

**Considerations Regarding Wildland-Urban Fire
Risk Mitigation
and the
Galloway Land Development
Fernie, BC**

Response to concerns from the Fernie Snow Valley Community Association

Submitted to:

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EXECUTIVE SUMMARY

This report responds to a request by the Fernie Snow Valley Community Association to review material and documentation regarding wildland-urban interface (WUI) fire concerns related to Galloway Land Development.

It is my overall professional opinion that, given the wildland fire environment of the Galloway Lands (i.e., weather, fuel types and topography), the area can be expected to burn with very high surface fire intensity, most often accompanied by extremely intense and rapidly spreading crown fire during times of high, very high and extreme fire danger. Forest fires burning under these conditions are very difficult to contain and often exceed all fire suppression capabilities. These are the conditions associated with virtually all wildland-urban interface (WUI) fire disasters.

The early planning stages of wildland-urban communities offer the best opportunity to mitigate the risk of wildfire losses, by enhancing probability that homes will survive (i.e., measures to reduce the ignition exposure and ignition vulnerability of structures), and provide fire responders with advantages allowing them to be safe, and optimally effective. Deficiencies in planning and pro-active mitigations cannot be compensated for by added fire fighting capability. Acknowledged standards and guidelines set science-based benchmarks for developments to be built in wildfire-prone areas and for the planning and construction of essential infrastructure, including the homes and surroundings. These are a requirement to construct safe, wildfire resilient communities.

My review of submissions made by the Proponents reveal significant deficiencies, inadequacies, information gaps and some inaccuracies regarding critical elements of wildfire safety, infrastructure, and risk mitigation:

- The interface fire hazard/wildfire threat, as represented in submissions, is incorrect; it is high to extreme.
- The proposal places too much emphasis and responsibility on fire control, and not enough on risk mitigation.
- The proposed road “system” seems largely overlain onto a network of old logging haul roads designed to extract timber resources, rather than to provide safe all-weather emergency access and egress in accord with applicable standards for safe development and emergency response in the WUI.
- Based on standard FireSmart™ requirements for slope adjusted fuel removal and modification within the Home Ignition Zone, there appears to be a significant conflict with the proponent’s expressed vision for protection of conservation lands. Additional spatial analysis is required at this stage to quantify the conflict, or to reconfigure development to avoid substantial impingements onto conservation reserves.
- The commitment to selectively reduce forest cover (modify fuel) raises questions how this can be achieved, given the conservation vision, and how debris disposal could occur without subsequent fire hazards.
- Given the absolute necessity for a reliable water supply, available and accessible for wildland/WU fire-fighting, a much more robust approach to evaluating water requirements and components of a water supply/delivery system is required at this stage. It would properly assess if, and how, a reliable supply may be provided in balance with accepted standards and minimal (but still adequate) water requirements.

With few exceptions, my views do not conflict with advice provided by the proponent’s wildfire consultant. As professionals, we agree on key principles and standards of wildfire risk reduction, many questions and disconnects remain. Overall, in my professional opinion, it would be prudent for the Authorities Having Jurisdiction to request the Proponent to more fully investigate, address and clarify these issues, in significantly more detail, prior to its final evaluation and consideration for re-zoning approval. I have provided additional recommendations within the text of this report, in relation to major subject areas.

1.0 Introduction / Purpose

In March of 2022 ForestWise Environmental Consulting Ltd. (FWECL) was asked by members of the Fernie Snow Valley Community Association to review material and documentation regarding wildland-urban (WU) fire relevant to the Galloway Lands development proposal. The purpose of this review is to provide insights and understanding relevant to concerns held by that Association. Expressed concerns encompassed the general wildfire threat; the risks of WU fire to the Galloway and nearby communities; fire suppression capability; public safety including safe access, evacuation, and egress for emergency responders; and the implications of essential “FireSmart”™ fuel modifications to the general environment, conservation lands and public trails.

2.0 Qualifications

Alan Westhaver (M.Sc.) is the principal and owner of ForestWise Environmental Consulting Ltd. He has nearly 40 years of direct experience in wildland and wildland-urban fire management as a senior wildland fire manager with Parks Canada (at Park, Regional and National levels), and as a wildland-urban fire consultant. He was a certified wildland fire behavior analyst on nationally mobile Fire Incident Command Teams. Alan is among the originators of the Canada’s National FireSmart Program and served on the Board of Directors and executive of its sponsoring organization 1992 – 2012. He is co-author of the *FireSmart Canada Neighbourhood Recognition Program* and has trained hundreds of fire personnel across Canada as **Local FireSmart Representatives**. As a resident of Fernie (2012 – 2019) he worked with residents throughout the city and the Regional District of East Kootenay to promote and implement FireSmart programs. As a researcher, he has authored several detailed examinations of WU fire disasters (e.g., Fort McMurray, Kelowna/Slave Lake, and Lytton - in press) and other major WU fire reports for the Standards Council of Canada, BC FireSmart Committee and the City of Fernie. He also contributed to the 2021 National Guide for Wildland-Urban Interface Fires, recently published by the National Research Council of Canada.

3.0 Scope of this Review

To address these concerns this review takes into account the four pillars of emergency management (i.e., preparedness, response, prevention/mitigation and recovery). It also considered the full array of solutions to the problem of wildfire losses, based on available science regarding the causes, conditions and patterns common to disastrous WU fires. Observations and recommendations pertinent to the Galloway Lands development are organized accordingly, and presented for use by the Fernie Snow Valley Community Association and the consideration of project proponents and external reviewers.

Well established communities are saddled with pre-existing wildfire hazards and deficiencies which are “built-in” due to community lay-out, construction designs and materials. In contrast, while still in its design stage, the Galloway development has the opportunity to avoid or substantially reduce many of the vulnerabilities and heat exposures which lead to the ignition and destruction of homes in WU fires. This report addresses the full range of these pre-emptive risk mitigation measures, which studies show to be highly effective, and cost-efficient.

4.0 Methods

As part of this review the author made reference to the original and subsequent applications for land use amendment submitted by Handshake Developments, supporting materials prepared on their behalf by B.A. Blackwell and Associates, relevant community protection plans and other references (see Section 8.0). Also, I am

familiar with some of the lands and trails on the property based on my own recreational travels by skis, foot and bike dating back to ~1990 and my extensive recent work at FAR. With the assistance of members of Fernie Snow Valley Community Assoc. I conducted a site visit to view the forest and make a cursory, but first-hand, evaluation of local conditions.

5.0 Results and Discussion

5.1 Important Perspectives on Wildland Fire, Wildland-Urban Fire Disasters, and Wildfire Control

Many myths and misunderstandings prevail about wildfires and WU fire disasters. These often impair the ways in which society attempts to prepare for them. In simple form, past WU fire disasters provide important lessons that apply to Galloway Lands development:

- Wildland fires are inevitable, are an essential natural process in healthy ecosystems and will continue.
- Rising frequency of extreme weather, forest fuel build-up & population - make wildfires more probable now.
- Only 3 – 5% of wildland fires escape containment and become large, but cause 95+ % of all area burned.
- Those few wildfires burn under extreme conditions (high wind/very dry fuel) & exceed all control capability.
- All disastrous WU fires occur under these extreme conditions; no conceivable response can be effective.
- The 1908 Fernie Fire proved this can happen here; the entire town (pop. 5,000) burned in 90 minutes.
- Wind-driven embers or low, creeping flames & smoldering fire cause the vast majority of structure ignitions.
- Science has demonstrated that if homes and conditions in their immediate surroundings (i.e., ~30 meters) are fire-resistant, they do not ignite, and survive WU fire events;
- The home (structure) and a 30 m. radius extending outward from it is known as the “Home Ignition Zone.”
- Similarly fire-resistant communities can survive, if adjacent and overlapping Home Ignition Zones are in accord with risk-reduction guidelines. Only in this way, can WU fire disasters be prevented.
- Wildfires are NOT the problem; the problem is structures/homes that are too easily ignited.
- The latter is a solvable problem, especially if WU fire risk mitigations are implemented concurrent with community planning and development.

The main conclusions from this are that:

- citizens, communities and government have been, and continue to be, far too reliant on fire responders and fire suppression techniques to prevent community wildfire losses,
- continued reliance on fire prevention and suppression will be ineffective, and results in needless socio-economic disruption, and
- far greater attention must be paid to comprehensive, proactive risk mitigation across multiple disciplines.

Based on current science and a review of all major wildland-urban interface fires in Canada and the USA (Cohen and Westhaver, 2022) no amount of enhanced fire fighting protection capability (on the part of emergency responders and/or individual residents) appears likely to overcome, or compensate for, critical inadequacies in meeting accepted criteria and standards for community lay-out, infrastructure like road and water supply/delivery systems, fuel modifications and the fire resistance of structures. Inappropriate community planning, design and construction also have negative implications for the safe evacuation of residents. Preparing for “average” wildfire conditions is fully inadequate.

5.2 Fuel Typing of Galloway Forest

I am in full agreement with statements by Blackwell (2012) and Pashkowski (2022) that typing of forest fuels into recognized categories is an essential input to calculate wildfire threat, but that provincial fuel typing is not accurate at the local scale, like on the Galloway Lands. They also highlight the variability of fuel at fine scales,

and the importance of ground-truthing fuel types, but have not conducted on-site investigations of the Galloway Lands. Pashkowski (2022) further warns there are “significant limitations with the fuel typing system”, and “accuracy of fuel typing on private land, when available, is variable due to lack of source data.”

My on-site evaluation of fuel types on the Galloway Lands, with focus on the areas to be developed, showed the forest fuel to be strongly dominated by nearly continuous, dense stands of un-even aged conifers, mostly 20 – 70 years old (pole-sized to 40 cm. DBH¹) with abundant low-hanging branches to near the ground, and nearly continuous vertical fuel continuity. This forest is not yet mature but has re-grown significantly since merchantable trees were logged (leaving immature trees) about 40 years ago. Tree heights now commonly range up to 20+ m. but average 8 – 17 m. tall. Small pockets of boggy terrain are more open, with clumped conifer and somewhat more deciduous, but these areas are <10% of the area, and mostly would be avoided by development.

Density of dominant and subdominant conifer canopies is high, generally 60 – 80%. For reference, a fuel-modified forest would be reduced to 30 – 40% canopy cover, or less. The upper forest canopy is mostly a mix of spruce, cedar, lodgepole and western white pine, true fir, larch, and limited Douglas-fir. More fire-resistant deciduous trees are mostly isolated and generally comprise <5% of the forest canopy. Lower forest layers (understory) are also dense and dominated by woody conifers like cedar, followed by spruce and fir with minor cover of deciduous shrubs. The predominant ground cover is thick with needle and branch litter. Pine/spruce forest mixtures dominate the canopy on dryer aspects and cedar/spruce/fir/pine canopies on moister sites.

Photos typical of existing forest vegetation on the Galloway Lands are shown below to help readers appreciate current conditions. Overall, the forest is dense, growing vigorously, and prone to high intensity crown fire.

Figure 1: Typical views of current forest conditions on Galloway Lands



¹ Diameter at breast height)

Figure 2: Additional typical views of current forest conditions on Galloway Lands



Forest types on these Galloway Lands most closely resemble the structure and continuity of Canadian Forest Fire Danger Rating System/Fire Behavior Prediction Types C-4 (Immature Jack or Lodgepole Pine) and C-2 (Boreal Spruce). These observations do not vary significantly with the summary of remotely sensed interpretation provided by Pashkowski (Blackwell) (2022), given the margin of error noted in those interpretations.

5.3 Wildfire Threat and Fire/Wildfire Hazard

Wildfire Threat

B. A. Blackwell and Associates make it clear in their 2022 submission to the developer that wildfire threat was not evaluated on private lands, including the Galloway Lands, in the 2011 Community Wildfire Preparedness Plan. This was because the necessary fuel type data was not collected.

However, based on my observation of fuel types on the Galloway Lands, it is my expectation that during times of high to extreme fire danger, the dominant fuel types of the Galloway Lands can be expected to burn with extreme head fire intensity and rates of spread, characteristics similar to C-4 and C-2. These are among the 3 most volatile fuel types in the CFFDRS - FBP system, in terms of fire intensity (crown fire) and rates of potential fire spread.

My evaluation is in accord with algorithms used in the BC wildfire fuel typing system (Perrakis and Eade, 2015). Outside of the Galloway Lands, the City of Fernie Community Wildfire Protection Plan Update (2018) evaluates these types to burn “almost always crown fire, high to very high fire intensity and rate of spread” under high levels of fire danger. This type of fire behavior is further aided by local terrain factors (e.g., slopes between 10 and 30%, and multiple gullies created by tributaries of Lizard Creek) which tend to funnel diurnal and prevailing winds and accelerate wildfire behavior.

Wildfire threat also projects to nearby areas. As stated in the CWPP (2018) and reiterated in the March 2022 update submitted by Haworth, T. Pashkowski highlights that:

“ The areas within the (City of Fernie) study area that represent the highest wildfire behaviour threat to the City are the slopes on the eastern side of the valley, the area including and surrounding the Fernie Alpine Resort (north and south), and on either side of Mount Fernie Park Road.”

It is my opinion, by extension, that a similar wildfire threat to the City of Fernie is caused by the Galloway Lands, which are surrounded by and component to the areas described in the CWPP.

Fire Hazard

Fire hazard is a general term to describe the potential behaviour for a given fuel type based on physical fuel characteristics.

In this regard, it is important that a statement by the proponent in the original development proposal (August 2021, page 29) be challenged:

“As a result of previous logging of the lands, most of the property is rated as low interface fire hazard.”

This claim is simply not true. It is well known that interface hazards can be extreme even in areas of grassland, very open forest (such as Lytton), or in areas where recently logged areas where debris and regenerating young conifer regrowth result in dense surface fuel. See Sections 5.3 and 5.4 for further description of current forest and fuel.

In the case of current Galloway Lands, much of the young growth present during the time of logging (1970's to ~1980) has grown into immature timber up to 20+ m. in height and 15 – 40 cm. in diameter, 40 years of re-growth has crowded the forest understory with dense stem 5 – 15 cm. in diameter and 5 – 8 m. in height.

5.4 Wildland-Urban (Interface) Fire Risk

Wildfire risk is defined as the combination of the likelihood of a wildfire occurring combined with the potential impacts of that fire. I concur with Blackwell's prediction (Section 1.3, page 4, of his Galloway Lands Recommendations, March 2022):

"This type of development scenario is at higher risk for damage from wildfire because of the isolation of the homes, proximity to the forest and the potential for evacuation and egress routes to become blocked."

I also agree with his assessment that the area is at risk from human-cause fires. This will increase with development

On the other hand, fire risk (i.e., risk being probability of fire loss times the consequence of fire) is currently low on Galloway Lands. But this is only because no structures are now present, thus there are no consequences. Interface fire risk within the parcel will dramatically increase once homes are constructed on the Galloway Lands, the degree being dependent upon the extent comprehensive WU fire mitigations are implemented.

Recommendation: The proponent should incorporate actual, site specific, fuel type conditions and topography into accurately modelled wildland fire behavior predictions (not assumed, estimated or remotely interpreted parameters) in order to realistically assess wildfire threat levels and devise sound mitigations as an element of planning and implementing developments on the Galloway Lands to assure wildfire safety of local communities.

5.5 Wildfire Risk Mitigation (FireSmart) Measures

I am in agreement with, and supportive of, most of the recommended "FireSmart™" guidelines for wildfire hazard reduction made by B.A. Blackwell (February, 2022) as they pertain to:

- FireSmart Priority Zones (FPZ's), buildings and construction materials, property maintenance and setback,
- vegetation and fuel management strategies pertaining to the Home Ignition Zone,
- FireSmart landscaping and maintenance.

See Section 5.6 for details of fuel modification requirements for FPZ's

However, I do not advocate for the effectiveness or installation of rooftop sprinklers. Nevertheless, I do support Blackwell recommendations #14 and #15 in terms of annual testing of the water system and having water pumps connected to an independent power source.

Recommendation: I strongly recommend the proponent review and adopt the newer, more comprehensive and more effective guidelines published by the National Research Council for overall risk mitigation guidance, and in particular with reference to structures and construction materials. That is (i.e., *The National Guide for Wildland-Urban Interface Fires: Guidance on hazard and exposure assessment, property protection, community resilience and emergency planning to minimize the impact of wildland-urban interface fires.* (Benichou et. al. 2021).

The NRC guide incorporates current knowledge and standards proven world-wide from accredited sources (e.g., NFPA, ASTM, Fire Underwriters Survey, ULC, etc.); and is intended to inform and update the full scope of existing Canadian "FireSmart" guidelines, community planning and development efforts, and eventually the National (Canadian) Building Code.

Recommendation: Given the multitude of ways that sprinkler systems can fail and uncertainties regarding reliability of the water and power systems, it is highly advised that reliance on roof-top sprinklers as a means of preventing structural ignition or suppressing wildfire and, instead, the focus be placed on less complex and effective means of reducing the ignition potential of homes and outbuildings.

Recommendation: The application for land use amendment be altered such that standard wildfire risk reduction standards apply equally to outbuildings, as well as homes, within the development.

5.6 Vegetation and Fuel Modification

Much of the development proposal, and concerns flowing from it, turn on questions about where and how vegetation, and subsequently fuel for wildland fire, will be managed. The descriptions (Blackwell, 2022; Section 2.2) of how forest vegetation should be managed in accord with accepted risk mitigations, within four concentric rings of the Home Ignition Zone - called FireSmart Priority Zones (FPZ's), is thorough, accurate but technical. The panel below offers a less technical description. Fuel modification can be done in a highly selective manner, with methods and equipment that preserve integrity of the forest, visual quality and the health of residual trees and wildlife habitats, while still reducing wildfire concerns.

On level Galloway Lands, and in layman's terms, **FireSmart guidelines** call for removal of all trees within 0 – 1.5 m. of structures and their attachments, all but a few trees to be removed from 1.5 – 10 m., wide-spacing of trees (removing about 9 of every 10 trees; mostly younger trees) from 10 – 30 m., and removing about 3 of every 4 trees to thin density of the forest beyond 30 m., if required due to steep slopes or other compounding hazards. These criteria are designed to prevent extremely intense (crown) fire. In each FPZ there are also requirements for removal of flammable woody fuel on and near the ground surface, and debris; this reduces the intensity of fire spreading on the ground. Regardless of these fuel modifications, fire will spread to homes in ANY kind of fuel dry (e.g., grass, needle/leaf litter, brush or other woody debris, or flammable residential materials) thus creating the potential to ignite structures.

From the perspectives of wildland and wildland-urban fire, and based on my own review of the development proposals, it appears that the answers to many questions remain unclear. For example:

- What are the site-specific objectives and criteria for management of forests and other vegetation (e.g., will all forest vegetation be stripped from the building envelopes)?
- What means will be utilized to achieve forest and vegetation removal/retention objectives?
- Are the chosen means capable of meeting stated objectives? and,
- How will the tremendous amounts of woody debris generated during land and road clearing and construction be disposed of to avoid exacerbating the wildfire hazard?
- What requirement will there be to maintained modified fuel conditions to ensure relative fire safety?

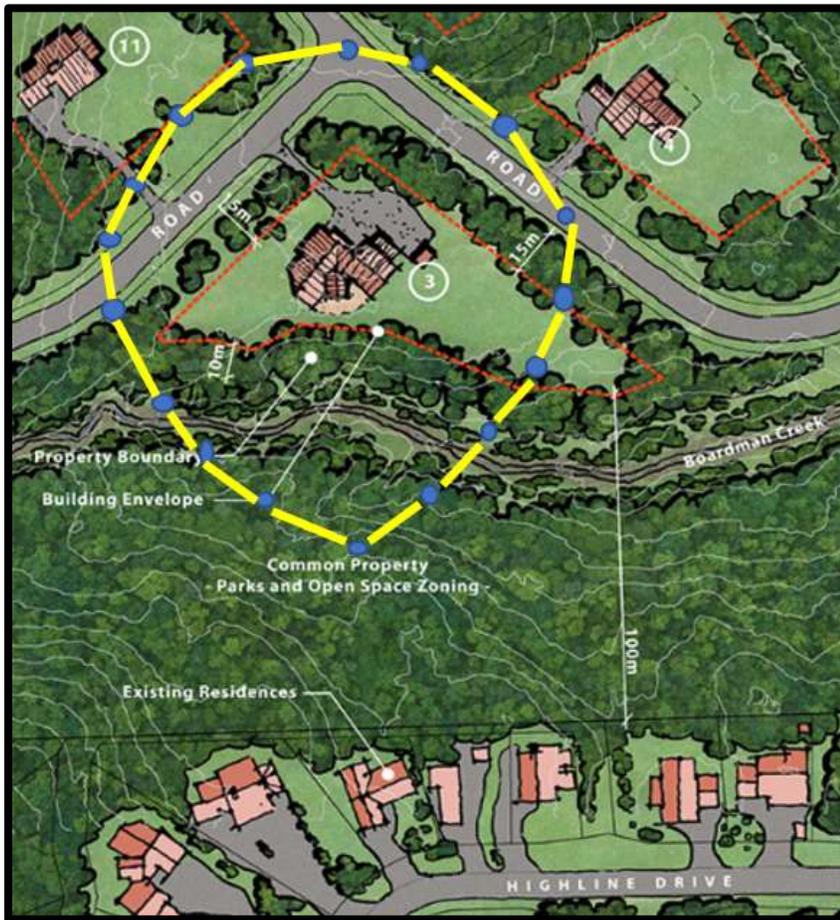
Recommendation: That these questions be thoroughly addressed, prior to final evaluation and consideration for re-zoning approval, in order to assure safety of Elk Valley residents, the public and emergency responders and to understand how conservation objectives will be achieved.

5.7 Potential Conflicts between the Building Lot (Homesite) Plan & Home Ignition Zone Fuel Modification

Cursory examination² by FWECL identified apparent contradictions between the proponent’s vision for a community nestled within a high proportion of preserved natural area (using principles of conservation subdivision design), and the proponent’s ability to (concurrently) meet commitments to modify forest fuels in accord with prescribed risk reduction standards (i.e., to a distance of at least 30 meters³ from building exteriors).

This conflict becomes evident when scale-drawn circles representing standard FireSmart fuel modification zones (i.e., part of the Home Ignition Zone) are overlain on Figure 21 of the 2021 Application (i.e., the Homesite Plan).

Figure 3: FSZ’s projected onto a single homesite along Boardman Ck., near Fernie Alpine Resort



Explanation: The yellow ellipse represents the outer boundary of FireSmart Priority Zone 2, where significantly modified forest fuels are recommended for a distance of 30 metres on level ground. In this location, with about 30% slopes to Boardman Creek below the home, widening the zone to an ellipse that is 45 m. above and beside the home - and 60 m. downslope of the home is the recommended guideline. Extending fuel treatment further, to a portion of PZ-3 would also be advisable but is not shown.

Approx. Scale: 30 meters = 24mm.

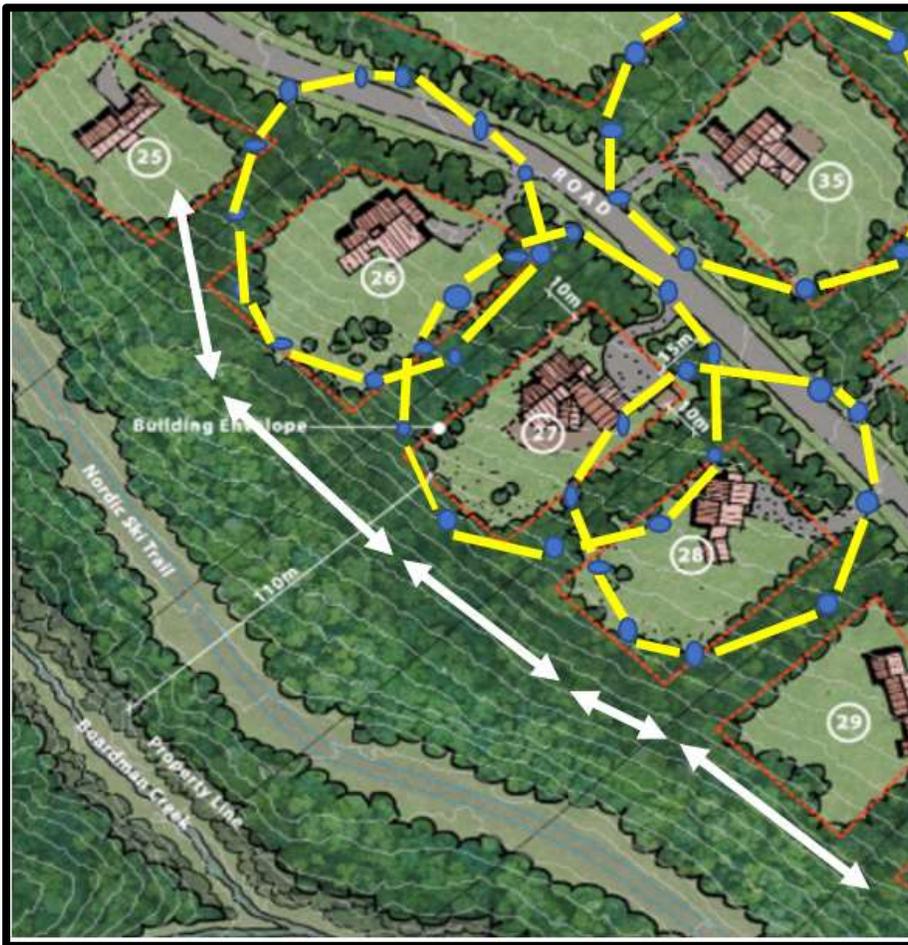
Reference: *FireSmart: Protecting your Community from Wildfire* (2003) page 3-11.

Full implications of this conflict are even more evident when HIZ’s (fuel modified zones) of adjacent properties in the development are drawn, thus revealing overlaps between fuel modified areas of adjacent homes in the community. This causes an equivalent reduction in the areal extent of expected forest conservation areas. The result is that a significant proportion of forested conservation lands previously expected to remain, more or less, in a natural state (i.e., through covenants applied between the property line and building envelope of individual homesites, in forested buffers mapped between individual homesites and between homes and the main access road, and within designated primary and secondary conservation lands) could be heavily altered.

² While details are lacking within the proposal, the potential for conflicting purposes remain strong.

³ It appears that the proponent has anticipated a need for only 30 m. of fuel modification in Priority Zone 2

Figure 4: FireSmart Priority Zone 2 drawn around group of homes



Explanation: Yellow circles represent the outer boundary of FireSmart Priority Zone 2, where significantly modified forest fuels are recommended for a distance of 30 metres (on level ground). In this location, with slopes ~15 – 20% it is recommended to expand FSP 2 somewhat downslope as indicated by white lines.

Adding an additional width of FSP 3, even closer towards the trail and creek below, would also be recommended by FireSmart guidelines.

Approx. Scale: 30 meters = 13mm.

The impact to conservation lands would likely increase further, if the proponent maintains its reassurance to fully implement critical “FireSmart” guidelines such as:

1. Establishing HIZ’s surrounding all outbuildings, such as garages and workshops as well as home,
2. Placement of outbuildings a minimum of 10 m. from the home, and each other,
3. Elongating Priority Zones to include larger areas when homesites are placed on the sloping, but “buildable,” terrain. For example, Priority Zone 2 would need to be increased to a 60 m. x 30 m. ellipse on slopes of 30%, rather than being limited to a 30 m. x 30 m. circle on level terrain) and,
4. Adding a fuel modified Priority Zone 3 (up to 100 m. beyond PZ 2) in situations where fuel, topography and winds combine to magnify the wildfire threat (e.g., steepest slopes, aligned with valley winds and gullied terrain located below homes grouped above Lizard Creek/Highway #3 and above Boardman Creek, near Fernie Alpine Resort.

The Application also fails to mention important planning considerations such as:

- how on-going work to maintain acceptable forest fuel conditions⁴ within Home Ignition Zones, but beyond the privately owned “homesites” will be achieved or who will bear those costs.
- How massive quantities of woody debris will be disposed of during the removal and selective thinning of forest as homesites, roads and other utilities are developed.
- How wildfire ignitions will be prevented and accidental ignitions contained during the prolonged period of progressive land clearing and home construction.
- The costs associated with conducting selective, environmentally sensitive fuel modification and debris disposal programs in steep terrain is \$12,000.00 - \$15,000.00/hectare.

Recommendation: Following more intensive field assessments, the proponent should develop a series of GIS-based scenarios to devise alternative concepts for the “conceptual land use (site) plan (e.g., bigger lots, more widely spaced or fewer lots, avoidance of steep slopes, placement of homes in the center of the building envelope, lower overall home density or clustering of homes, or reducing home ignition potential to a degree that total fuel modification is limited to 30 m.). These alternatives may also increase the potential for preserving the conservation vision while achieving low ignition vulnerability and exposure of homes and outbuildings.

Recommendation: The Proponent conduct further investigation and analysis to re-calculate actual proportion of conservation lands located beyond required zones of managed fuel and to respond to questions about the maintenance of modified (FireSmart) fuel conditions, the disposal of woody debris from fuel modification activities, and measures to ensure fire prevention and control capability during the construction stage.

5.8 Roads and Access

Importantly, inadequate road networks are a leading cause of WUI fire fatalities, and a major safety factor that may discourage fire responders from attending a poorly served area when prioritizing resource deployment during wildland-urban fire events. Past and current CWPP’s for the City of Fernie (Blackwell, 2011 and 2018) and an assessment of Fernie infrastructure (Westhaver, 2019) both identified existing weaknesses in Fernie’s municipal road network regarding emergency access and evacuation safety and made priority recommendations for resolving those problems. Special concerns were expressed for neighbourhoods on the west side of Highway#3, and for Fernie Alpine Resort (FAR).

The existing access network on the Galloway Lands appears to have evolved from a network originally designed for logging purposes and later adapted into a recreational network of hiking, cycling and Nordic ski trails. The map provided by Cascade Environmental shows homesites to be arrayed along portions of the winding former haul road and on several cul-de-sacs (dead-end roads) emanating from the haul road. Each home has an individual driveway leading away from the haul road. There is no internal circulation pattern, nor is there a perimeter ring-road to allow for shortened egress from individual clusters of homesites to the access points (2) off Highway #3. Proposed road outlets for the Galloway Lands, both for everyday and emergency access/egress, are to link with existing roads at Fernie Alpine Resort and The Cedars subdivision, plus one other possible link to Highway #3.

⁴ Due to changing forest fuel conditions from forest re-growth, wind damage, insect and disease activity.

Internationally accepted criteria for means of safe access for fire protection and evacuation have evolved over decades, and are identified in “NFPA 1141 – Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural and Suburban Areas”(NFPA, 2017). Those criteria are reiterated in recommended FireSmart™ guidelines (Partners in Protection, 2003) and in the National Guideline for Wildland Urban Interface Fires (Benichou, 2021), the two definitive Canadian references on this subject.

Although the analysis by Blackwell (2022) in Section 2.5.1 rightly emphasized the general importance of providing multiple two-way access roads and several other attributes of a safe wildland-urban road network, he did not directly reference many of NFPA 1141’s most fundamental requirements. For example, specifications for road width, curve radius, grades, construction and load-bearing capacity, bridges and culverting, dead ends and turnarounds, the separation of fire lanes from evacuation routes, etc. were omitted. Instead, the Proponent has committed only to meeting MOTI requirements for development of a secondary emergency vehicle access point.

My own on-site observations, familiarity with the complex terrain, and interpretations of terrain and development maps and air photos provided by the Proponent prompt me to:

- Believe the proposed network of non-looping internal access roads has a multitude of significant deficiencies in terms of standards expected within a subdivision located in a wildfire-prone forest, and potential traps caused by its current alignment;
- Question the ability of water tenders and Type 1 engines to negotiate short, steep pitches and tight corners of existing roads, turn around in cul-de-sacs;
- Evaluate that the fuel modifications recommended by Blackwell immediately adjacent roads used for evacuation routes are insufficient to prevent lethal heat exposure of evacuees and/or traffic congestion; treatments should be extended to 30 M. from both edges of the road surface;
- Identify that no information has been provided by the proponent to ascertain whether MOTI requirements are equivalent to NFPA-1141 based standards, and therefore effective in meeting essential safety requirements that can be anticipated during a WUI fire incident;
- Raise the concern that road linkages, as now proposed, to 2 adjacent communities also minimally served by current 1-way access roads, may exacerbate emergency access/egress in all three communities.

Recommendation: Fuel treatments parallel to roads to be used as emergency access or evacuation routes should be extended to 30 m. on level terrain, and as much as double that when steep slopes are located below the road. This standard has been applied in Jasper and Banff National Parks, on similar roads.

The likely implications of a re-aligned road network, adequate road standards and widened fuel modification zones adjacent to all roads is that development will impinge substantially more into areas of previously designated conservation zones within the Galloway Lands and further reduce the visual/natural habitat buffers between roads, riparian areas and homesites.

Recommendation: In order to be effective and adequately understood and evaluated by reviewers, road network criteria in Application for Land Use Amendment need to be more explicitly stated, and address the full range of standards developed and recommended for use at communities in wildfire-prone areas; they should be inclusive of main access/egress routes as well as driveways onto individual properties. For more details, see section 4.2.3 of *The National Guide for Wildland-Urban Interface Fires* (Benichou et. al. 2021) and NFPA 1141.

5.9 Water Reliability

The Blackwell wildfire report on Galloway Lands (2022) provides clear recommendations:

- During the development stage, reliable water supplies are available and accessible to firefighters during the fire season; and are appropriately located and spaced.
- In areas where water supply is limited, follow NFPA 1142 (Standard on Water Supplies for Suburban and Rural Firefighting) for minimum requirements of water supply.
- Design the water source / systems to be capable of supplying enough water for multiple house fire(s) simultaneously (e.g., enough pressure and capacity for a minimum of four and up to six houses).

Blackwell also makes suggestions for alternative sources (e.g., dry hydrants for drafting/suction) are provided.

In the following paragraphs, I used data provided by the Proponent to construct a crude comparison of the implied water supply to estimated volumes required by the external roof-top sprinklers recommended by Blackwell, and for fire control purposes at a mildly fire-involved home (according to NFPA standard 1142):

Western Water Associates Ltd., the proponents hydrological consultant, estimated an average home well on the Galloway property will yield, on average, 9 US gallons/minute (36 liters/ min) or about 52,000 L/day). B.A. Blackwell recommends a system of automated roof-top sprinklers for each home and water capacity to run the system for a minimum of 2 hours.

Depending on the sprinkler type, and assuming 5 sprinklers/home, this calculates to a water demand of 36 – 88L/minute. Therefore, if the consultant’s well yield is correct, it can be expected that the water supply at about half of the homes would be inadequate to operate a roof-top sprinkler system. This calculation does not provide for any additional water for use in wildland firefighting near to homes.

Similarly, using an on-line calculator based on NFPA 1142, it is estimated that an early structural response to one mildly involved 3,000 square foot single-story home would require a water demand of about 4,000 L/minute, or 120,000 liters over a 30-minute period. In turn, for 6 simultaneously burning homes (the criteria recommended by Blackwell), this calculates to a total water demand of about 24,000L/minute with an expected pressure of about 20 pounds/square inch, or about 720,000 liters over a 30-minute period. This calculation does not provide for any additional water for use in either structural or wildland firefighting near to homes.

Based on the current Application for Land Use Amendment, it is unknown:

- If it is feasible to build a mountainside reservoir sufficient capacity to meet these water requirements,
- How a reservoir of adequate capacity would be supplied with water, and suitably re-charged,
- How water would be distributed from a reservoir for year-round fire control at all homes, or wildfire use,
- If added water drafting/hauling/pumping is required, how it would impact fire control efforts,
- If each resident will be required to build their own all-weather cistern,
- How apparent discrepancies between water supply measures proposed by the proponent and meeting all recommendations of the Blackwell report (i.e., NPFA 1142) will be resolved,
- If the eventual system for providing water for fire control will be adequate for Fire Underwriters Survey to consider Galloway homes insurable.

This cursory analysis helped identify several vitally important deficiencies in the Application regarding WU fire protection.

Recommendation: Given that a reliable water supply is the essence of firefighting response, the consequences of a water system failure, and the immense potential magnitude of costs and land disturbance associated with installing an all-weather “reliable water system”, it is recommended that a table-top WUI fire simulation exercise be conducted.⁵ This is a common technique for emergency management training and, in this case, replicate conditions of a sustained wildland-urban interface fire event and the anticipated inter-agency fire response (using the Galloway land base). The key objectives of the exercise are: 1). to estimate and document, as closely as possible, the expected water supply requirements of typical structural and wildland fire suppression tactics (including deployment of BC Sprinkler Protection Units), 2). to determine the essential components and placement of sufficient water supply system elements (both fixed and mobile), and 3). to answer other unknowns listed above. This simulation would provide all parties with a tangible, realistic perspective of actual water volume requirements, water deployment and delivery modes, and the implications and/or feasibility of meeting commitments expressed in the proponents March Update for the proposed 75 home development.

6.0 Conclusion

There is an overall consensus in published reports that:

1. The risk of a disastrous wildland-urban fire in and around the City of Fernie is high,
2. The threat of wildfire is most severe in the vicinity of subdivisions located on sloping terrain, with dense forest fuels, and served by questionable road networks and/or water supply.
3. Rapidly growing population, climate warming and expanding urban development has compounded magnitude of this problem in recent decades, and it continues to grow.

Modern measures to pro-actively mitigate risks in wildfire-prone areas (e.g., fire-resistant construction and landscaping, modified forest fuels nearby) and appropriate infrastructure (e.g., roads, water availability and fire flow) to provide for safe and effective WU fire response are the cornerstones for creating “fire resilient” communities. The urgency to meet proven, science-based established standards for fire mitigation and response capability was underlined in BC, by WUI fire disasters in 2017, 2018 and 2021.

As an expert in wildland-urban fire loss reduction, I have deep concerns about how these foundational elements of community wildfire protection are being addressed in development of the Galloway Lands, specifically about the about systems for water supply, road access/egress and wide-area fuel mitigation treatments. These are all components of critical infrastructure to be provided by the developer.

Each element is a complex problem of its own, and requires significant levels of analysis, planning and investment. In order to function effectively, they must be integrated into a coordinated whole. In turn, decisions about their implementation will have cascading implications for other stated objectives of the development (e.g., conservation lands, wildlife habitat, aesthetic values, outdoor recreation).

⁵ Facilitated by an independent WUI fire response specialist (having also strong simulation experience) with active participation by representatives of the City of Fernie Fire Department, RDEK Emergency Services, BC Wildfire Service (SPU specialists and Incident Command), the proponent, and B. A. Blackwell; and observers from Fernie Alpine Resort, the Fernie Snow Valley Community Association, Fernie City Council and other Elected positions.

In each case, there appear to be important discrepancies, inadequacies and/or gaps in the baseline information provided, and in the analysis and planning process communicated by the developer. These concerns lead me to have substantial doubts regarding:

1. The feasibility of some solutions proposed by the developer (e.g., reliability of on-property and community water supplies for fire control; wide-area fuel modification as per FireSmart guidelines);
2. If they are feasible, the effectiveness of suggested solutions in providing fire protection and/or safety for the public and firefighters (e.g., fire pond with gravity flow, dry hydrants; primary road lay-out and secondary emergency vehicle access roads);
3. The adequacy of proposed solutions for water supply, road access, and vegetation/forest manipulations in relation to nationally and internationally recognized standards developed specifically for WUI fire protection and safety of emergency responders (e.g., NFPA codes 1141, 1142, 1144; corresponding FireSmart guidelines; new national guidelines (Benichou et. al. 2021).
4. The likelihood of any emergency response being triaged⁶ to a major WUI fire event on Galloway lands unless critical infrastructure is in place to meet recognized (NFPA) standards.
5. The degree of certainty that project reviewers (RDEK and others) can anticipate the potential costs, complications, and environmental impacts associated with appropriate and effective systems for emergency access, water supply and forest fuel modifications.

In my professional opinion, it is essential to more fully investigate and address these issues in significantly more detail prior to its final evaluation and consideration for re-zoning approval. Much additional effort is required to reduce the risk of serious wildland-urban fire impacts (on and off the Galloway Lands), to improve public safety in the face of inevitable wildfires, to increase the likelihood of effective fire control responses and to ensure the safety of wildland-urban fire responders.

A recent study published by the Institute for Catastrophic Loss Reduction, demonstrated a benefit to cost ratio of 14:1 over a 10-year period for fully following the National WUI Guide in construction of a new community (inclusive of infrastructure, GST and other costs) over the cost of standard construction costs.

7.0 Limitations/ Disclaimer

This report was prepared by ForestWise Environmental Consulting Ltd. for the Fernie Snow Valley Community Association. Its contents reflect the best available information and are based on preliminary field assessment. Any use that a third party makes from this report, or any reliance on or decisions made based upon this report, are made at the sole risk of any such third parties. ForestWise Environmental Consulting Ltd. accepts no responsibility for any damages or loss suffered by any third party or by the Client as a result of decisions made or actions based upon the use or reliance of this report by any such party. Although every effort has been made to ensure that these recommendations are reasonably accurate, further field assessments should be conducted to understand the forest covers, fuel types, forest health and topography in the area, the distance of the properties to high-risk fuel types and other parameters required to predict wildland fire behavior. Periodic re-evaluations

⁶ Triage criteria relate to safety of fire responders and probability of success by structure protection efforts.

should be conducted to gain an understanding of changing forest conditions and the impact of human-caused changes (such as development) potentially impacting forest health and forest stand structure, which in turn affect fire behaviour patterns. Notwithstanding the recommendations made in this report, ForestWise Environmental Consulting Ltd accepts no responsibility for the implementation of all or any part of the mitigation treatments as outlined in this report. Acceptance of this report and implementation of potential development in no way implies any inspection or supervisory role on the part of ForestWise Environmental Consulting Ltd. This report has 17 pages and shall be considered as a whole; no sections are severable, and the report shall be considered incomplete if any pages are missing. The original report has coloured illustrations. If the reader has a black and white copy the report shall be considered incomplete and any interpretation of the report may be incorrect in the absence of a full colour copy. ForestWise Environmental Consulting Ltd. accepts no responsibility for any such misinterpretations.

8.0 References

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