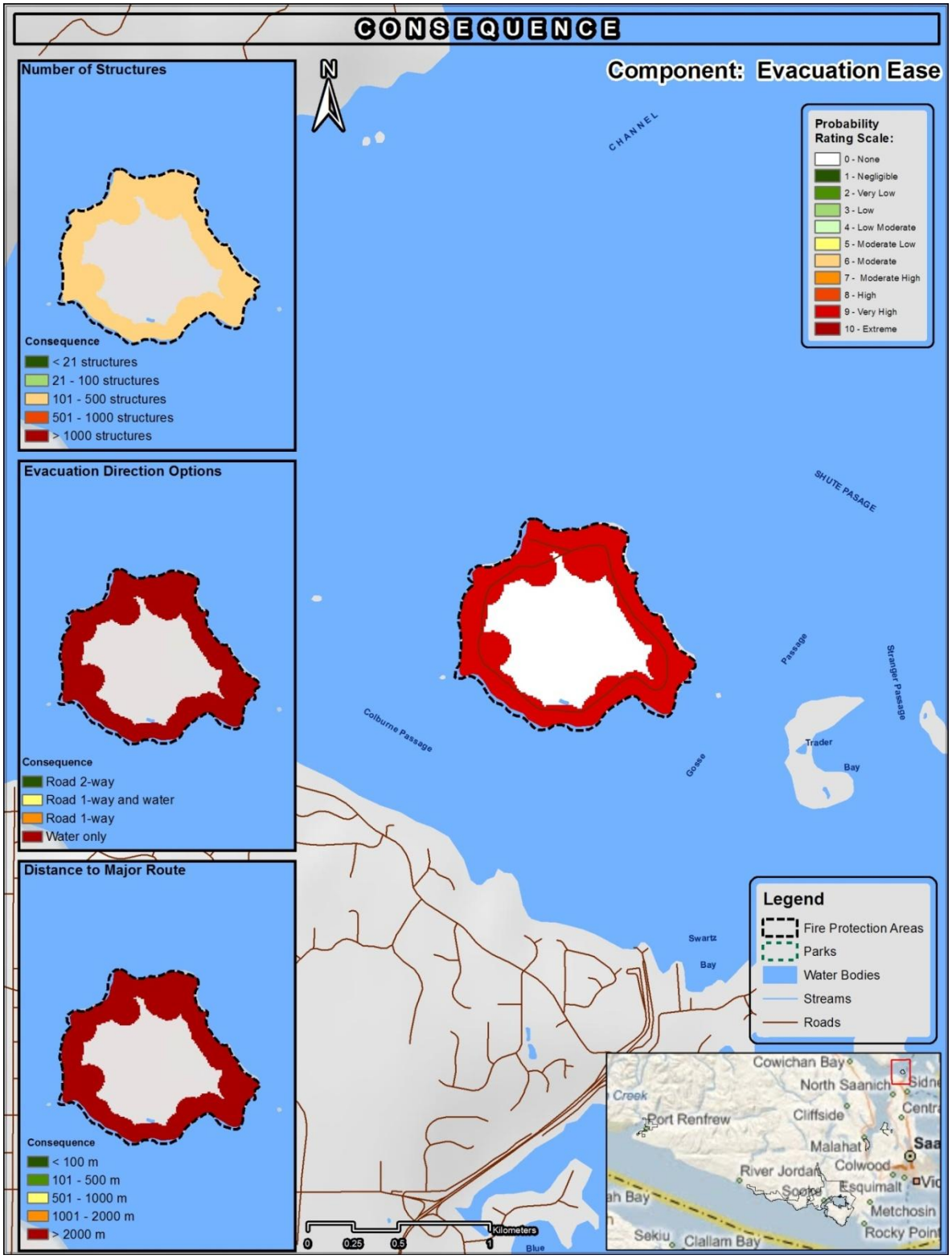
Woody debris in excess of CWD and fine fuel targets should be burned in small piles. If burning, avoid piling around large CWD, stumps, living trees, standing dead snags or under live canopy.

Appendix 1 – Wildfire Risk Management System Outputs

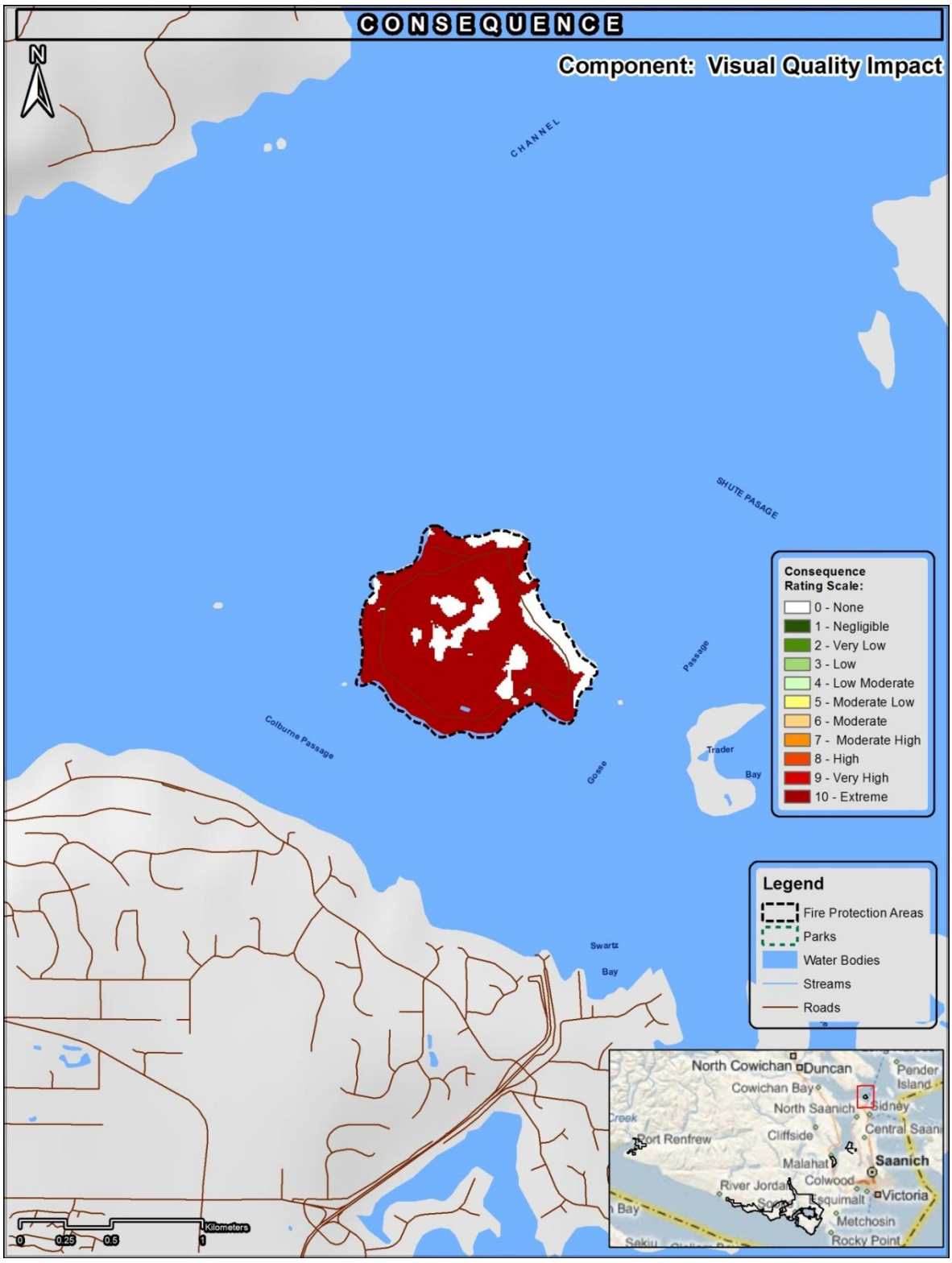
Urban Interface (Consequence)



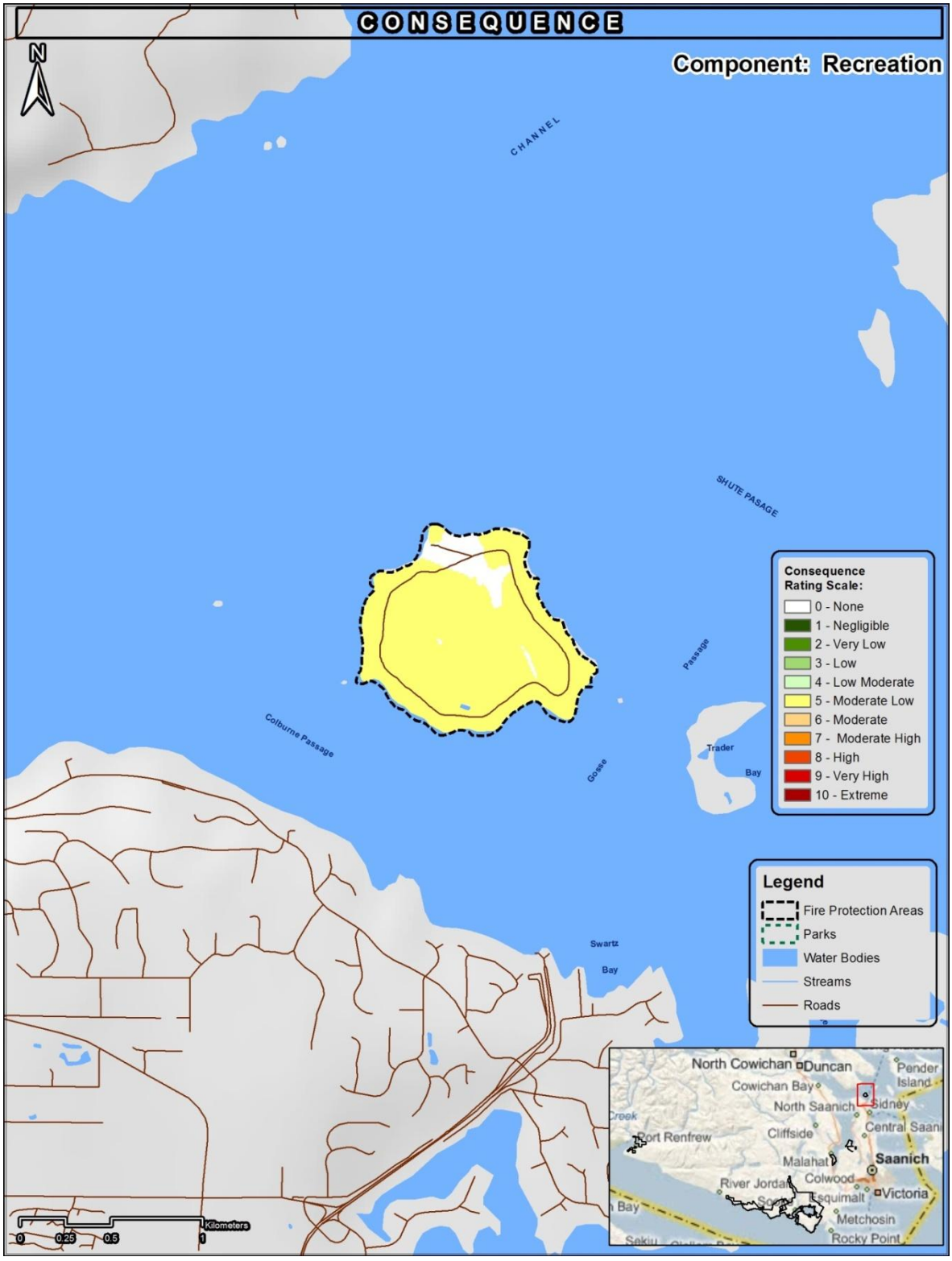
Evacuation Ease (Consequence)



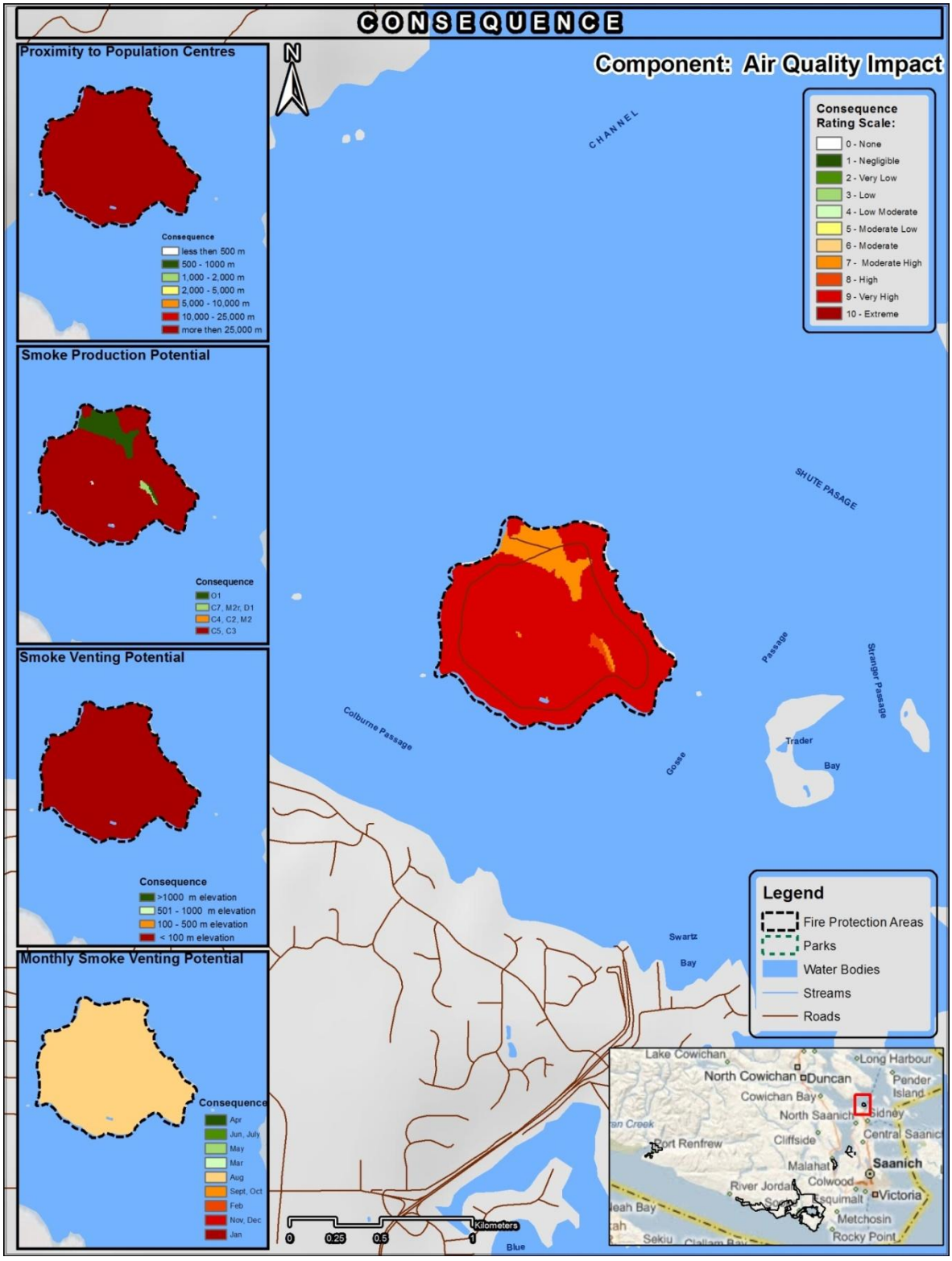
Visual Quality Impact (Consequence)



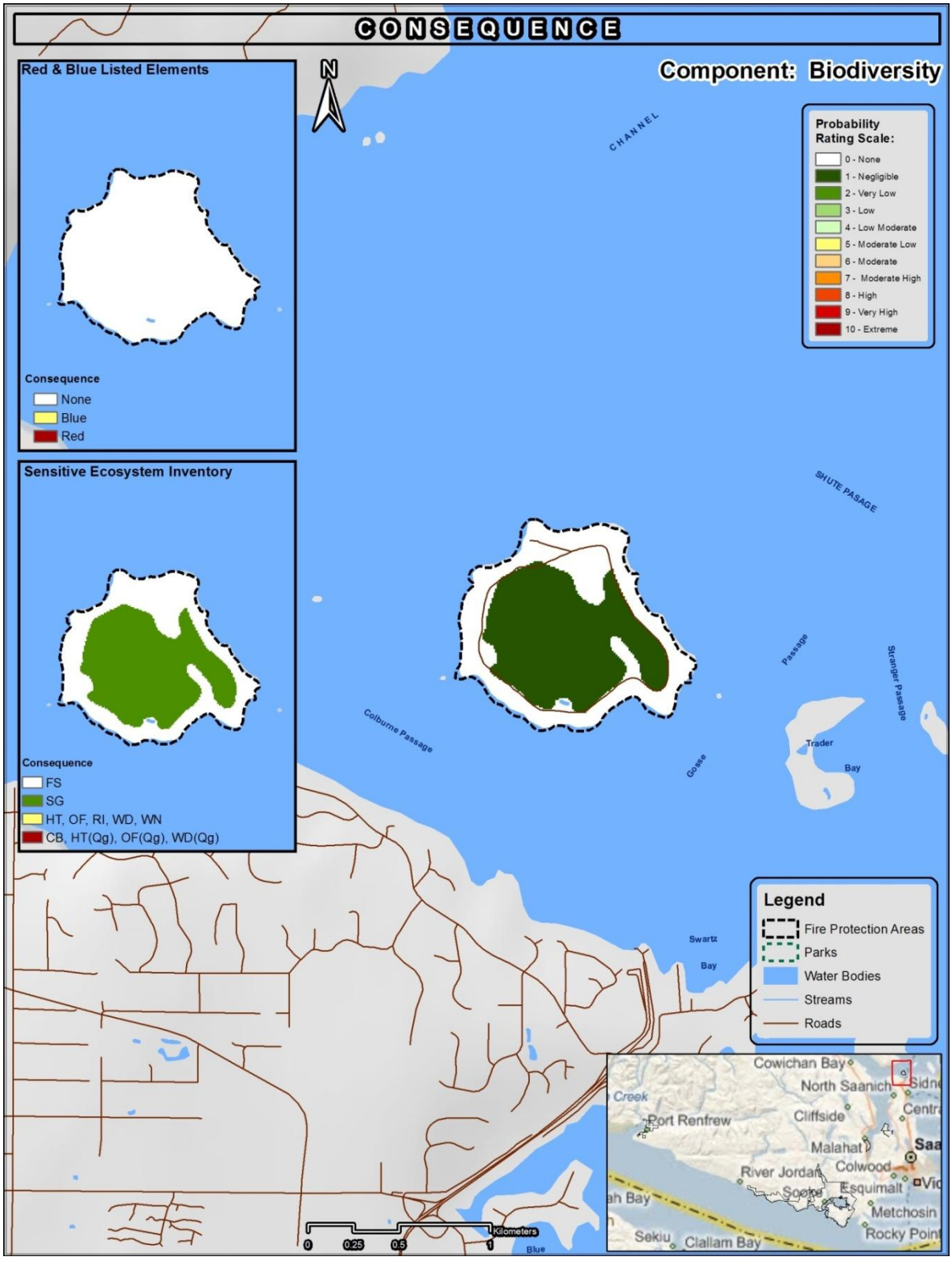
Recreation (Consequence)



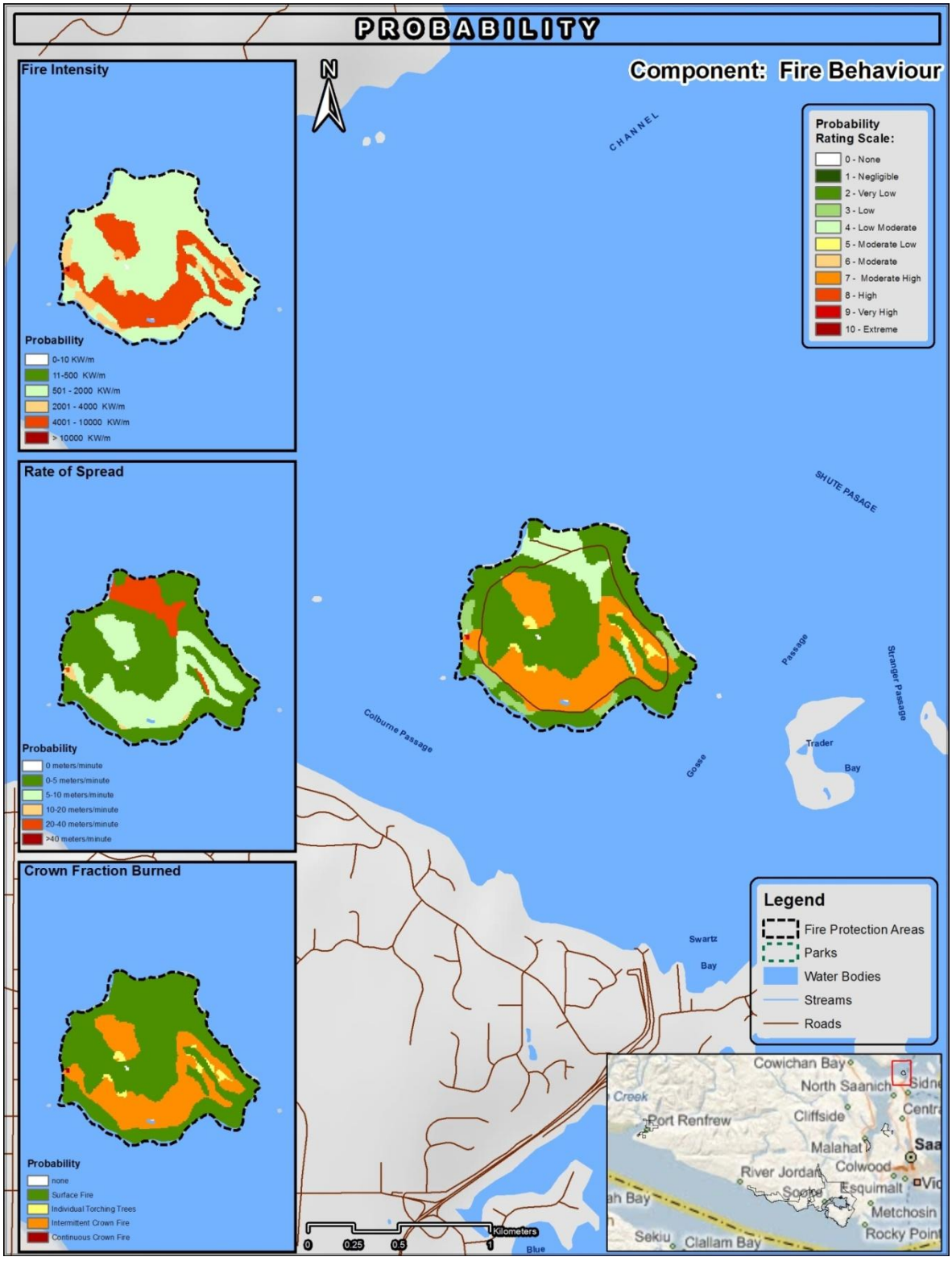
Air Quality Impact (Consequence)



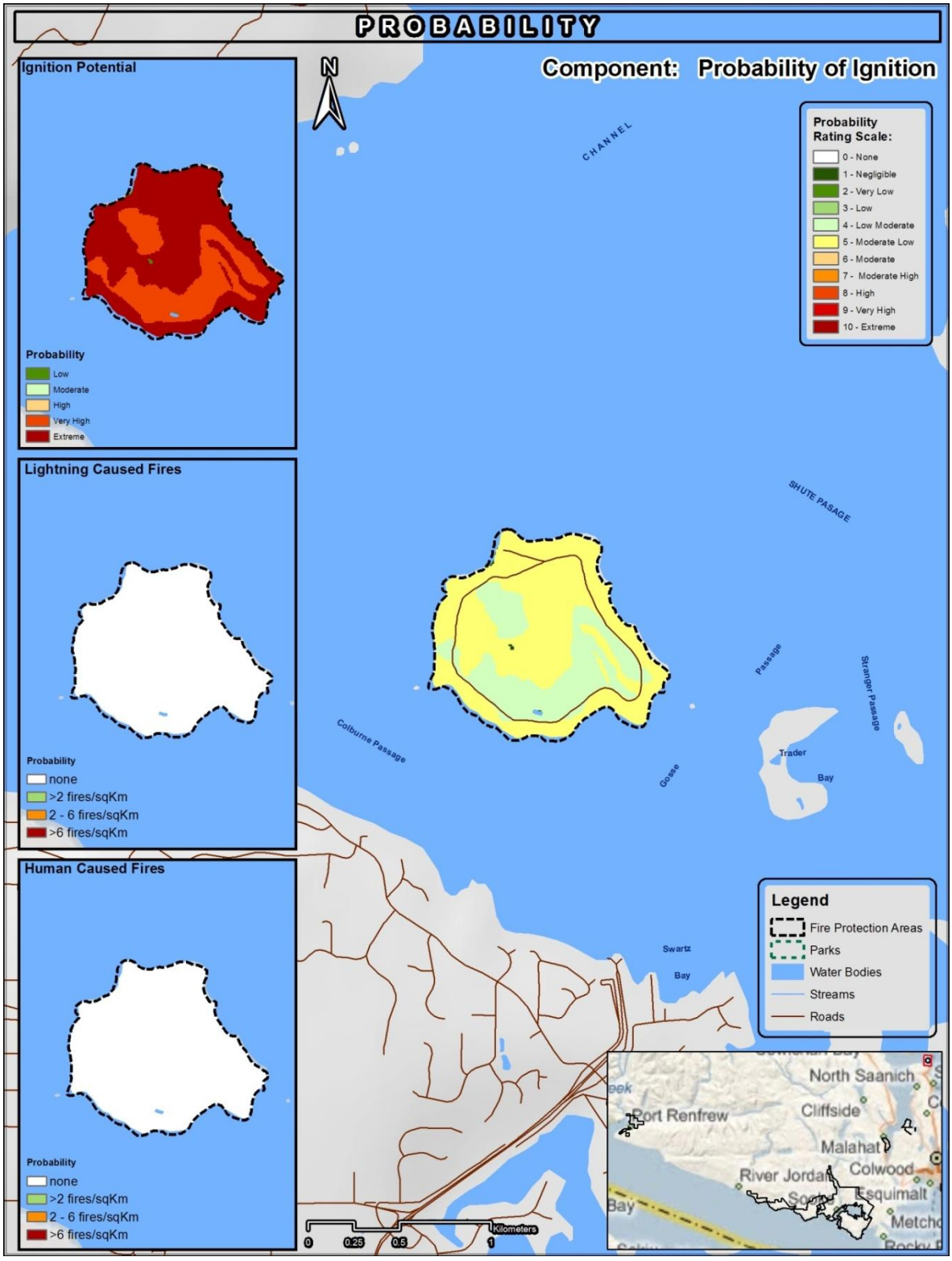
Biodiversity (Consequence)



Fire Behaviour (Probability)



Probability of Ignition (Probability)



Suppression Response Capability (Probability)