

Village of Belcarra

Wildland Interface Fire Management Plan

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Executive Summary

The *Village of Belcarra*, through opportunities created by the *Union of British Columbia Municipalities* (UBCM), and in recognition that a wildland interface fire represents a higher probability than most natural threats, has initiated the preparation of a Wildland Interface Fire Management Plan. The *Sasamat Volunteer Fire Department* is considered to be a key component of the plan and directly involved in its conclusions. The *Village of Anmore* has also expressed interest in the plan and is referenced.

In the *Village of Belcarra*, the high recreational use, steep terrain, and the number of homes in isolated wildland settings may create problems in addressing wildland interface fires. To reduce the potential for wildland fire, government agency officials, the Fire Department and residents must work together to address fire hazards and create mitigation strategies for the area. Planning is the key to both efficient responses to a wildland fire event and to reducing the potential for fire hazards. The plan for wildland fire occurrence includes options such as giving information to residents on evacuation and introducing hazard mitigation through the *FireSmart* program. Modifications to current *Official Community Plans*, subdivision by-laws and zoning regulations are important tools that can significantly reduce fire risk as well as create defensible properties.

The *Village of Belcarra*, with homes valued from approximately \$500,000 to over \$1,500,000, is bordered by water and forest on three sides. The main canopy cover is Douglas-fir, western redcedar and western hemlock. Coniferous species can often act as ladder fuels because they retain lower branches.

The Village's road system is considered limited; consequently the Fire Department access and response time could be critical. The water supply for coping with a wildland interface fire in Belcarra is also considered limited for fires beyond 300 metres of a fire hydrant or water source. A community hazard assessment conducted by the *Ministry of Forests* indicates moderate hazard but a relatively poor suppression capacity, largely due to topography and access. The "water access only" residences are of particular concern since the *Sasamat Volunteer Fire Department* must rely on marine transportation from other agencies to respond.

The *Sasamat Volunteer Fire Department* (SVFD) has, over the last four years, been acquiring specialized wildland interface fire training to MOF and BCERMS standards and has obtained suppression equipment that includes light weight forest fire apparel, fire hose, adaptors and portable sprinklers. The Department's two tender vehicles are suitable for remote access areas serviced by rural roads.

Resident, Municipal and Fire Department options are discussed in the following plan with respect to fire occurrence and hazard mitigation.

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Figure 1: Forest Interface-Belcarra Municipality. Source:
<http://www.belcarra.ca/index.htm>

1.0 Introduction

Provincial regional districts, municipalities and fire departments are creating plans for wildland/urban mix or interface fire occurrence in their jurisdictions. The objectives of these wildland interface fire plans are to:

- Empower communities to organize, plan, and take action on issues impacting community safety,
- Enhance levels of fire resistance and protection to the community,
- Identify the risks of wildland/urban fires in the area, and
- Identify strategies to reduce the risks to homes and businesses in the community during a wildfire.

The *Village of Belcarra* has created a wildland interface fire management plan for the municipality that also includes reference to the *Village of Amore*. This plan will discuss both the fire hazards and the methods that can be used to mitigate hazards that involve wildland interface.

Wildland fires are of two types: wildland mixed and wildland interface fires. Wildland-urban mix fires occur in areas where vegetation and residential or public and commercial buildings are interspersed. Interface fires are those that may spread from continuous urban development to forest or from forest to urban settings. Wildland fires are often more difficult to control and behave differently than structural fires. They can be increasingly flammable because long-term fire suppression policies that culminate in a build-up of fuels. Moreover, the inhabitants of these areas often have come directly from urban settings and may not be aware of the fire hazards associated with their community.

Seven large interface fires occurred within the Kamloops Fire Centre jurisdiction in 2003, resulting in the loss of 334 homes and 10 businesses as well as other high value structures. Remarkably, there were no serious injuries during the process despite 50,000 people being evacuated.

This situation may be repeated in the future within municipalities like Belcarra and Anmore because of the terrain, growing resident and visitor density and recent fire weather patterns. There is much less time to respond to a wildland fire incident in these municipalities compared to some locations in BC because of access and topographic constraints.

Procedurally, the *Sasamat Volunteer Fire Department (SVFD)* is in agreement with Lion's Bay, North Vancouver, Port Moody, Coquitlam, Port Coquitlam, Fire Departments and the GVRD Watershed Fire Protection in an early notification and unified forest closure protocol, intended to provide a rapid deployment of resources, or early advisement of wildland fire events. The SVFD liaises or requests the services of the Ministry of Forest Protection Officers from the Coastal Fire Centre for all wildland fires. However, if the Ministry manpower and equipment has already been allocated to a fire with a greater imminent danger to a population and consequently a higher priority, the agency may dramatically limit a call for the Belcarra-Anmore area. Since wildland fires can travel rapidly, the municipalities must be ready to respond quickly.

The last ten years' average fire weather shows an index with an equivalent fire hazard less than Rank 4. The 2003 fire weather patterns are above the ten-year average

1.0 Introduction (Continued)

reaching Rank 5 for extended periods; patterns for 2004 are, so far, quite similar to 2003. **The next few years are predicted to be drier than the ten-year average. These factors make it important for the Belcarra and Anmore Municipalities to plan for interface or mix fire occurrence.**



Figure 2: Fire Weather Index-Ten Year Average and 2003. Source: BC Forest Service Protection Branch.

2.0 Characteristics of the Belcarra and Anmore Municipalities

2.1 Belcarra Municipality

Belcarra, situated on the east side of Indian Arm, has a population of 700 and a travel time from Vancouver of 45 minutes. The residential population is expected to peak at about 800. However, the attractive regional and local parks, beaches, campgrounds and facilities for boaters draw up to 50,000 visitors per month from the surrounding area. Belcarra Regional Park alone has an estimated 848,995 visitors for the year 2005.

The Municipality contains a number of developments including Belcarra Bay, Bedwell Bay, Whiskey Cove, Cosy Cove, Farrer Cove and Twin Islands. Twin Islands and Cosy Cove are particularly problematic in terms of fire management planning because they have water access only. Belcarra's spectacular views and rural setting within commuting distance of Vancouver places the average price of homes at \$400,000-\$800,000 inland; and \$900,000 to over 1.5 million along the waterfront.

Most houses are average to above average single-family dwellings though there are now an increasing number of renovated and newer senior-executive waterfront properties. Because of its isolation, homes obtain their water from wells and dispose of

2.0 Characteristics of the Belcarra and Anmore Municipalities (Continued)

sewage using septic treatment systems. Belcarra household incomes are among the highest in the Vancouver Region whereas the property taxes are relatively low. The Village is nearing the completion of its fire protection water main strategy. This strategy reduces the need to rely on establishing a water supply from natural sources. The community has only two main collector roads, Bedwell Bay Road and Belcarra Bay Road.



Figure 3: Aerial Photo of Belcarra Village. Source: Belcarra village website
<http://www.vob.belcarra.bc.ca/vob-profile.htm>

2.2 Anmore Municipality

Anmore also draws upon the resources of the *Sasamat Volunteer Fire Department*, and as a result, an understanding of fire risk for the municipality is relevant. Anmore, incorporated on December 7th, 1987, is a semi-rural residential community situated north of Port Moody in the Northeast Sector of the *Greater Vancouver Regional District*. The current population is approximately 1,400 and it has been steadily increasing since incorporation. It is not unusual for an Anmore landowner to have over an acre of land, with average prices around \$800,000. Sprawling lots and estate homes typify this area. The current village *Official Community Plan* and Zoning Bylaw will accommodate a future population growth to approximately 4,000. Sunnyside and East Roads serve as the major traffic routes for residents and provide access to Buntzen Lake. There are a few commercial enterprises: the BC Hydro power and pumping station, grocery store, riding academy, rafting company and private campground.

Recreation attracts a large number of visitors. *Buntzen Lake Reservoir Recreation Area* operated by BC Hydro, has recently been incorporated in municipal boundaries. This Recreation Area attracted 745,404 visitors in 2004 and the estimated number of visitors to July 2005 was 382,122. It has a number of hiking, biking and horse trails scattered throughout the park and is a favourite spot for picnics, swimming, canoeing and fishing.

3.0 Hazard Levels in Three Zones-Belcarra and Anmore Municipalities

The Belcarra and Anmore Municipalities can be divided into three zones based on geographic location and the results of interface community fire hazard assessment conducted by the *Ministry of Forests Fire Centre*. The assessment forms allocate points to key characteristics according to fire hazard. These points are summed to create a hazard rating system. Categories are extreme, high, moderate and low.

The first Zone (I) consists of the west-facing portion of Indian arm in the Belcarra municipality including Farrier Cove, Cosy Cove, Whiskey Cove and Belcarra Bay. Here topographic aspect creates warmer conditions and summer outflow winds in the late afternoon. The second Zone (II) is characterized by north-easterly aspects along Bedwell Bay. This Zone has a cooler and moister condition than Zone I. The third Zone (III) is the municipality of Anmore with the exception of the higher elevation developments. Zone 1 has an extreme hazard rating, Zone II and III are considered moderate respectively. The higher elevations of Anmore with recent development have a moderate-high hazard rating because of the steeper terrain.



Figure 4: A House that Caught Fire in an Interface Area, Belcarra. Source: L. G. Scott, *Sasamat Volunteer Fire Department*.

3.1 Detailed Hazard Zone Characteristics

3.11 Belcarra

Zone I: The northeasterly border of Indian Arm, including water access only, and within Municipal boundaries.

The Zone is classified as rural with continuous forest. Litter is 13-20 cm deep; the ground surface contains scattered, crossed branches > 1 m high. The stand is generally coniferous with salal and other shrub understory. This locality contains steep areas and rocky outcrops. Lot sizes are greater than 1 hectare. The Zone has high recreational use, with some seasonal and year-round residences and there is a high fire potential on adjacent lands. In terms of fire fighting capability, there are no hydrants and it has

3.0 Hazard Levels in Three Zones-Belcarra and Anmore Municipalities (Continued)

a poor water supply. The Sasamat Fire Department is volunteer group; the response time by the Department is within 30 minutes due to its reliance on other agencies to provide water transportation to portions of the zone. The Zone has fire history of 2-5 fires. Late afternoon winds may make engaging a fire in this Zone more difficult. Ferrer Cove and Twin Islands typify the Zone.

Zone II: The southwesterly “rim” of Bedwell Bay (a northeastly aspect).

The area has scattered forest. Litter is between 5 and 13 cm deep while the ground surface contains scattered branches and tops in continuous contact with the surface. The forest is mixed deciduous-conifer with an understory of wildland brush and/or salal. The topography is rolling and gullied. There is complete development throughout the area and as a result, the fire potential is somewhat limited to the perimeter although forested corridors do exist. The area has high recreational use with a medium fire potential on adjacent lands. There is partial water coverage-water is within 350 m. Fire department response time less than 15 minutes. However, there are significant areas that are inaccessible and the average number of fires is in excess of 15 over a 5-year period. The area with residences adjacent to Bedwell Bay was used to characterize the Zone. Fire protection hydrants are available to most areas.



Figure 5: Bedwell Bay Looking North. Source: L. G. Scott, *Sasamat Volunteer Fire Department*.

3.12 Anmore

Zone III: Anmore Village South District

The vicinity contains continuous forest with litter depths between 5 and 13 cm. Surface fuel consists of scattered branches and tops not elevated above the ground. The canopy is comprised of mixed deciduous and conifer with brush such as salal in the understory. The topography is rolling and gullied with incomplete development throughout. A low fire potential exists for the entire area; this locality has infrequent recreational use. In terms of fire suppression capabilities, there is partial coverage or

3.0 Hazard Levels in Three Zones-Belcarra and Anmore Municipalities (Continued)

water within 350m; Department fire response time is estimated to be less than 15 minutes. The municipality is going through a rapid growth period that generates considerable civil and residential construction activity throughout the area. Areas are generally protected by fire hydrants. Sunnyside Road was used to characterize the Anmore South District.

Zone III Anmore Village North District

The fire weather potential sometimes reaches Class 3 in this portion of the zone. The area can be described as continuous forest with litter between 5-13 cm. Land clearing and BC Hydro transmission corridor management produce scattered branches and tops lying on the ground surface. The canopy is mixed deciduous and conifer with brush such as salal. The topography is rolling and gullied. There is incomplete development throughout and fire potential throughout. It has infrequent recreational use and has a low fire potential. The fire history is 2-5 fires. Fire response is within 15 minutes by the *Sasamat Volunteer Fire Department*. In terms of fire suppression, there is partial coverage for water, that is, water within 350m. The area is generally accessible.

Gathering information on wildland interface fire hazards:

A free set of Strategic Analysis Data is available from UBCM. It is based largely on existing data combined with work conducted by Bruce Blackwell and Co., a firm with strong ecological background. GVRD or consulting firms can use this information to produce hazard maps for the Municipalities. The maps will require checking on the ground because they were initiated at the provincial level.



Figure 6: Topographic Challenges, Belcarra. Source: L. G. Scott, *Sasamat Volunteer Fire Department*.

4.0 Response to Fire Hazard Occurrence

4.1 Options

There are three major options for hazard mitigation:

- **Technical:** -creating accurate hazard maps; designing silvicultural alternatives for reducing vegetation hazards for each zone,
- **Public-Oriented:** -engaging residents, non government organizations, agencies, corporations and public works in mitigating structural and vegetation hazards on residential, commercial and public property and,
- **Planning or Policy:** - reviewing and modifying current municipal policies and construction “best practices” to be compatible with hazard mitigation strategies.

Given that the Belcarra and Anmore Municipalities:

- Are heavily treed with conifers and have steep or gullied terrain,
- Have only one or two access roads in each zone with several narrow dead end roads branching from main roads,
- Have in many cases, water and/or forest on three sides,
- Have some areas that are water access only,
- Have community terrain hazard assessments with extreme and moderate rating,
- Have poor or limited available water supply for engaging fires in some cases,
- Have an average response time of less than 15 minutes, and
- Have no detailed fire evacuation plan,

specific strategies are necessary to respond to a wildland interface fire occurrence.

The zone of most concern for the Municipalities of Belcarra and Anmore is Zone I in Belcarra with an extreme rating. This zone contains residences with water access only. The Sasamat Fire Department has limited capacity to respond to fires that involve water access only residences because marine transport must be arranged to reach the site.

4.2 Strategies and Targets for Hazard Improvement

The following actions have, will or should be taken:

- A *FireSmart* (2003) manual has been distributed that outlines steps that residents can take to protect homes.
- Residents working with Sasamat Fire personnel can undertake individual terrain and building assessments as well as landscape management modifications in the Municipality using a *FireSmart* Assessment Form issued by the Municipality.
- Sasamat Fire personnel will provide public education opportunities at community events.
- Public meetings will be held with residents to determine what can be done to mitigate fire hazards as well as to explain general evacuation plans.

4.0 Response to Fire Hazard Occurrence (Continued)

- Bylaws and policies should be reviewed and modified to make the neighbourhood safer (for example, increased fire suppression access and changes to building by-laws).
- Additional training and specialized equipment has been received and will continue to be given to the Fire Department.
- A written strategy for general evacuation appears within the *Village of Belcarra Emergency Plan*. It can be considered a work in progress as collaboration with agencies and residents takes place. A brief *Wildland Interface Fire Evacuation Plan* should be completed independent of the *Wildland Interface Fire Management Plan*.
- The media should be engaged in raising public awareness about fire hazards.
- Public lands should be assessed for vegetation hazards and hazards will be reduced as necessary.
- Fire Department staff should inform water access only residents that the *Sasamat Volunteer Fire Department* cannot service them as well as other portions of the Municipality with limited or no access.
- Consideration should be given to creation of accurate hazard maps for Belcarra Municipality.
- Other organizations like GVRD Parks, YMCA Camp Howdy, Sasamat Camp and BC Hydro should dialogue with the *Sasamat Volunteer Fire Department* to define the means to reduce wildland interface fire risks, improve access and create defensible spaces.



Figure 7: Zone 1-Extreme Hazard Rating, Belcarra Municipality. Source: L. G. Scott, *Sasamat Volunteer Fire Department*.

5.0 Specific Strategies

In the Village of Belcarra, the high recreational use, steep terrain, and the number of homes in isolated wildland settings may create problems in addressing wildland interface fires. To reduce the potential for wildland fire, government agency officials, the Fire Department and residents must work together to address fire hazards and create mitigation strategies for the area. Planning is the key to both efficient responses to a wildland fire event and to reducing the potential for fire hazards. This section of the total Wildland Interface Fire Management Plan has been designed as a stand-alone portion to provide a circular for the general public.

A *FireSmart* manual (2003) was produced to aid Canadians in understanding interface and mixed fires and how to mitigate and prepare for them. Although some of the noted best practices are more suited for areas other than the Coastal Temperate Rainforest, the principles remain sound. The manual includes a hazard assessment that can be conducted for all buildings and landscapes in neighbourhoods. Typical general responses to the wildfire hazard include:

- Hazard mapping,
- Educating individuals about what they can do to make their property safer,
- Fuel management, and
- Adoption and enforcement of stricter building codes.

For the Belcarra and Anmore Municipalities the following strategies could be undertaken.

5.1 Technical Strategies

Belcarra Village should confirm accuracy of previous community hazard assessments and seek the means to produce new hazard maps. The GIS information available from UBCM might be used to generate the initial hazard maps but this information must be checked for accuracy. Once the assessment of hazards has been conducted, silvicultural options for mitigation can be implemented.

One mitigation strategy where the public will require assistance is in implementing vegetation modification. This action is important because fire brands or spotting can travel up to 200 metres in advance of a crown fire and the flame length of a burning forest can be as high as 100m.

Development of silvicultural options for reducing vegetation hazards.

The *FireSmart* manual recommends certain vegetation configurations and understory removal to reduce fire hazards. These options include actions on both public and private lands such as:

- Building and maintaining fireguards,
- Modifying green spaces,

5.0 Specific Strategies (Continued)

- Clearing transmission lines and
- Modifying landscapes about homes.

Discussion should take place to determine the appropriate silvicultural options given the climate of the Municipalities.

- Municipal officials should assess public areas with respect to green space, transmission lines and fireguards to determine existing hazards.
- Residences with treed acreages, ladder understories, grasses, and decayed surface fuels are most vulnerable to a wildland fire. For landscapes, silvicultural options include stand thinning and removal of surface debris that can be followed by maintenance of a “parklike” understory through light fires.

Just as the impact of longer fire frequency has changed the flora and fauna surrounding Belcarra and Anmore, the introduction of long-term modifications to the canopy and ground surface should consider the modifications to natural and social resources. Removal of crown canopy could return the forest to some semblance of the natural fire regime and create wildlife habitat found in more open situations. Creating defensible spaces using nature is the objective.

The *FireSmart* manual suggests removing trees so that there is a significant space between existing trees immediately adjacent to buildings or along well traveled roads on the down hill side. A cleared zone about houses is highly recommended.

- Cluster spacing can also be implemented with one tree width between clusters on lower slopes grading to cluster spacing of two tree heights on the upper portions of slopes. Clusters should have ladder fuels and surface fuels removed.
- Belcarra, like other districts and municipalities in BC, has adopted chipping and debris removal programs to assist residents in modifying their acreages.

It is recommended that the mitigation strategies for the Belcarra and Anmore Municipalities incorporate investigation of silvicultural treatment options. Assessing impacts on natural resources can be incorporated into a second technical stage that includes mapping and the specifics of silvicultural options. A follow up survey of residents to determine the success of resident *FireSmart* building and vegetation mitigation programs is also recommended.

Other Technical Considerations

In the *FireSmart* manual, points are assigned according to the landscape conditions and building materials. There are 11 residence, 5 terrain factors and some ignition factors that are considered. The following is a short summary of the *FireSmart* list:

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5.0 Specific Strategies (Continued)

Residence Factors:

- Factors 1-3: Roofing material with the lowest hazard rating is noncombustible tile, asphalt or metal; shakes are not recommended because firebrands may ignite the roof. Roofs should be clean and gutters should contain no debris; siding like stucco or metal provide a better defense; log, shake or vinyl siding provides poor radiation or direct flame resistance.
- Factors 4-6: Eaves should be enclosed, vents screened, and balconies or decks should be composed of noncombustible material; the underside of decks or balconies should be sheathed in.
- Factors 7-9: Combustible fuels such as chopped wood, lumber or logs should be at least 10 m from the home. Houses should be set back 10m from the crest of a slope or follow all *FireSmart* building recommendations. In terms of landscaping, deciduous tree canopies are recommended within 10-30 m of the house because they are less likely to sustain a crown fire.
- Factors 10-11: Lawns and noncombustible surface materials are recommended within 10 m of a home. Tall dry grass, branches, logs and twigs on the ground are a hazard. The presence of ladder fuels (trees or shrubs that can carry a flame into the tree canopy) is hazardous.

Terrain Factors:

- Factor 1: The overstory vegetation: deciduous canopy is more desirable than coniferous canopy (the latter is more flammable and tends to retain branches low to the ground).
- Factor 2: Surface fuels: an abundance of dry logs, branches and tall, dry grasses near homes is hazardous.
- Factor 3: Fuel assessment: Dense conifer cover with branches close to the ground is a greater hazard than scattered park-like landscaping with the lower branches of trees removed.
- Factor 4: Terrain type: Steep (more than 25%) or gullied slopes constitute a greater risk because fires usually burn more rapidly upslope.
- Factor 5: Position on slope: Homes on upper slopes are at greater risk.
- Fire Ignition – south aspects, areas with high human activity, unscreened chimneys (no spark arrestors), chimneys with over hanging branches, inadequate burning barrels, propane tanks near vegetation, and vegetation near powerlines may contribute to fire ignition.

5.0 Specific Strategies (Continued)

5.2 Public-Oriented Strategies

Recommendations for engaging the public would involve the cooperation of all relevant Municipal committees, consultants and employees. It may also involve representatives from other agencies such as GVRD and BC Hydro Authority. Suggestions include:

- Training neighbourhood block watch, service and environmental groups, youth groups and other volunteer organizations in hazard mitigation,
- Offering contests for the best *FireSmart* residence/commercial adaptation,
- Taking advantage of municipal debris pickup for residents,
- Engaging the schools and teachers in hazard mitigation programs,
- Town hall or public meetings to present *FireSmart* concepts, and
- Local media coverage of mitigation strategies.

The creation of a local best practices model is suggested as well as workshops in vegetation modification for the public. Certain information on fire preparedness can be conveyed to the public through meetings and the media. There are a number of additional fire suppression actions that residents can take such as provision of:

- Sprinkler systems for roofs,
- Landscape sprinkler systems,
- Foam converters or adaptors for garden hoses,
- Fire gels (these have a longer effect than foams but can be difficult to clean off).
- Long garden hoses,
- Shovels and grubbers and,
- Barrels of water in locations where water for fighting fires is limited.

Residents with wells should consider having an additional electric generator. Residents should insure that their driveway is sufficiently wide for a fire truck to enter and has sufficient space at the end for a truck to turn. Long treed driveways may mean that a truck must back in. Steep driveways with sharp turns may mean that the truck cannot navigate the driveway.

Fire Evacuation Procedures for Belcarra Municipality

Water access only residents should be aware that the *Sasamat Volunteer Fire Department* might not be able to assist them. Precautions and fire preparedness information will be made available to these households in particular. In the event of a severe interface fire, the *Sasamat Volunteer Fire Department* and MOF will be responsible for deployment of resources and all aspects of firefighting within the municipalities. These two agencies will take the lead in evacuation. Since Belcarra has an excellent Block

5.0 Specific Strategies (Continued)

Watch Program, Captains could be involved in hazard mitigation, as well as in informing residents about appropriate evacuation procedures.

For Belcarra Municipality, several evacuation routes are specified in the Village Emergency Plan. These are:

- Bedwell Road through Sunnyside Road to the *Village of Anmore*,
- Bedwell Bay Road through First Avenue to the City of Port Moody,
- Bedwell Bay to Senkler and through Bowser Avenue and the GVRD Public Works Service Road to White Pine Beach,
- Tum-Tumay-Wheuton Drive through GVRD Parks to Thermal Drive and Bedwell Bay Road,
- Bedwell Bay Road to Belcarra Park, and,
- Water evacuation from Belcarra Park Picnic Grounds, Marine Avenue or Coombe Lane.

A brief specific fire evacuation plan is recommended for each of the three hazard zones described earlier.

Residents can be informed of the general MOF and emergency preparedness information.

Residents should:

- Check insurance coverage,
- Plan for pet and livestock removal to safety,
- Locate all family members or employees and designate a safe meeting place should an evacuation be called while individuals are separated, and
- Have a routine in place to prepare the house for closure (for example, closing doors and windows) in the event of an evacuation.

For an imminent evacuation residents should:

- Gather family documents, valuable business papers, photos, medications, eyeglasses, care needs for dependents in readiness for departure.
- Plan for removal of the disabled, the elderly and children, and
- Remove livestock and pets to safety.

When a wildland fire threatens a community, the *Office of the Fire Commissioner* in consultation with the *Sasamat Volunteer Fire Department* and the *Ministry of Forests (MOF)* will implement four stages of alert. These levels of alert are specified in the *Village of Belcarra Emergency Plan*.

- **Evacuation alert:** people are warned of an imminent threat to life and property through all media types including radio and TV, blow horns and

5.0 Specific Strategies (Continued)

possible door-to-door contact, if manpower and time permits. Moving handicapped and special groups is given high priority. The alert means that residents should:

- Be ready to leave on short notice,
- Be prepared for worsening conditions, and
- Monitor news sources for evacuation orders that will include the location of emergency shelters, travel routes, and reception centers.
- **Evacuation order:** people must leave the area immediately. Travel routes and the location of a reception centre for evacuees will be given. The evacuation reception center will register all evacuated individuals. At that time:
 - Transportation requirements to reception areas for evacuees will be determined and arranged.
 - The location of pick-up points to transport residents will be designated and
 - Residents will conduct house closure including power and gas shut off procedures as applicable.
- **Evacuation rescinded:** Residents are advised that they can return to their homes when the danger is passed.
- **All clear:** Residents are advised that the danger has passed (an evacuation may not necessarily have occurred).



Figure 8: An Interface Fire. Source: BC Forest Service Protection Branch
<http://www.for.gov.bc.ca/protect/images/titlepage/Photos.htm>

5.3 Planning Strategies: Best Practices for Development and Hazard Mitigation

There are three general aspects of developmental planning that affect the Municipalities:

- Broad land use options that involve local government and developers such as: greenspace and fire breaks, road networks, right of ways, water accessibility

5.0 Specific Strategies (Continued)

and housing density as well as structure placement with respect to terrain factors.

- Agency and government planning for specific services and public use, and,
- Resident and developer choices for home materials such as roof and siding materials, sprinkler systems and landscape vegetation.

Broad Planning Aspects

Levels of planning are directed by municipal or district policies. Area structure plans contain information about land uses and density, access (rights of way, emergency access) and public utilities. Mitigating wildfire risk can be achieved through standard by laws and subdivision guidelines that specify:

- Shape,
- Water supply and
- Perimeter protection buffers.

Information required for development permits can be used to assess the wildfire risk. This information includes:

- Use of the lot or building,
- Placement of the building,
- Landscaping,
- Access and internal traffic circulation,
- Exterior building material, and
- Location of fire suppression infrastructure.

In terms of larger developments such as subdivisions, several factors are of concern:

- Topography,
- Parcel density,
- Layout, and
- Infrastructure such as road access and internal traffic circulation.

Subdivision authorities can require information on:

- Use of lots,
- Slope,
- Location of buildings and
- The location of water sources for fire suppression purposes.
- Access and internal traffic circulation information insures safe evacuation and access of fire fighting equipment.

Subdivision layout depends upon the location of the development. High-density wildland development can generate a more extreme hazard condition depending on how susceptible the building materials are to ignition. At least 15-20m is necessary between buildings. Buildings on slopes should be spaced further apart because fires tend to spread

5.0 Specific Strategies (Continued)

more rapidly upslope. Subdivision staging can be conducted in a way to keep fire hazards to a minimum. Emergency access and service delivery should be addressed at the design stage. The specific amount of water needed to fight a fire for example, and how it is delivered is an important part of the subdivision planning process.

Where possible fireguards should be placed about subdivisions and fuels should be eliminated close of buildings. This action will reduce the possibility of firebrands igniting additional fires. Fireguards can take the form of:

- Walking trails,
- Playgrounds or athletic fields, and
- Strip parks.

Environmental reserves may be required to protect ravines, gullies and drainage courses. The question of fire hazard mitigation for these reserves while allowing for natural succession within the reserve is a complex issue.

Some specific concerns in agency and government planning.

Roads act as evacuation routes for residents, access routes for fire trucks, and fire breaks. Roads should meet required width and bearing capacity for firefighting vehicles. Dead end roads without cul-de-sacs are a problem for fire trucks to turn. As a result, roads should provide two-way access and dead end roads should be posted as no through roads. Gates should follow regulations in terms of width and should open inward. All roads, bridges and complexes should be clearly signed with nonflammable material.

Greenbelts should be incorporated into the protective aspect of designs for buildings and developments.

Greenbelts, like the fireguards, include:

- Orchards,
- Cultivated fields, and
- Parks and playgrounds.

These areas should have short grass and no ladder or surface fuels. Potential water sources can be mapped such as ponds, or creeks in the proximity of wildland subdivisions. In terms of utilities, vegetation should be clear of overhead powerlines. Hazard trees that might touch a powerline should be removed and vegetation should be removed near propane tanks.

Resident and developer choices for homes and landscapes.

By introducing bylaws, developers can be required to use safer materials. Many of the safer building materials have been mentioned under Technical Strategies. It would be desirable if all trailers had sheaths of noncombustible materials. Mobile homes require

5.0 Specific Strategies (Continued)

adequate tie-downs because movement can cause damage to electrical and gas service connections that may start fires.

Currently, the Sasamat Volunteer Fire Chief does review developer applications and variance permits on an individual basis for the Anmore and Belcarra Municipalities. He may make suggestions and recommendations to the administrator on a wide variety of issues ranging from road maintenance, turn around space and grades, to the installation of sprinkler systems. However, it would be desirable to have a more systematic approach through regulation to address certain hazard issues.

With respect to present fire interface-related policies in the Belcarra and Anmore Municipalities:

- 1) Fire hazard mitigation has not been addressed in the Official Community Plan.**
- 2) Fire hazard mitigation has not been addressed in Subdivision Zoning Bylaws and,**
- 3) Fire hazard mitigation has not been fully addressed as policy in the Variance Process.**

As a result it will be necessary to introduce some changes to the planning and policies of both Municipalities.

6.0 Summary of Recommendations

- 1) Neighbourhoods should be confirmed as belonging to certain hazard zones and appropriate silvicultural options should be suggested to address vegetation hazard levels. Maps can be produced. Detailed silvicultural options would form a second stage of fire hazard mitigation management -the current overall plan being the first stage.
- 2) Examples of best practices could be provided that would include examples of silvicultural options and effective use or recycling of waste materials.
- 3) Training of community groups, particularly neighbourhood watch captains, should take place to forward the implementation of the *FireSmart* recommendations for landscape and building modification.
- 4) A brief written fire evacuation plan for each zone is recommended.
- 5) Programs for schools should be developed through local School Boards, MOF, and teachers. The demonstration of best practices would be an excellent opportunity for school involvement.
- 6) The media should be involved in raising public awareness about interface fire hazard levels, hazard mitigation contests, *FireSmart* recommendations, the involvement of schools in fire hazard mitigation and so forth.
- 7) Water-access only residents should be informed of the inability of the Fire Department to service them and should be encouraged to take additional steps to protect their property, including but not limited to on-site fire suppression equipment.
- 8) Residents should take advantage of debris pickup when undertaking wildland defense landscape modifications.
- 9) All relevant municipal and District policies for Belcarra and Anmore should be reviewed and modified to include appropriate interface fire hazard mitigation.

7.0 Sasamat Volunteer Fire Department Tactical Strategies Related to Wildland Fire Interface Fires

The possible effects of a wildland interface fire in addition to the fire itself:

- Injuries,
- Fatalities,
- Trapped victims,
- Collapse of buildings,
- Explosions,
- Disruption in utilities,
- Disruptions in traffic,
- Evacuation and
- Media attention.

Role of the Fire and Rescue team in an interface fire emergency is to:

- Activate and coordinate mutual aid systems as necessary,
- Protect the life and safety of people,
- Contain and control the spread of fires (protect property),
- Undertake rescue and on site first aid,
- Check the status of utilities and,
- Provide information on restricted hazardous areas to the Leadership Team.

The Fire Department will:

- Establish an Emergency Management site (Incident Command),
- Designate a muster station,
- Prioritize the deployment of resources,
- Turn off power and gas supply if required, and,
- Report any dangerous sites to the communication team.



Figure 9: Sasamat VFD and Auxiliary Coast Guard Water Access Training. Source: L. G. Scott, *Sasamat Volunteer Fire Department*.

7.0 Appendices

8.1 Fire Science

Fire risks continue to escalate in the Belcarra and Anmore Municipalities because of:

- Population growth,
- Greater numbers of homes where canopied vegetation surrounds the houses, and
- Recent changes in BC weather patterns.

As a result of relatively recent fire suppression strategies and tree cutting principles, there is a greater incidence of hemlock, balsam fir and redcedar in the canopy and a greater natural accumulation of finer fuels than in the prior 150 years. To manage fire occurrence, fires are classified according to three fuel types and several levels of intensity. Ground fires are those that smoulder in forest floor litter. Surface fires are those that burn dead branches lying on the ground surface, or consume shrubs and lower tree branches. Crown fires are those fires that move through tree canopies. Embers or fire brands from an advancing fire can spread the fire to a considerable distance from its origin and once the fire moves into the tree crowns the fire can create its own wind that can carry the fire at a remarkable speed.

Fire intensities are rated according to the flame height and rates of spread. There are six fire ranks but only four are of concern to the Sasamat Fire Department:

- Rank 1 fire is a small smouldering fire with flame heights of <10 cm,
- Rank 2 fire is larger, but the flame height is under 1.0 m,



Figure 10: Fire Intensity Rank 2. Source: BC Forest Service Protection Branch.

- Rank 3 fire has a flame height of 1-2 m but has not reached the lower branches of trees,

- Rank 4 fire has flames are beginning to climb up lower branches and shrubs into the canopy; flames have a height of 2.0-2.5 m,



Figure 11: Fire Intensity Rank 4. Source: BC Forest Service Protection Branch.

- Rank 5 fire has flames have a height of > 2.5 m and the fire is in the canopy, and
- Rank 6 is described as a blow-up or conflagration.



Figure 12. Fire Intensity Rank 6. Source: BC Forest Service Protection Branch.

8.2 Definitions for Wildland Interface Fires

- **Fuel** – Combustible structures and wildland vegetative materials. It includes dead plants, parts of living plants, duff, and other accumulations of flammable vegetation.
- **Fuels Management** – The practice of planning, manipulating or reducing fuels to obtain conditions that permit protection forces to meet fire suppression objectives.
- **Highly Flammable Fuels** – Zones designated by fire agencies as having specific characteristics – e.g., fuel loading, slope and topography, fire weather, and other relevant factors – that would allow a fire to become uncontrollable.
- **Pre-Fire Mitigation** – Prior to wildland fire ignition, a systematic application of risk assessment, fire safety, fire prevention, and fire hazard reduction techniques may be undertaken to reduce wildland fires, damages and cost of suppression.
- **Slope** – A piece of ground that is not flat or level, it may rise or fall in percent; where one percent of slope means a rise or fall of one foot of elevation within a distance of 100 feet, thus 45% would equal 45 feet of rise in 100 feet.
- **Wildland** – An area that has low-density development. It can include hobby farms cattle ranches and forests managed for timber production.
- **Wildland Interface** – The geographical meeting point of two diverse systems, wildland and structures. At this interface, structures and vegetation are sufficiently close that a wildland fire could spread to structures or a structure fire could ignite vegetation.

8.3 A Representative Interface Fire Hazard Assessment

Location: _____

Completed by: _____ Date: _____

DESCRIPTION OF THE COMMUNITY

Important Factors	Potential Hazard	Point Rating	Your Score
Fire Weather Potential	Moderate Danger Class or higher < 25% during fire season	0	
	Moderate Danger Class or higher 25%-42% during fire season	4	
	Moderate Danger Class or higher 42%-60% during fire season	10	
	Moderate Danger Class or higher >60% during fire season	20	20
Area Description	Strictly urban	0	
	Suburban with scattered forests	2	
	Rural with scattered forests	4	4
	Rural with continuous forests	6	
Duff and Litter Layer	< 5 centimetres	1	
	5 to 13 centimetres	3	
	13 to 20 centimetres	5	
	>20 centimetres	6	
Fine and Coarse Debris	None or spread more than 5 metres apart and not elevated	1	
	Scattered branches and tops close to the ground	2	
	Scattered branches and logs grouped and crossed	5	
	Continuous branches and logs grouped and crossed	6	
Forest Stand Description	Generally deciduous	0	
	Mixed deciduous and coniferous	3	
	Generally coniferous	6	
Other Vegetation	Primarily domestic	0	
	Primarily domestic and wildland grasses	2	
	Primarily wildland brush	4	
	Primarily broom	6	
Topographic Features	Generally flat	0	
	Gently rolling and even	2	
	Rolling and gullied	4	
	Many steep areas or rock outcrops	6	
Values Protected	No significant development, primarily wildland values	2	
	Complete development, perimeter fire potential only	4	

	Incomplete development, fire potential throughout	6	
	Lot sizes larger than one hectare, homes at risk	6	
Recreational Use	No obvious use	2	
	Infrequent use, difficult access and few trails	4	
	Frequent use, signs of obvious use, well-tramped trails	6	
	High use, well-tramped trails, parks, private recreation areas	8	
	High use and the area has a history of recreational fire starts	10	
Fire Potential on Adjacent Lands	No significant fire potential	0	
	Low fire potential	2	
	Medium fire potential, small industrial development	4	
	High fire potential, garbage dump, school, campground, high-use	6	

FIRE SUPPRESSION

Important Factors	Potential Hazard	Point Rating	Your Score
Availability of Water	Good hydrant coverage, available water within 200 metres	1	
	Partial hydrant coverage, available water within 350 metres	2	
	No hydrants but good water supply within 500 metres	4	
	No hydrants and poor water supply	6	
Response Time to Fire	15 minutes	0	
	30 minutes	2	
	60 minutes	4	
	90 minutes	10	
Access for Emergency Vehicles	Fully accessible by fire trucks and water tankers	2	
	Some areas have access problems but can drive within 50 metres of fire location, grades less than 25%	4	
	Narrow winding road or bridge load limit but can drive within 50 metres of fire location, grades less than 25%	5	
	Significant areas of inaccessibility, air or foot access only	6	
Fire History	Fewer than 3 fires within the previous five years	0	
	3 to 5 fires within the previous five years	3	
	6 to 15 fires within the previous five years	6	
	More than 15 fires within the previous five years	11	

OTHER FACTORS

Important Factors	Potential Hazard	Point Rating	Your Score
Frequent high winds over 30 km/h		0 - 6	

Extensive areas of steep, south or west exposure slopes	0 - 6	
Large-scale industrial or construction projects anticipated	0 - 6	
Large-scale recreational activity project anticipated	0 - 6	
Fuel loading increase due to logging or land clearing activity	0 - 6	
Utilities within the interface area	0 - 6	
<i>TOTAL POINTS</i>		

Interface Fire Hazard Risk Rating

- 0 - 53 Low
- 54 - 68 Moderate
- 69 - 83 High
- 84+ Extreme

[AREA MAP]

Notes

Guidelines

Area Description

- Urban – strictly urban, high structure density and no trees
- Suburban with scattered forests – communities adjacent to a city, moderate structure density, scattered forested areas
- Rural with scattered forests – small communities and farmland with scattered structures and forest
- Rural with continuous forests – small communities and farmland with continuous forest throughout, some isolated structures

*Village of Belcarra
 Wildland Interface Fire Management Plan
 Dr, S. M. Hope Sept. 2005*

Duff and Litter Layer

The duff and litter represent the decomposed, semi-decomposed, and freshly fallen material that makes up the upper layers of the forest floor. This includes fallen twigs, leaves, needles, cured grasses, herbs, and, any other combustible material present. To determine the point rating for the thickness of duff/litter, use the following procedure:

- Use a sharp shovel to cut through the litter and duff, creating a soil profile.
- The depth should be measured from the top of the first mineral soil horizon to the height of the upper litter as it occurs naturally.
- Do not compress fresh needles or other recently fallen material.
- Create soil profiles in at least three different locations, and record the average reading on the form in the right hand margin.
- Avoid squirrel caches, rotten materials, and abnormal fuel accumulations.
- Add one point to this factor rating if pockets of thick duff or litter occur at least every 10 metres.

Fine and Coarse Debris

Debris represents the amount of all types of ground fuels, including all combustible and woody material, even rotten wood, and their distribution. Debris ranges in size from branches and treetops, to logs and fallen trees.

- Scattered branches and tops – scattered material is found where the fuels are one to five metres apart, and 10% to 20% of the fuel is in contact with other material in this debris class. A majority of the fuel is close to the ground.
- Continuous branches and tops – continuous debris is found at least every one metre, and more than 20% of the material is in contact with other material in this debris class. Debris may be elevated; an under-layer of branches and twigs with an over-layer of needles creates air pockets and the debris dries out more quickly.

Forest Stand Description

The forest stand description reflects the general composition of the surrounding area forest and the density of the upper canopy. Forest stand descriptions should be determined by a combination of air photo interpretation and local knowledge.

- Fuel Type – a recognizable fuel complex of sufficient homogeneity of characteristics and aerial extent, that steady state equilibrium fire behaviour can be predicted, and, be expected to be maintained over a considerable period of time.
- Deciduous – refers to moderately well-stocked stands of semi-mature to mature deciduous trees; 75% of the upper canopy is deciduous.
- Coniferous – refers to well-stocked stands of mixed maturity conifers; full crown closure or not.
- Ladder Fuels – low brush, branches, and, immature trees that provide access for ground fire to the upper canopy of the forest stand.
- Add one point to this factor rating if ladder fuels are present.

Other Vegetation

Refers to fuels in the area other than mature trees. It includes grasses, shrubs, brush, and immature trees that are not part of the canopy. Other vegetation and fuel types within the interface area should be determined through the use of aerial photographs and local knowledge.

- Domestic – includes lawns, shrubbery, golf courses, farmlands, etc., which are maintained by human activity.
- Wildland – wild, natural grasses, shrubs, brush, and scattered, downed woody materials.
- Broom – introduced species, especially common on disturbed sites, and very hard to get rid of. Considered alone because of its properties as fuel type. It is a very flammable shrub because of its oiliness.

Topographic Features

The general topography of an area includes the slope of the ground measured from the horizontal and whether the slope is even or gullied. The general topography and terrain of the interface areas should be determined using aerial photography and by ground survey.

- Even slopes – have a smooth or gently rolling texture.
- Gullied slopes – have cuts running up the slope, which can provide funnels for up-slope, wind-driven fire spread.

Values Protected

The values at risk, including both structural and timber values, if a fire were to ignite and spread. Proximity to wildland is assumed. The values protected should be determined using aerial photograph and ground surveys

Recreational Use

Recreational use levels are determined by old fire pits, well-tramped trails, signs of 4x4, motorcycle or bicycle use, local knowledge, and the size of the local population. A combination of aerial photography, recreation maps, local knowledge and ground surveys should be used to determine recreation use levels within the interface zones. No obvious use – no access and no signs trails.

- Infrequent use – difficult access and few trails.
- Frequent use – signs of obvious use, easy access routes, well-tramped trails, evidence of camping, as well as any area within one kilometre of a high use area.
- High use – as above, also include parks, private recreation sites, and areas with permanent fire pits.

Add two points to this factor rating if the area has a history of recreational fire starts.

Fire Potential on Adjacent Lands

Consider the risk of accidental ignition by such land usage as nearby schools, garbage dumps, campgrounds, parks, industry, or airports. An area fire history should approximate the number of human-caused fires in the past. Risk of accidental ignition should be determined through air photo interpretation, local knowledge of land-use, and ground surveys.

Availability of Water

The distance to available water is measured from the actual location that the forested area meets the development, to the first accessible location of the available water source. Air photos should show water sources such as lakes, rivers, and oceans. Municipal planning maps will show hydrant coverage.

The following criteria are used to assess available water:

- The water source must be present year round.
- Fire hydrants and/or standpipes must be in working condition with adequate flow.
- High volume community wells or irrigation systems can be considered if they are accessible for quick hook-up by firefighters.
- Residential wells should NOT be considered.
- Seasonal creeks should NOT be considered.

Subtract one point from this factor rating if the area is provided with an independent water system usable by firefighters.

Response Time to Fire

The time it takes for emergency response (fire department, wildland crews, etc.) to respond to the fire. Local knowledge should be used to determine the response time to fires.

Access for Emergency Vehicles

Refers to the ease of accessibility for emergency equipment to respond to a fire. Air photo interpretation and ground surveys should determine access for emergency equipment. Consider locked and unlocked fire gate accesses.

- Pumpers and tankers – Very limited in their mobility, normally limited to paved or major gravel roads. Most full tanker trucks have trouble negotiating adverse grades over 15%. Loaded tanker trucks will also have trouble negotiating curves with a radius of less than 30 metres where the curve occurs in conjunction with a gradient over 10%. Tanker truck accessibility is considered good if it can get within 100 metres of a fire location. If a bridge is present, consider weight restrictions.
- Air/Foot – Ground crews or air attack should be considered where vehicles cannot travel to within 100 metres of a fire location.

Fire History

Refers to the number of fires within the area over the previous five years.

Frequent High Winds Over 30 km/h

The stronger the wind, the faster the spread of fire. Utilize local knowledge and historical weather information.

Extensive Areas of Steep, South or West Exposure Slopes

Southern aspects receive the most direct sun, are the driest, and provide the best conditions for fires to ignite and spread. Western aspects receive direct sunlight during the heat of the day, creating easy afternoon burning conditions. The steepness of a slope can also affect fire spread. Wind currents are normally uphill and this tends to push heat and flames into new fuels. Convection heat rising along a slope causes a draft that further increases the rate of spread. Air photo interpretation and local knowledge should be used to determine south and west exposure slopes. Ground surveys should determine the point rating.

Large-Scale Industrial or Construction Projects Anticipated

Creates disturbance of the land and increases the risk of accidental ignition through the use of machinery and increased human activity. Examples include residential development, industrial park expansion, new garbage dumpsite, and road construction. Local knowledge and air photo interpretation should be used to determine what major projects exist in the interface area. Ground surveys and the above resources should determine what, if any, major industrial projects are anticipated or currently happening.

Large-Scale Recreational Activity Project Anticipated

Increased risk of accidental ignition due to increase in human activity in immediate area, as well as adjacent lands. Examples include park development, new campsites, and increased tourist traffic from such activities as hiking, fishing and hunting. Local knowledge and advertised projects should determine what projects are happening in the interface zones. Utilize the same resources as above, and possibly community and special interest groups.

Fuel Loading Increase Due to Logging or Land Clearing Activity

Increased risk of accidental ignition due to equipment use. Increased ground fuel accumulations due to slash. A combination of air photo interpretation, local knowledge and ground surveys should be used to determine amounts of logging or land clearing activity in the interface area.

Utilities Within the Interface Area

Consider hydro rights-of-way, overhead wires, gas pipelines, etc., within the interface area or adjacent areas. Air photos and topographic maps should be used to determine where and what utilities exist in the interface area. Ground surveys and topographic maps should determine the point ranking for this factor.

Source: Wildland Fire Hazard Assessment

British Columbia Ministry of Forests Protection Branch May 2004