2022 Fuel Management Prescription Guidance

Provided by BC Wildfire Service

Contents

1 PURPOSE

The purpose of this document is to provide direction to forest professionals on fuel management components for stand level prescriptions that are being prepared for a wildfire risk reduction (WRR) objective (otherwise known as "fuel management prescriptions") that are funded by the Forest Enhancement Society of BC (FESBC), the Community Resiliency Investment (CRI) program or other government programs (Economic Recovery). This document assumes that all other approaches to, and components within, the prescription meet legal requirements and follow Association of BC Forest Professionals (ABCFP) published guidance, specifically around quality prescription development including, but not limited to: Standards of Professional Practice: Guidelines for Interpretation, Interim Guidelines – Fire and Fuel Management, Guidance for Professional Quality Field Work, and Guidance for Professional Quality Rationales and Comments.

BC Wildfire Service (BCWS) has developed a suite of tools to support fuel management activities that are located on the BCWS Tools for Fuel Management webpage. These tools and other direct supporting information are hyperlinked in this document.

In addition, this document is not meant to cover all aspects of fuel management and fire behaviour and is directed towards experienced professionals working well within their scope of practice as outlined in the 2013 ABCFP released Interim Guidelines – Fire and Fuel Management;

"Practicing in the field of fire and fuels management requires a specific education and training in subjects such as, but not limited to: fire ecology, fire effects, fire behaviour, fire regimes, conditions classes, fuel types, fuel moisture content, fire suppression, prescribed burning, fire behaviour modelling, and fire weather in addition to forestry subject. Education provided at post-secondary school is insufficient and often additional expertise is obtained through experience fighting wildfires or working with a competent forest professional already practicing in the field."

2 PRINCIPLES

The primary objective of any fuel treatment is fuel reduction to effectively reduce the potential fire behaviour over an area to a level that allows for the best chance of a successful suppression opportunity by wildfire crews (i.e. direct attack firefighting, establishment of sprinkler lines, burn-out/burn off operations). Fuel treatments should be planned through a higher-level planning process such as the CLWRR Tactical Plan or Community Wildfire Resiliency Plan where design considerations at multiple (community or landscape) scales can be determined in addition to interactions with other values. Fuel treatments are generally located within the wildland urban interface (WUI) but may be applied across the landscape either for an isolated value (e.g. critical infrastructure) with a specific community risk reduction objective, or as a predetermined control line from which to action future wildfires (fuel break). Akin to the FireSmart® Structure Ignition Zone principles, the priority should always be to treat closest to the value first, then stratify outward. It is the expectation that fuel treatments meet basic design principles, fire behaviour targets, legal requirements, and other considerations outlined below. When the primary objective is for habitat, ecosystem restoration or an ecosystem resiliency outcome and the secondary or tertiary objective is for fuel management, then other targets for fire behaviour may be applied that are consistent with the primary objective.

A fuel management prescription is a document that describes existing conditions in an identified area, and recommends fuel management activities that will reduce potential fire behaviour. It is expected that the prescribed *post treatment* stand conditions will result in reduced potential fire behaviour, such as a decrease in surface fire intensity and rate of spread, crown fire initiation and spread, and the potential for sustained ignition. **Fuel management prescriptions must ensure a cost effective and measurable reduction in expected fire behaviour with the consideration and management of other values on the landscape** (e.g. ungulate winter range, visual requirements, etc.).

Fuel management prescriptions should be consistent with all the principles outlined below and meet government objectives for fuel management. Understanding the desired future condition for a treatment area is critical for long term success and must be part of the prescription. Fuel management prescriptions need to be reviewed after two years to ensure consistency and relevance with updated legislation, First Nations consultation, prescription standards, and new activities (e.g prescribed fire).

Fuel management prescriptions need to consider the balance among potential fire behaviour implications, resource values, and conservation values to meet legislative and non-statutory requirements in relation to their proximity to communities and values at risk (e.g treatments closest to the value are treated more intensively). Fuel management treatments occur on various jurisdictional lands and require a sound understanding of each land managers' mandate and legislation in order to prepare a sound prescription (e.g conservation areas, municipal and First Nations lands). For example, BC Parks has developed a template to support prescribing foresters to work with BC Parks in recognition of the unique legislation and mandate for BC Parks. For more information on legislation, policies, planning and values within BC Parks, please utilize the specific BC Parks Template and Guidance and the BC Parks Team.

A team approach is required with land managers, BCWS, prescribing, and qualified professionals working together to determine the final outcomes. Consultation with the appropriate authorizations' government staff is required during the development of the prescriptions and all permits need to be in place prior to any and all activities. Permitting options must consider all existing tenures and land management objectives, including other variables such as fibre utilization, tenure type, ownership, legal objectives, cut control, timber supply review and many other factors that control or limit tree removal, according to the tenure.

A sound fuel management prescription follows three guiding principles:

- Prescribes specific and measurable targets for fire behaviour reduction;
- Contains site specific considerations tied to WRR objectives; and
- Meets with other legal, resource management and non-statutory objectives including First Nation consultation requirements.

2.1 SPECIFIC AND MEASURABLE TARGETS FOR FIRE BEHAVIOUR REDUCTION

For each treatment unit, specific and measurable fuel reduction targets are described so that post treatment outcomes can be measured and verified.

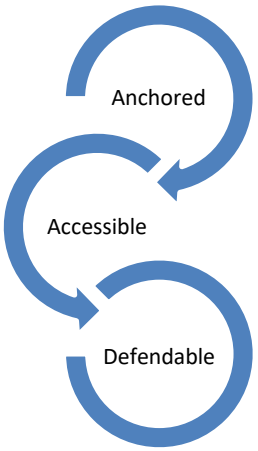
1. Prescribed fuel reduction targets should be sufficient to be effective to meet treatment objectives of reduced fire behaviour under 90th Percentile Fire Weather Index Conditions (FFMC, ISI, BUI), which is available

on the Tools for Fuel Management webpage. The shortest range of most recent 90th percentile fire weather index conditions data available should be used unless rationale is provided.

2. Reducing forest stand structure fuel loading and continuity to effectively affect fire behaviour **prioritizes surface and ladder fuel modification and reduction over canopy modification**[1]:
    a. Reducing the potential for sustained ignition and crown fire initiation by reducing surface fuel loading to achieve potential surface fire intensity levels below the critical surface fire intensity threshold, to a maximum of 2,000 kilowatts per metre (kW/m).
    b. Increasing the height to live crown through a reduction in ladder fuels (crown base height) to reduce potential for crown fire ignition to render a higher critical surface fire intensity threshold.
    c. Reducing crown closure and canopy bulk density (volume/density/basal area/stems per hectare) as necessary to reduce crown fire spread rate and potential (e.g. spotting) and to encourage crown to surface fire transition. This is only applicable in specific forest types and will vary depending on site circumstances.

2.2 SITE SPECIFIC CONSIDERATIONS TIED TO (WRR) OBJECTIVES

Wildfire risk reduction fuel treatments do not stop wildfire spread; they are successful by supporting suppression by designing treatments that are anchored, accessible, and defendable. This is achieved through defined fuel management objectives that consider the unique features of the site such as terrain and fuel attributes, fire behaviour potential, and proximity to communities and other values.



Anchored and Accessible: Ties the treatment to low or non-flammable areas to provide safety for responders and allows access to defend the space.

A fuel break or fuel polygon is not expected to stop a wildfire that is approaching, but to transition the crown fire to the surface where wildfire crews have greater chance of suppression success. A plan for suppression

[1] Martinson, Erik J.; Omi, Philip N. 2013. Fuel treatments and fire severity: A metanalysis. Res. Pap. RMRS-RP-103WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 38 p.

should be considered when designing a fuel break.

A prescription should always consider how the potential treatment area fits within the landscape and existing Higher-Level Plans, as well as existing treatments or pre-identified anchors on the land base. Fuel treatment location design maximizes opportunities to anchor to non-fuel or low flammability areas such as water bodies, wetlands, and roads and provides adequate breaks in continuous fuels (e.g. wildlife tree patches, riparian reserves etc.). Riparian, deciduous, and wetter sites should be considered differently as there are multiple ecosystem benefits associated with them.

Accessible treatment areas ensure ability to move resources when there is fire on the land base. It ties into how you plan to defend from it: foot traffic, 4wd access, fire engines, air support, etc.

1. **BEC and fuel types:** Treatments are appropriate for the given Biogeoclimatic Ecosystem Classification (BEC) zone, sub zone and/or site series and consider factors such as rate of decay for slash and retaining suitable residual species that are resilient to the post treatment conditions, including but not limited to natural disturbance (wildfire, insect, disease, and windthrow). For example, best management practices for fuel treatments in the Coast and Mountains and the Georgia Depression Eco provinces are outlined in the linked guidance document above.

2. **Site specific variability:** A prescription considers the unique variability that exists in each stand, including but not limited to vertical fuel strata, horizontal fuel continuity, extent of the surrounding fuel, fire weather components, topography, and values at risk. These should be stratified out if required.

    a. Fuel treatment **widths** must be adjusted to account for topographic effect (slope) on fire behaviour and the consideration of the potential fire behaviour associated with the untreated adjacent fuel type. The treatment area will be managed to the 2,000 kW/m or critical surface fire thresholds as stated above.

3. **Zoned approach:** This applies to both polygon treatment units and fuel breaks. Treatment targets utilize a zoned approach generally within 2 kilometers of the value; fuels are more intensively treated to prioritize wildfire risk reduction closest to the value at risk (to below the critical surface fire intensity threshold, up to a maximum of 2,000 kW/m within the at least 100m). This allows for application of different management goals (e.g WRR, recreation, cultural or preservation of rare ecosystems) and subsequently less intense treatments further out that seek to balance all resource and land management objectives.

    a. For fuel breaks, any width in excess of the zonation defined above, the subsequent zoned area may prescribe reduced fire behaviour associated with surface fires to below the critical surface fire intensity threshold, up to a maximum of 4,000 kW/m.

4. **Safety and response:** Fuel treatments consider firefighter safety as a primary objective including consideration for rate of spread (fine flashy fuels) and mobility (road access, easy walking, etc.) for fire fighters. Fire intensities beyond 2,000 kW/m reduces efficiency and effectiveness of ground crews and compromises firefighter safety on the fireline. Contact the Fire Centre BCWS Wildfire Prevention Officer

for more information on whether there are additional targets and measurables regarding surface fuel loading and crown base height.

2.3 LEGAL, NON-STATUTORY AND RESOURCE MANAGEMENT OBJECTIVES

Fuel management prescriptions must recognize and address overlapping legal and non-statutory objectives relevant to the prescribed area (e.g., mule deer winter range, BC Parks land management, First Nations interests) in conjunction with fuel management objectives. Note: overlapping objectives **should be identified and reconciled at the initial higher-level or WRR Tactical Planning stage** when determining strategic placements and design of potential fuel treatments.

Prescriptions must consider all of the following;

1. Where 'overlapping legal objectives' exist that have not been reconciled through a previous planning exercise, resolution is required prior to final prescription approval. Ideally resolution should be sought early in the prescription planning phase to minimize investment in planning that will have to change to address overlapping objectives. This may involve further consideration to the physical location of the treatment area, adapting boundary location & size of treatment areas, and/or revised focus on removal of specific components of the stand and fuel structure. Ensuring that the right qualified professionals (e.g. Habitat Biologist) are part of the team is paramount.
    a. When overlapping objectives are encountered in fuel treatments (e.g minimum of 100m for fuel break or 100% of the fuel polygon areas around communities), consideration should be given to modify land management objectives to the extent required to meet the fire behaviour outcome and targets.
    b. Where the public value of WRR implementation is seen to outweigh other established legal values, the development of a detailed rationale will support the process, should the land manager agree on this approach.
    c. BC Parks and Protected area legislation is unique in that it is specific to each individual park and protected area and based on the specific values and uses that are defined. These values and uses are described in the individual park or protected area strategic management planning documents (management plan, purpose statement and zoning plan, or direction statement).
    d. Within BC parks and protected area boundaries, specific park values require further discussion with BCWS and the land manager. In these circumstances, a variance **may be necessary** to meet BC parks and protected area legislation, Conservation Policy, and impact assessment processes.
2. Identifies relevant non-statutory objectives such as SAR and best management practices.
3. Seeks to align with other forest stand improvement and collaborative management opportunities to maximize cost effectiveness. Such as MDWR or SAR habitat in dryer ecosystems with forest encroachment where stand improvements are meeting multiple objectives. Opportunities should focus on identification of management objectives that have similar desired future conditions required for wildfire mitigation, such as ecosystem restoration objectives in NDT4 ecosystems. This will also provide opportunities for accessing/leveraging of additional funding to support wildfire mitigation initiatives.
4. Considers timing of treatments to avoid impacts such as bird nesting windows and ground disturbance.

5. Prioritizing the retention of large size trees to increase resiliency to wildfire and forest health factors and the resiliency of broadleaf trees. The Fire Management Stocking Standards Guidance (under Fuel Management Stocking Standards) provides a summary of the fire resistance and fire resiliency characteristics of all trees in B.C.
6. Meets the Chief Forester's Guidance for Coarse Woody Debris "*lower amounts of CWD are appropriate where fire hazard is high*" (pg. 2), the Chief Forester's Guidance on CWD Management Wildfire Mitigation Treatments and/or other applicable guidance. BC Parks doesn't have a specific CWD policy, but the Conservation Policy references the importance of CWD, and guidance will be park- and project-specific.
7. Meets provincial and local land manager requirements for First Nations Consultation. This includes consideration of the new DRIPA legislation as well as the Modernized Land Use Planning framework. It is also important to contact local Natural Resource District staff for information and direction on details to include in referrals.
8. Minimizes the creation of new roads or trails during treatment design and if the opportunity is there, roads, trails and access should be reduced post treatment.
9. Targets fibre utilization as a primary debris management strategy when consistent with objectives of the prescription. Where surface fuel reduction targets cannot be achieved through fibre utilization, additional activities are prescribed to manage material (e.g. broadcast or pile burning, etc.). Opportunities to access carbon sequestration funding should also be investigated to reduce or eliminate the need to burn debris resulting from fuel treatments.
10. When prescribed fire is part of the prescription treatments, considers future Burn Plan development where an identified containment area may span beyond the identified treatment unit boundary. It is beneficial to include the proposed containment area boundaries at the prescription phase to inform operational treatment planning. Boundary locations may need to be adjusted as a result of the referral process.
11. Units are designed to consider the full lifespan of the treatment (e.g. logical burn units for maintenance burns and/or appropriate Fire Management Stocking Standards) and to avoid undesirable consequences such as:
    a. Increased forest health risk post treatment.
    b. Significant reduction in fuel moisture content and susceptibility to wind in the understory.
    c. Unacceptable windthrow levels post treatment.
    d. Excessive overstory thinning, grass or shrub ingrowth and surface fuel loading (e.g. chipping).
    e. Mortality along treatment unit edge exposed to wildfire from adjacent stands.
    f. Creation of conditions favourable to establishment or proliferation of noxious or invasive weeds.

3 CONTENT REQUIREMENTS

The prescription must identify treatment unit objectives and measurables for the modification of fire behaviour

(head fire intensity, crown fire initiation and spread, spotting, etc.) that will guide the development of fuel treatment targets consistent with the principles described above. The Fuel Management Prescription Template is available for the development of prescriptions on the Tools for Fuel Management Webpage and is a useful tool that can help to meet the content requirements laid on in this guide. The Critical Surface Fire Intensity Worksheet must be attached for rationale.

3.1 FUEL MANAGEMENT OBJECTIVES WITH RATIONALE

Fuel management objectives must be specified and will drive the rationale for treatment unit placement and treatment method selection. Common WRR objectives may include but are not limited to public safety, critical infrastructure resilience, range improvement, ecosystem restoration, recreation, and wildlife habitat. Fuel management objectives need to:

1. Provide a rationale for the fuel treatment with specified objectives (e.g. improved suppression opportunities around communities by reducing the potential for crown fire initiation).
2. Describe fuel management specific strategies that outline how the treatment units are designed to be anchored, accessible and defensible as well as designed according to expected fire spread and intensity.
3. Provide clearly defined objectives and measurable target conditions for fuel management that include measurable fuel load reduction targets and measures for expected fire behaviour outcomes post treatment (e.g. reducing crown fire initiation potential by XX and rate of spread by XX from the adjacent stand by reducing surface fuel loading to XX and increasing height to live crown to XX).
4. Include relevant supporting details such as fire history, probability of ignition and spread, fuel type and continuity including stand structure, weather trends (i.e. prevailing winds) that support the treatment as a priority to mitigate negative impacts to the identified values at risk to help build the rationale.
5. Address legal objectives such as ungulate winter range, grassland benchmarks, visual quality, and recreation; and describe the associated management considerations. Indicate how the prescription seeks to balance the objectives or support through common desired future conditions while meeting the targets.
    a) If overlapping objectives are too broad or there are too many, need to consider the viability of the project as designed and alternative location and design should be considered at this stage.
    b) Provide information on how this target is being achieved (e.g., use of residual basal area, DBH distribution, BDq, etc).

3.2 FUEL TREATMENT UNIT SUMMARY

Each fuel treatment unit (FTU) is described by site characteristics, location, treatment type, and fuel type hazard distribution.

3.2.1 GENERALIZED SITE CHARACTERISTICS

Describe the treatment area and its boundaries in the context of the local terrain including terrain characteristics

(e.g. flat, rolling, etc.) or features, any landscape/topographic limitations to wildfire, and any other physical characteristics. For example: "*The treatment unit (TU) is uniformly sloped with a few rocky outcrops that were excluded from the net treatment area. The TU is located between the Chapman Road and the lake, being bounded on the east by Deep Creek and on the west by the BC Hydro campground*". Include a description on forest health factors that will influence fire behaviour such as beetle mortality.

3.2.2 STAND AND FUEL DESCRIPTION

This section describes the existing and desired characteristics of the forest stand within the treatment unit. This information is essential in ensuring the prescription is meeting the established objectives with measurable specifications. In all cases, data should be collected in accordance with the principles outlined in the most recent version of the BCWS Fuel Management Survey Data Collection Standards to a level that provides sufficient and accurate data required to determine the desired treatment specifications, measured fuel loading, and assist with harvest/treatment planning and valuation (if applicable).

3.2.3 TIMBER TYPE

Enter major tree species and percent species composition. For example, Fd7 Lw3 (Py) denotes a stand dominated by Douglas fir (70%) followed by Western larch (30%), with a minor component (<10% which is denoted in brackets) of Yellow pine.

3.2.4 STAND AND STOCK TABLE

The stand and stock table (SST) is required for all treatment methods other than clear-cut and should include both pre- and post-treatment density measures. An example SST is provided in the Example Fuel Management Prescription FRPA located in the Appendix.

SPECIES AND DIAMETER CLASS: Fill in a separate line for each species by layer / diameter class. Use appropriate diameter classes to ensure adequate data for treatment specifications and for fire behaviour model inputs. Include total dead potential and total live.

CROWN BASE HEIGHT: Record the conifer Crown Base Height (CBH). CBH is a measure from the ground to the live or dead crown in the veteran dominant and co-dominant coniferous canopy layers and provides a measure of the fuel stratum gap. Dead crowns are only measured when they are of sufficient density to allow vertical wildfire to spread. Individual dead limbs should not be considered. Full whorls of dead limbs, especially with needles and fine branches or volatile mosses or lichens should be considered as part of the live crown in this measurement.

TREE HEIGHT: Record the average tree height for each species within each diameter class.

STEMS AND VOLUME PER HECTARE: Existing, cut and leave number of stems per hectare (sph) are required. Where merchantable timber cutting is prescribed, also populate the volume per hectare section for all merchantable diameter classes.

3.2.5 SURFACE FUEL LOADING

Provide the dry weight of combustible materials per unit area and describe the distribution (i.e. scattered,

continuous, elevated, etc.). Recommended units are kilograms per square metre (kg/m^2) and tonnes per hectare (tonnes/ha) (0.5 kg/m^2 is equivalent to 5 tonnes/ha).

Describe the composition and the continuity of surface fuel including the duff depth, moisture type, vegetative material composition, and % cover of both fine woody material </= 7.0 cm in diameter, large diameter woody material > 7.0 cm – 20.0 cm in diameter, and coarse woody debris material > 20.0 cm in diameter, including grass fuel types. Describe methods for determining this value at the pre- and post-treatment stages.

For a treatment to be effective under 90th percentile fire weather conditions, loading of dead, fine woody surface fuel </= 7.0 cm in diameter must generate surface fire intensity less than 2,000 kW/m or if the critical surface fire intensity is less than 2,000 kW/m, then below that threshold for the critical surface intensity. When including surface fuel loading in the prescription, it is expected that fine woody debris </= 7.0 cm in diameter, large diameter woody debris > 7.0 cm – 20.0 cm in diameter and coarse woody debris > 20.0 cm in diameter will be broken out into T/ha or kg/m^2, these will be done separately.

Surface fuel management should be focused on fine woody debris < 7.0 cm in diameter as this is the largest contributor to fire behaviour. The critical surface fire intensity should be considered when determining how much woody fuel is prescribed to be removed from site. Larger diameter dead woody surface fuels generally have a less significant contribution to fire behaviour, depending on arrangement and continuity, thus may receive reduced focus when managing surface fuel loading. *This approach maintains consistency with the Chief Forester's Guidance on Coarse Woody Debris Management and the Chief Forester's Guidance on CWD Management Wildfire Mitigation Treatments.* Chipping in areas may cause increased surface fuel loading and create more of a hazard within the treatment. If chipping is being done, a plan for removal or burning of the chips should be in place. Fire behaviour must be kept under 2,000 kW/m when determining a debris management strategy.

As an alternative, surface fuel loading associated with all treated areas will need to meet the intent of 'A Guide to Hazard Assessment and Abatement in British Columbia' for areas in the severe category. The expectation is areas are lowered below the rating of "severe" for the Fuel Hazard Threshold. Standard within this 2012 Guidelines apply to the management of post harvest debris associated with fuel management activities. Fuel management treatments will meet the 5t/ha target for surface fuel loading of fine woody debris </=7.0 cm outlined within the hazard abatement guide. The Guide does provide "flexibility for forest professionals to set site specific targets for fuel loading" or vary from the guide, assuming they are operating within their scope of practice and provide a specific written rationale.

"Conducting a fire hazard assessment and the development of a fire hazard abatement strategy falls under the scope of practice of a professional (see definition) as part of fuel management work. A professional can also prepare, review, amend and create hazard abatement strategies in accordance with "professional document" as defined in the Foresters Act."

Note: the requirement to meet timelines associated with Fire Hazard Assessment and Abatement as defined in the Wildfire Regulation (Div. 2, Sec. 11) apply to fuel management treatments.

3.2.6 CROWN CLOSURE AND CANOPY BULK DENSITY

Describe the stand in terms of canopy bulk density through the vertical profile as well as crown closure. Removing overstory trees results in a reduction of canopy bulk density and subsequent crown fire behaviour.

However, final outcomes are related to where in the canopy the reduction occurs. Estimate the percentage of the crown touching and effectively blocking sunlight from reaching the forest floor. If there is a deciduous component to the stand, provide percent of crown closure for both the live and dead components.

3.3 FUEL TREATMENT DESCRIPTION

3.3.1 TREATMENT SPECIFICATION RATIONALE

Provide a summary as to how the treatment specifications and treatment unit widths were determined and how they will meet the prescription objectives. The rationale should describe the retention strategy and associated fire behaviour outcomes including a summary of adjacent fuel types and values at risk. Include consideration of site-specific fire behaviour components, fire history, design, and anchoring of treatment units. Targets further out from the value can consider a time objective linked to rate of decay for fine and coarse surface fuels. Also include specifics around determination of treatment targets (e.g. surface fuel loading, pruning height, and thinning density). Attach any supporting documentation (e.g. model runs, references, etc.).

3.3.2 STAND MODIFICATION TREATMENTS

This section describes the treatment phases for each FTU including post treatment targets and associated fire behaviour outcomes (e.g. surface fire flame length to avoid crown fire). Enough detail is required to ensure transparency with prescription objectives and the management of identified values and concerns. BCWS has developed a Fuel Treatment Design Wildfire Intensity Tool that can be used to support the determination of wildfire intensities for surface fuelcomponents.

3.3.3 TREATMENT SPECIFICATIONS

BRUSHING: Provide details such as target species and size for removal, as well as desired post-treatment density.

PRUNING: Describe the current stand's crown base height/fuel strata gap and the target crown base height/fuel strata gap, and the live crown ratio that will result.

DEBRIS MANAGEMENT: Describe activities to achieve the target surface fuel outcomes including the fire behaviour targets on page 3 (90th percentile weather) and surface fuel loading, section 3.2.5. If prescribed fire (i.e. broadcast and/or under burning) is being prescribed, a contingency activity should be identified should a suitable burn window not materialize. Surface fuel targets need to be specified in the prescription, but methods to achieve them are more operational and should only be presented as recommendations. Please refer to the Tools for Fuel Management Webpage.

COARSE WOODY DEBRIS MANAGEMENT: Describe the activities to meet the Chief Forester's Guidance on Coarse Woody Debris Management (fuel management guidance portion), the Chief Forester's Guidance on CWD Management Wildfire Mitigation Treatments, or other land manager objectives (e.g. BC Parks). Details of how much CWD needs to be removed or retained; what size and decay classes should be removed/retained; what should be the distribution pattern of the retained CWDs, etc. must be described.

PRESCRIBED BURNING: For treatment units where resource management open fire is in a fuel management prescription, an operational burn plan must be completed on the BCWS Burn Plan Template. A prescription must

accompany the operational burn plan. The prescription should include the historical fire dependence of the ecosystem, approximate fire cycle and return interval. Generally, the prescription should include the pre-fire fuel conditions, objectives, desired effect(s) of the prescribed fire (i.e. desired amount of duff consumption; surface fuel reduction targets: type and size of material to be consumed, % burn coverage, crown fraction burned or desired tree mortality, crown base height targets; acceptable % leave tree mortality; % acceptable understory survival, etc.), and fire effects monitoring. Provide a specific, measurable, realistic, and time- bound range of outcomes for each of these objectives, so that burn objectives are achievable and can be easily incorporated to a prescribed fire burn plan.

FTU design should include logical burn units to incorporate natural, existing, or other control lines to be utilized during implementation of the burn. Development of these burn units should be considered and carried out during the implementation of earlier phases of operational treatments to maximize efficiencies and help set up the treatment unit for subsequent burning.

The Containment Area (see Appendix A definitions) that will be incorporated within the prescribed fire burn plan should be identified on the prescription map and attached to the prescription.

OTHER: Describe any treatment not specifically listed above or under prescribed burning; including the method, and the target results, and how debris will be disposed of (e.g., pile burning, chipping, composting, or biomass utilization). Explain how the treatment will meet the objectives of the prescription while addressing the identified values and issues.

3.3.4 FOREST HEALTH CONSIDERATIONS AND TARGETS

Describe any forest health factors and mitigation measures relevant to treatment design including post treatment risks such as windthrow, beetles (e.g Fd beetle), root rot, etc.

3.3.5 TREATMENT SPECIFICATIONS SUMMARY

TREE REMOVAL/RETENTION STRATEGY BY SIZE/SPECIES: For each treatment unit, summarize the tree removal/retention strategy by size/species specifications that are outlined throughout the stand and stock table. For example: “Retain all Yellow pine (25 sph), Western larch (30 sph), hardwoods (15 sph), and 50% of Douglas fir greater than 40 cm (15 sph). Remove all Douglas fir below 40 cm dbh, 50% of Douglas fir greater than 40 cm dbh, and all Lodgepole pine. Target density = 85 sph, with an acceptable range of 60 – 110 sph.”

3.3.6 POST TREATMENT

This section addresses silviculture obligations and the effects of the proposed treatments over time.

3.3.7 MAINTENANCE

EXPECTED VEGETATION RESPONSE: Describe the amount and type of vegetation expected to occupy the site over time because of the treatment(s).

MAINTENANCE PLAN: Include a maintenance plan based on the length of time the treatment will be effective in achieving the fire behaviour targets and outcomes. This section will include treatment objectives and triggers such as increased fuel load (kg/m^2) or a reduction in inter tree spacing. Treatments should be monitored and re-treated at the most economical time frame. For example, it may be more economical to use prescribed fire to

maintain forest encroachment while the regen is small enough to kill with understory fire. Once regeneration or grass loading is too advanced, a mechanical treatment will have to be conducted, which may be more expensive. This can be said for hand/mechanical treatments where an increased amount or larger debris is more expensive to treat and remove. Any prescribed maintenance treatment activity(s) not already identified in the treatment specifications should be described here to ensure that it is included within referral and consultation processes. (i.e. prescribed fire).

3.3.8 POST TREATMENT REPORT

Post treatment reporting should be thought about during the prescription development. During the treatment phase of the project as well as post treatment, monitoring by the practicing forester or qualified professional is important to ensure that the treatment meets the targets of the prescription and additional values on site are managed for. Measurement of post treatment surface fuel loading is critical due to the potential for additional debris accumulation from the treatment activities themselves. Ensure that a post treatment report is completed after initial treatment is done. Stems/ha, surface fuel loading (t/ha or Kg/m^2), before and after photos, as well as crown base height, all must be included in the post-treatment report. See the BCWS Fuel Management Survey Data Collection Standard for more details.

3.3.9 SILVICULTURE OBLIGATIONS

In prescriptions where silvicultural obligations exist, develop the appropriate Fire Management Stocking Standards and request approval by the Natural Resource District Manager if required. Provide details around silviculture obligations (e.g. planting, stand tending, free to grow) if applicable. See Appendix Two of the Fire Management Stocking Standards Guidance (under Fuel Management Stocking Standards) for information on the fire resistance/resilience characteristics of common tree species used for reforestation in BC. Think about:

- Regenerating with deciduous species or mixed wood that have higher moisture content foliage and live stems, are less flammable, have reduced fire intensity, and have less crowning potential at most times of the year.
- Regenerating with fire resilient conifers (e.g. Larch, Douglas fir, Ponderosa pine) at low densities. Widely spaced trees reduce both the crown bulk density and the continuity of crown fuels, making crown fires unlikely however, care must be exercised with excessive crown spacing as it increases in stand wind speeds and solar radiation to the surface fuel bed.

PLANTING: Provide specific planting specifications not found in the stocking standards table. Any ribboning required should also be stated in the “Outstanding Works” section if not completed at the time of the prescription.

3.3.10 OUTSTANDING WORKS

Describe any outstanding work required prior to treatment (e.g. assessments, ribboning, authorization and tenure acquisition, sowing request, etc.). It is expected that the majority of work required for the prescribed treatment(s) will be completed at the prescription stage. If this is not possible it is expected that the local government, land manager and the Wildfire Prevention Officer (WPO) are informed and that details are provided in this section.

3.3.11 ATTACHMENTS

If a professional assessment was completed, indicate the date the report was completed and the professional who completed the work, and incorporate supporting assessment into the final prescription package.

3.3.12 OTHER CONSIDERATIONS

Due to the complexities associated with planning for and prescribing fuel treatments, it is fundamental to build the planning team early on to ensure that land and values managers, BCWS fire behaviour expertise, and qualified professionals are working together to design, locate and identify objectives. Prescribing Foresters and other qualified professionals (RP Biologist, Professional Agrologists etc.) working with the agency (B.C. Parks, MOF) are required to work with the Fire Centre Wildfire Prevention Officer (contact information located on the Tools for Fuel Management website) for technical input to ensure that the prescription outcomes are consistent with government objectives for fuel management.

4 MAPPING STANDARDS

Include the following georeferenced map(s) that is accompanied with KML or shapefiles:

- Overview: General overview map of the project boundary in relation to communities and other major features and base data should be geo-located.
- Fuel Treatment Prescription Map.
- PDF map accompanying the KML or shapefiles.
- Previously treated and disturbed areas (blowdown, insect, and disease, etc.) in close proximity to the treatment area.
- Any important legal boundaries.

Prescription map should include:

- Treatment unit boundaries and should also include administrative boundaries, previously treated and disturbed areas (blowdown, insect, and disease) in close proximity to prescription area if available.
- Prescription Map Legend Should include Treatment Unit (TU) Summary i.e. Gross Area, Less Reserves & Existing Roads to Arrive at Net Ha to be treated.
- Static Reserves (including wildlife tree retention areas, riparian reserve zones, etc.).
- Streams, Wetlands, Lakes including the class and identification number/name.
- Existing and proposed roads and skid trails (labeled).
- Land ownership boundaries (if applicable).
- Existing or proposed stream crossing structures (culverts, bridges).
- Any other values or features that should be mapped (i.e. Goshawk nests, bear den, range fencing, power lines, a licensed waterworks that is within 100 m of proposed treatment, etc.).
- Natural range barriers that may be affected by treatment.
- Any areas of safety concern (i.e. steep slopes, utility lines, etc.).
- Prescribed burning containment areas (if applicable) as per burn plan direction.
- An easy to view scale.

Note: *If features or areas discussed above are not labeled, they should be included in the legend. A separate harvesting, road building, or planting map may be required depending on the treatment.*

5 APPENDIX A KEY DEFINITIONS

Critical Surface Intensity - (based on Van Wagner's crown fire theory, 1977b).
The threshold intensity value (kW/m) of a surface fire where crown fire initiation will occur as a function of the crown base height (CBH) and foliar moisture content (FMC) characteristics of a forest stand.

Additional CSI information can be found on the 'explain' tab of the Critical Surface Intensity Worksheet located on the Tools for Fuel Management Webpage. Byram's formula for calculating surface fire intensity is located on the 'equations' tab of the same worksheet.

Critical Infrastructure: Publicly, provincially and First Nations owned critical infrastructure: Assets owned by the Provincial government, local government, public institution (such as health authority or school district), First Nation or Treaty First Nation that are either:

- Identified in a Local Authority Emergency Plan Hazard, Risk & Vulnerability Analysis and/or Critical Infrastructure assessment and/or
- Essential to the health, safety, security or economic wellbeing of the community and the effective functioning of government (such as fire halls, emergency operations centres, radio repeaters, etc.

Resource management open fire –

a) means an open fire that burns non-piled slash over an area of any size, or
b) is not a campfire or a category 2 or 3 open fire and is lit, fueled, or used for silviculture treatment, forest health management, wildlife habitat enhancement, fire hazard abatement, ecological restoration, or range improvement (BC *Wildfire Act* & Regulation)

Fire Effect(s) - Any change(s) on an area attributable to a fire, whether immediate or long-term, and on- site or off-site. May be detrimental, beneficial, or benign from the standpoint of forest management and other land use objectives (CIFFC 2003).

Fire Effects – The physical, biological, and ecological impacts of fire on the environment. (NWCG, 2012)

First Order Fire Effects – The effects that concern the direct or immediate consequences of fire, such as biomass consumption, crown scorch, bole damage, and smoke production. First order effects form an important basis for predicting secondary effects such as tree regeneration, plant succession, and changes in site productivity, but these involve interaction with many other non- fire variables (NWCG, 2012).

Second Order Fire Effects – The secondary effects of fire such as tree regeneration, plant succession, and changes in site productivity. Although second order fire effects are dependent, in part, on first order fire effects, they also involve interaction with many other non-fire variables. (NWCG, 2012)

Containment Area - An area outside of the intended project area where the application of fire has been identified, incorporated, and authorised by an Official in the approved Burn Plan. This is the area that fire may be considered as acceptable and whereby does not trigger the declaration of a wildfire until the prescribed fire escapes the containment area or is imminent to do so.

Fuel Break – A fuel break is defined as a linear feature placed appropriately on the landscape to mitigate wildfire risk to a value(s) and will be at least 1 km in length if feasible and a minimum of 100m wide. All fuel breaks must begin and end at an anchor point.

Polygon Treatment Area – At times the anchored approach is not feasible, or does not make sense, and the intention is to protect a specific value (ie. Critical infrastructure). A polygon treatment is a fuel treatment that does not form part of a continuous fuel break unit and is not necessarily anchored into an anchor point.

6 APPENDIX B EXAMPLE FUEL MANAGEMENT PRESCRIPTION FRPA

An example of a Fuel Management Prescription for provincial Crown land is available. Not all legislation may apply to First Nations or local government lands. If treatments are being prescribed within BC Parks, please see BC Parks Treatment Template. Prescribing professionals need to ensure they are completing a fuel management prescription within parks and protected areas that speaks specifically to parks and protected area legislation, regulation, and policy.