FLNRORD STANDARD FOR DEVELOPING TACTICAL PLANS FOR WILDFIRE RISK REDUCTION

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PROVINCE OF BRITISH COLUMBIA

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Introduction

In British Columbia, creating or maintaining fire resilient ecosystems and communities that are fire adapted is fundamental to ensuring the long-term sustainability and health of our forests while also reducing the impacts of wildfire to those who live within the wildland urban interface. Fuel management activities can aid in achieving the above through the manipulation or reduction of living or dead vegetation in the various components of the forest and grassland fuel strata. Fuel management is an important part of wildfire prevention; if done correctly and maintained over time, its impact on potential fire behaviour can be significant. Proper planning now will allow for more seamless integration of fuel management activities into various community and land management planning processes in the future.

Purpose

The purpose of this document is to provide direction for the development of wildfire risk reduction (WRR) tactical plans in areas of higher risk within a resource district or region. This guide is intended to support WRR planning conducted through two streams of funding under the Community Resiliency Investment Program (CRI)[1]: FireSmart Community Funding and Supports (FCFS); and Crown Land Wildfire Risk Reduction (CL WRR). This guide is also relevant to WRR planning not funded through the CRI program.

Scope

This standard is applicable to WRR projects on crown land that meet the criteria outlined in the Crown Land Wildfire Risk Reduction Planning Guide 2021-2022 or are funded by FLNRORD. The CL WRR areas are areas that are either identified as a high or extreme wildfire threat based on the Provincial Strategic Threat Analysis or Wildland Urban Interface Risk Class Maps or have been identified as a high or extreme threat at the local level with updated data that has been ground verified and approved by the Fire Centre. These areas must also have priority values based on RSWAP (e.g., communities, critical infrastructure) or are considered a priority for this type of planning.

This document is focused primarily on providing guidance on the principles of fuel management planning, and operational fuel management unit identification. The outcome of this planning process is to provide the responsibility area with prioritized treatment units with clear fuel management objectives that are ready for the next phases of WRR activities, prescription development and operational treatments in the WUI. The output of this process should not resemble that of a Community Wildfire Prevention Plan (CWPP) or a Community Wildfire Resiliency Plan (CWRP) as the audience and scope are different, but it should complement these plans or be a component of a planning process if the one-kilometer wildland urban interface (WUI) is included. Guidance on the completion of a CWPP or CWRP is not within the scope of this document, however this standard should be referenced when CWPP or CWRP fuel management planning is occurring.

[1] More information on the CRI program can be found here.

Responsibilities and Expertise Required

Forest professionals that are within their scope of practice with regards to fuel management and fire behaviour expertise are required for the development of a tactical WRR plan. The members of the Association of BC Forest Professionals are entrusted to ensure that practices applied to forest, forest lands, forest resources and forest ecosystems comply with legislative requirements, including the *Wildfire Act*, *the Forest and Range Practises Act*, *Park Act* etc., and that assessments, plans and prescriptions for fire and fuel management meet the intended objectives. Many aspects of fuel management fall under the scope of practice of professional forestry with the Association of BC Forest Professionals (ABCFP). In 2013 the ABCFP released Interim Guidelines – Fire and Fuel Management to provide ABCFP members with information and guidance to be considered when working in the area of fire and fuel management.

This document assumes that all other approaches to, and components within, the tactical overview and operational unit plans meet legal requirements and follow Association of BC Forest Professionals (ABCFP) published guidance, 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. In addition, the 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.

Fire behaviour, fuel management, fire ecology and fire effects expertise are required during the development of a tactical plan. Fuel management, fire behaviour and modeling expertise must come from within the BCWS or be approved by BCWS. Specific circumstances where engagement with BCWS is required or recommended includes, but not limited to: Determining project area of interest (AOI); determining overlap, relevance and level of standard with past, current and proposed plans; verifying methodology, fuel typing, modeling etc.; and review of draft plan and final deliverables.

Engagement with the local Forest Lands and Natural Resources Operations and Rural Development Resource District, Mountain Resorts Branch and/or BC Parks for projects must occur where responsibility area overlap exists, especially when projects are not being led by the respective responsibility area. This is to ensure: alignment with current initiatives; engagement processes are followed or identified (e.g., Indigenous partners, stakeholders, and local interest groups); and the opportunity to identify or address any overlapping values etc. is provided.

Definitions and Descriptions

Anchoring – linking a fuel treatment to a non-burnable or very low intensity burnable feature on the landscape (i.e., rock outcrop, swamp, lake, river, etc.).

Area of interest (AOI) – Preidentified area that defines the extent in which planning is to occur. The AOI is unique to the specific CRI funding streams:

> FCFS - In relation to Community Wildfire Resiliency Plans (CWRP), this includes the area that lies within the municipal boundary, regional district boundary, or boundary of First Nations land. For regional districts this could be the boundary of an electoral area that encompasses multiple communities. The eligible WUI area is defined up to a maximum of one kilometre from structure density class greater than 6. The decision to include crown land up to the one kilometre maximum as part of a CWRP must consider the currency of existing plans and the local resource districts plans and timelines for tactical planning.
>
> CL WRR – For tactical planning, this is the Wildland Urban Interface Risk Class polygon (or a combination of multiple), which is based on a 2.75km buffer originating from a structure density greater than 25 as a starting point. The AOI may be contracted or expanded (exp. large area of high PSTA threat within a structure density class greater than 6 polygons adjacent to) when supported by the responsibility area (e.g., natural resource district, BC Parks Area Managers) and BCWS. The AOI may also encompass multiple communities.

BEC – The biogeoclimatic ecosystem classification (BEC) is an integrated hierarchical classification scheme that combines climate, vegetation, and site classifications.[2]

BurnP3[2] – Burn-P3 is a spatial fire simulation model that is used for land-management planning and wildland fire research. It uses the Canadian Wildland Fire Simulation Model to determine the ignition and spread of a large number of fires to determine fire likelihood. P3 represents probability, prediction, and planning.

Community Wildfire Resiliency Plan (CWRP) – CWRPs are the next generation of CWPPs. CWPPs were introduced in 2004 as part of the Strategic Wildfire Prevention Initiative and served as the primary wildfire risk reduction planning mechanism for British Columbia communities.

Fire Adapted Species – Refers to specific species that are adapted to live with the presence of fire (e.g., ponderosa pine, Douglas fir)

Fire Effects[2] - Any ecosystem impacts attributable to a fire, whether immediate or long-term.

Fire Resilient Ecosystem – Ecosystems that are resilient to wildfire are those that can burn and then return to their pre-fire condition prior to the next fire.

[2] Meidinger D.V., Pojar J. 1991. Ecosystems of British Columbia. Ministry of Forests. ISSN 0843-6452.

Fire-adapted Ecosystem – Ecosystems that are characterized by a "fire regime" which describes the frequency at which fires in a given forest type typically burn, the season(s) in which they burn, and the amount of vegetation killed.

Fuelbreak[2] - An existing barrier or change in fuel type (to one that is less flammable than that surrounding it), or a wide strip of land on which the native vegetation has been modified or cleared, that acts as a buffer to fire spread.

Fuel Management[2] - The planned manipulation and/or reduction of living or dead forest fuels for forest management and other land use objectives (e.g., hazard reduction, silvicultural purposes, wildlife habitat improvement) by prescribed fire; mechanical, chemical, or biological means; and/or changing stand structure and species composition.

Fuel Treatment[2] – Treatment of living or dead forest fuels to diminish the likelihood of a fire starting, and to lessen the potential rate of spread and resistance to control.

Prometheus[4] – A localized scenario-based fire growth simulation model used to predict fire behaviour during wildfire operations and planning.

Provincial Strategic Threat Analysis (PSTA) – Provincial-level assessment of relative fire threat across the landbase that includes inputs of fire occurrence, fire intensity and spotting.

RSWAP –A system for prioritizing incidents for response. The system is the Resource Strategic Wildfire Allocation Protocol (RSWAP). This protocol defines four priority levels based upon high value resources and assets (HVRAs) at risk. In descending order of priority, the four levels are 1) human life and safety 2) property 3) high environmental and cultural values and 4) other resources.

Wildfire Risk Reduction Unit (WRRU) – an area (often linear) that will be managed for wildfire risk reduction over time. All polygons within WRRUs will have been assessed for risk, current and future fuel management opportunities, and will have objectives determined. Fuel Treatment Units (FTU) and fuelbreak opportunities will be identified within WRRUs as part of this planning process**.**

Wildland Urban Interface (WUI) – As defined in the FireSmart manual, the wildland urban interface (WUI) is any area where combustible forest fuel is found adjacent to homes, farm structures or other outbuildings. This may occur at the interface, where development and forest fuel (vegetation) meet at a well-defined boundary, or in the intermix, where development and forest fuel intermingle with no clearly defined boundary. In BC it is defined as 2km from structure density class greater than 6.

WUI Risk Class (WUI RC)– a BCWS classification system which weights the PSTA threat components within the individual WUI Risk Class polygons. Five risk class ratings were applied to the WUI polygons, with “1” being the highest relative risk and “5” being the lowest relative risk. WUI RC is used to aid in the strategic prioritization of provincially funded WRR projects.

General Fuel Management Principles

B.C. has a highly diverse landscape and as a result wildfire risk is not uniform across the province's land base. Fuel management objectives set for the Wildland Urban Interface (WUI) are intended to deliver outcomes for an identified area that will reduce fire behaviour to a targeted level, thereby allowing for increased fire suppression opportunities and fire fighter safety.

To achieve these outcomes, identifying the potential fire behaviour that could occur in a specific area is a critical first step. In BC, the chosen 90th percentile weather conditions are used as a target for determining potential threat and desired fire behaviour outcomes. Wildfires that occur in the 90th percentile and above weather may result in large-scale fires that occur under high winds, low fuel moisture with higher spread rates and intensities where large-scale losses occur.

Fuel management activities can influence the amount, composition, and arrangement of fuels, which means they can modify the intensity and severity of a wildfire. The size and spatial arrangement of fuel treatments across the land base are also fundamental to their overall effectiveness during wildfires and can be planned several ways. Fuel treatments affect fire behaviour by modifying the stand structure (fuel strata) to specifications that meet the desired fire behaviour outcomes (Graham et al. 2009).

Due to the location and types of values at risk (VAR) and critical infrastructure, including social, economic, and environmental values, differing risk levels require tailored management strategies to minimize negative impacts to values at risk from wildfires. WRR is approached from two varying perspectives:

- Community resilience - focussed on Human life and safety and critical infrastructure, primarily within the WUI and,
- Ecosystem resilience – focussed on maintenance or recovery of ecological function, primarily outside of the WUI, but still considered within.

The most successful approach towards wildfire risk reduction is to achieve effective fuel management (e.g., use of prescribed fire, fuel treatments, and other forms of hazard abatement) at multiple scales starting from the WUI out towards the landscape in combination with FireSmart principles applied within communities and isolated CI. The following principles apply to WRR planning:

1. Community resilience principles include:
    - Highest priority for wildfire risk mitigation is to reduce negative impacts to the community and high value critical infrastructure (CI).
    - Risk reduction begins from the value and extends out from there.
    - Minimizing the negative impacts from wildfire to life and property.
    - Creating FireSmart communities and homes which includes reducing the flammability of structures, appropriate landscaping, safe evacuation routes, and managing forest fuels.
    - Meeting the fire behaviour outcomes outlined in the latest version of the BCWS Fuel Management Prescription Guidance document.

2. Ecosystem resilience principles include:
    - Minimizing the negative impacts from wildfire to both cultural and natural resources including maintaining ecosystem resiliency to wildfire in fire maintained and fire dependant ecosystems.
    - Maintaining forest benefits such as hydrological and ecological function, wildlife habitat, visual quality, recreation, carbon sequestration, and timber supply across the landscape.
    - Balancing multiple objectives with wildfire risk reduction at the landscape scale will focus on reducing impacts to other objectives.
    - Lowering fire severity to improve ecosystem/wildfire resilience, limiting soil and watershed damage, and minimizing post-fire restoration activities.

Planning Overview

In British Columbia, the process for wildfire risk reduction planning and implementation involves multiple phases. Figure 1 below identifies the three main phases and outlines the key activities in each.

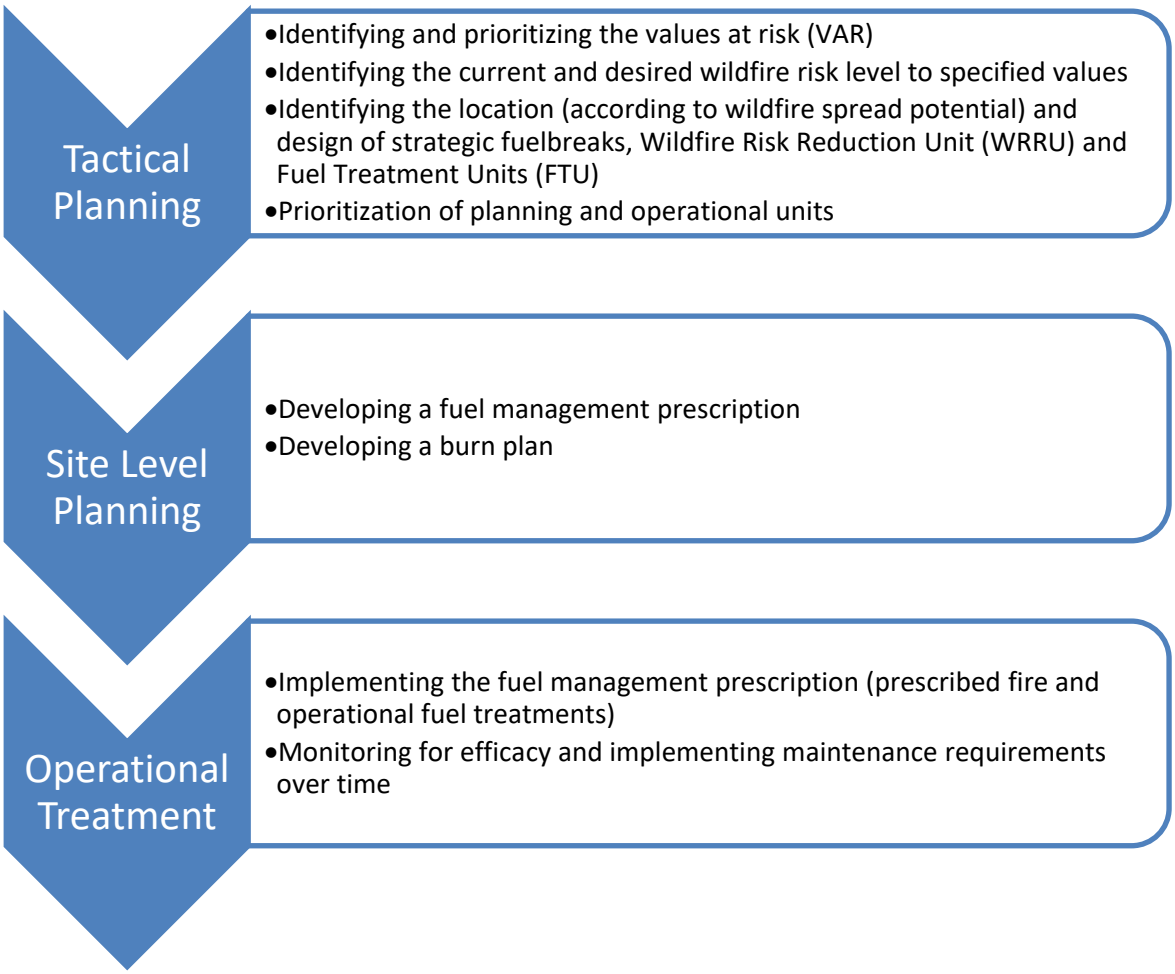

Figure 1. Wildfire risk reduction planning and implementation phases

Values at Risk Identification and Prioritization

Values are identified and prioritized based on consequence of the values interaction with fire. Priorities must align with the program mandate for provincially funded projects. For tactical planning within the WUI this is RSWAP values human life and safety and property, which includes critical infrastructure. RSWAP value human life and safety is priority one, followed by critical infrastructure, high environmental and cultural values, and resource values. WRR funding to date has prioritized public safety and critical infrastructure, but often other values are considered and included as a complementary or secondary objective during planning. Completing risk and vulnerability assessments or values at risk analysis/modeling is not required nor in scope for WRR funded projects. As planning moves into the landscape in the future, this type of analysis will be more critical. For larger communities or areas of contention, local wildfire risk assessments can be considered but approval is required from the FLNRORD designate.

Fuel Management Objectives

Developing fuel management objectives with accompanying rationales is a key component of operational unit tactical planning. Fuel management objectives are intended to outline the direction for reducing negative impacts to values at risk and provide for improved suppression opportunities. Fuel management objectives may include efforts to limit wildfire size or reduce overall fire intensity and spread potential for the area of interest (AOI). As AOI units change over time in terms of fuel conditions and extent of the WUI, objectives may need to be reviewed and adjusted accordingly.

In addition, fuel management objectives describe the general objectives for fuels within the AOI unit. These objectives are focused on the management of fuels at an FTU/stand level to achieve the desired fire behaviour outcomes, reduce potential harm to values from wildfire and provide suppression opportunities for when wildfire does occur. An example of this is reducing crown fire initiation, spread and spotting potential to specified and measurable targets.

Review of Existing Plans

In many cases, wildfire risk reduction plans already exist. A common plan completed by many local governments and First Nations communities include the Community Wildfire Protection Plan (CWPP), or CWRP (new in 2020) designed to identify the wildfire risks within and surrounding a community and to examine possible ways to reduce those risks. The new CWRP process allows communities to decide whether to include WRR planning on crown land within one kilometer of the community as part of that process. Where CWPPs/CWRPs or other existing fire and fuel management planning exists (such as fuel treatment opportunity maps and older landscape fire management plans etc.), all relevant data should be examined to determine linkages, avoid redundancies, and fill in any data gaps. Caution must be taken when considering implementation or incorporation of these existing plans as they may be outdated and not aligned with current standards. Establishment of or engagement with existing local Community FireSmart and Resiliency Committee's or equivalent is strongly encouraged through this process.

Selecting and designing appropriate fuel management treatment areas for wildfire risk reduction also involves consideration and integration of several land management objectives across the AOI at multiple scales. Integrating existing higher-level plans (e.g., LRMP, SRMP, Park Management Plans etc.) and regional

initiatives is critical to ensuring wildfire resiliency efforts are in line with legal requirements and responsibility area priorities. Overlapping resource objectives should be identified and considered during the tactical plan development through discussion with value managers to assess options for WRRU placements. Site level considerations to be addressed at the stand-level plan (prescription) phase.

Managing for Multiple Values

Fire and fuel management objectives may overlap other identified land management objectives. Options for managing multiple values differs according to the fuel treatment objective (e.g., WRR around communities and human life and safety vs landscape).

Determining the most appropriate management for multiple values will need to be discussed with the responsibility area and BCWS subject matter experts during the tactical planning process. Efforts should be made to have objectives complement one another consistent with the principles and objectives provided in this document. Overall, this means that fire behaviour is reduced to the targets outlined in the most current Prescription Guidance Document to the extent required to meet the fire behaviour outcomes; which are often achievable through minimal stand modification and with minimal to no impact on the overlapping values. At the tactical planning phase, this would be a higher-level conversation to ensure project viability and general agreement on objectives, with specific treatment targets being determined at the site level planning phase.

Analysis Process

Validating wildfire risk and the design of fuel management units (i.e., location, size, treatment specifications and maintenance regimes) can be complex in BC's diverse landscape.

Validating the Wildland Urban Interface Risk Polygons

The validation analysis process consists of completing the different stages of the development of this analysis. This will include the initial review of existing data and modeling (e.g., PSTA and BurnP3 outputs provided by BCWS etc.), followed by spatial analysis and field verification of fuel and timber types. This process must include analysis of fire history and the fire behaviour environment – fuels, weather, and topography as related to fire behaviour, initial spread index (ISI) roses for applicable weather stations etc. Validating risk in relation to stand level treatment opportunities may also include the utilization of tools such as the Critical Surface Intensity Calculator found on the Tools for Fuel Management webpage.

The following validation analysis methodology information is required as part of the final deliverable for all provincially funded WRR projects:

- A general description of the analysis process (i.e., models or spatial tools used, validation methodology etc.), the prioritization processes etc.
- Validation – how were analysis results validated?
- Assumptions – describe assumptions used as part of the validation process.

Simulating Potential Risk and Treatment Unit Options

Due to their complexity, there may be circumstances where WRR projects require additional risk and fuel treatment scenario analysis, outside of what is provide by BCWS, using modeling tools such as Prometheus or BurnP3. If modeling is being considered for a project, discuss with fire centre Wildfire Prevention Officer (WPO) prior to proceeding. If it is agreed upon to move forward, BCWS Predictive Services will then be contacted to initiate the request at BCWS.PredictiveServices@gov.bc.ca. Any, and all modelling must be done by competent, trained individuals that have a full understanding of the assumptions and limitations of the model approved by the BCWS. Many of the modelling products available require considerable set up and data/information collection. Due to a lack of availability of trained individuals to run these models it should not be assumed that modellers are always available. For modelling requests, a minimum of one-month lead time is suggested for any BCWS Prometheus or Burn P3 requests. More information on the modelling tools and products used by BCWS (e.g., Prometheus and Burn P3 products) is available by contacting Predictive Services.

As a part of the CWPP and CWRP process wildfire threat plots may be needed to completely assess threat to values. Threat is assessed based upon fuel type and distance to values among other factors. It is generally not necessary to carry out wildfire threat assessment plots as part of this tactical planning process however if deemed necessary discussion with the BCWS WPO must occur before threat plots are installed.

Planning and Operational Fuel Management Unit Identification

Planning involves the identification of units at different scales for various purposes. In the process of WRR tactical planning, there are two levels of planning: the planning units themselves followed by operational fuel management units. The planning units include three scales: the areas of interest (AOI), wildfire management units (WMU), and wildfire risk reduction units (WRRU). Within identified WRRUs, there are two operational fuel management units: fuel treatment units (FTU) and assessed-monitor units (AMU). Figure 2 below illustrates the planning sequence, while Figure 3 provides a mapping example.

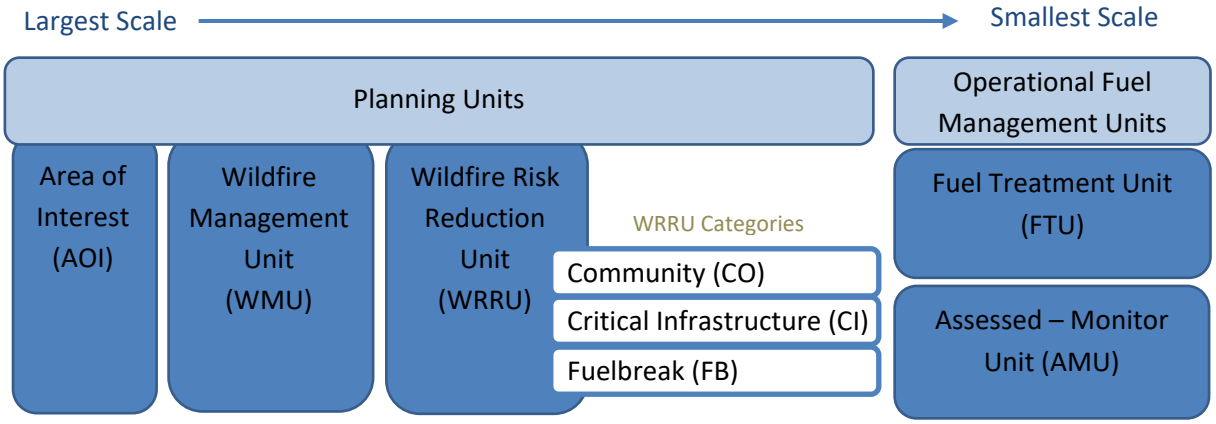

FIGURE 2. WRR TACTICAL PLANNING - PLANNING AND OPERATIONAL FUEL MANAGMENT UNITS

Planning Units

Area of Interest

The area of interest for tactical planning is determined by responsibility area leads and BCWS and are based on WUI Risk class maps and other factors (see the Crown Land Wildfire Risk Reduction Planning Guide 2021-2022). This area defines the boundary within which risk and operational fuel management unit identification are to occur, which is further refined through the identification of WMUs. Intensity of planning within this area will vary depending on many factors such as fuel types, topography, fire weather, and values within a given area.

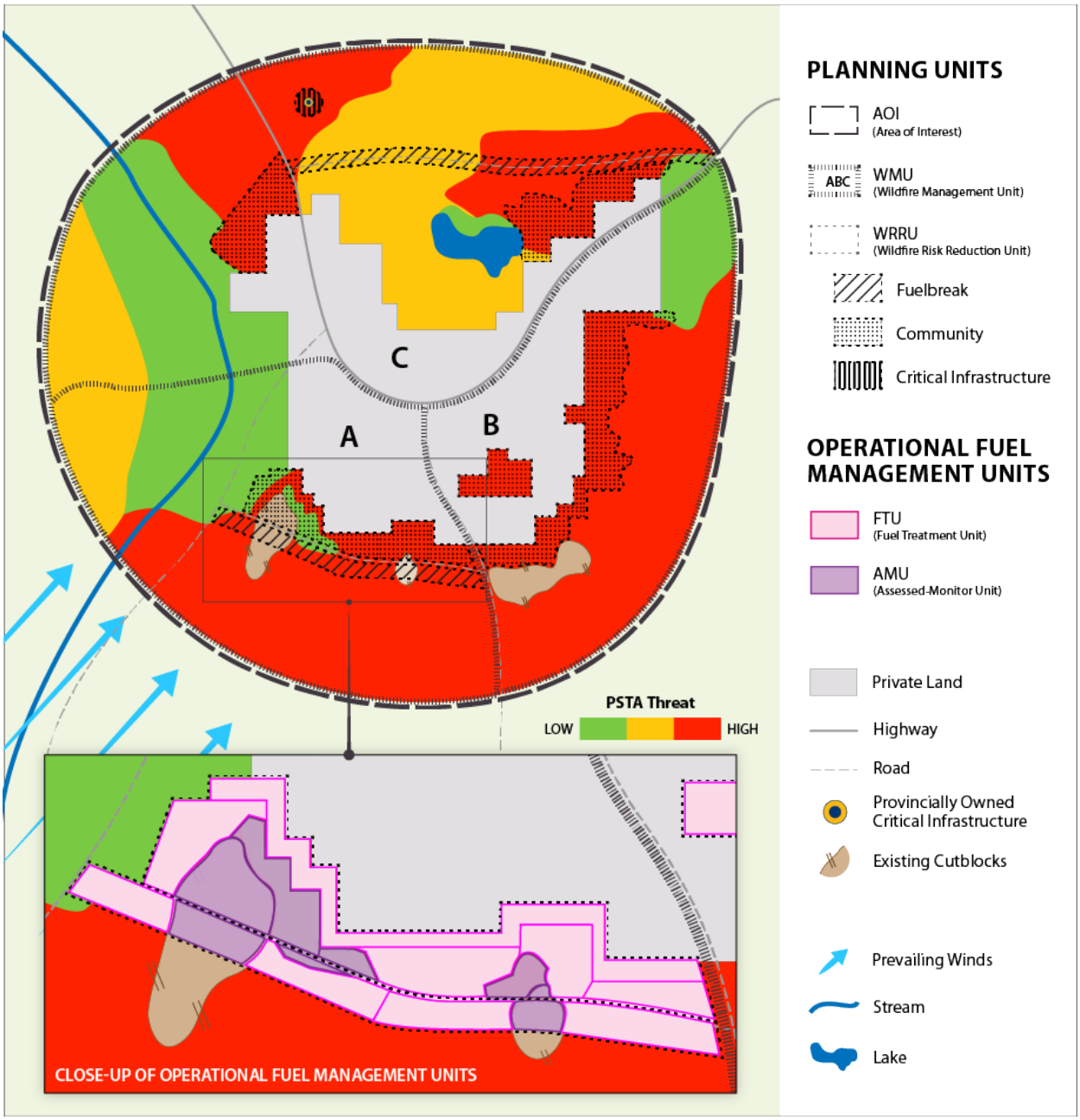

FIGURE 3. WRR TACTICAL PLAN PLANNING AND OPERATIONAL UNIT EXAMPLE. UPPER GRAPHIC ILLUSTRATES WRR PLANNING UNITS, AND LOWER GRAPHIC ILLUSTRATES TOTAL CHANCE OPERATIONAL FUEL MANAGEMENT PLANNING WITHIN AN IDENTIFIED WRRU.

Wildfire Management Units

Wildfire Management Units (WMU) are larger scale operational planning units that help break up the project area to aid in planning and prioritization. These units are based on fire weather patterns (e.g., prevailing winds), and areas of highest concentration of values etc. During the planning process, once the WRRUs are established, fuel treatment unit planning is usually completed in the highest priority WRRU before moving to a lower priority unit so that prescription development and operational treatments can proceed. Fuel treatment units may have already been established in older existing plans, but it is suggested that these be re-evaluated to make sure that there have not been any significant changes in the plan area that may impact boundary or priority (e.g., development, new CI, forest health etc.).

Wildfire Risk Reduction Units

Wildfire Risk Reduction Unit (WRRU) identification is a new component of WRR planning. Past WRR planning practices would have likely included the assessment of the area surrounding identified FTUs to ensure all high threat stands were identified and that fuel management design principles where met, but this was rarely spatialized. The intent of WRRUs is to move away from the historical "cookie cutter" FTU identification to a total chance planning approach that will include short- and long-term management to achieve overall objectives. The entire polygon may not meet objective(s) in the short term but will be managed to do so overtime as stand management allows. The intent is also to have WRR planning units in place that can be integrated into current or future landscape plans.

To ensure total chance planning and avoid wildfire threat gaps, all forest and range polygons within identified WRRUs must be assessed for fuel treatment or maintenance opportunities, including:

- All mature stands including mixed wood and deciduous.
- All existing cutblocks and plantations.
- All existing operational fuel treatment units including fuelbreaks identified in existing plans.
- All existing reserves (e.g., RRZ, UWR, OGMAs etc.).

There are likely to be multiple FTUs and AMUs within an identified WRRU based on a typical scenario of a mosaic of stand types and past harvest activity (see example in Figure 3). As an example, a 1980's plantation that was prescribed burned and has high CBH would likely be considered a lower threat, however it is still important to monitor this stand for changes over time and manage for WRR objectives over the next rotation. For the purposes of this planning process, WRRUs are to be categorized as one of the following:

- Community (CO)- crown land directly adjacent to property boundaries associated with communities or neighborhoods meeting WRR funding structure density criteria.
- Critical Infrastructure (CI) – crown land directly adjacent to isolated critical infrastructure meeting WRR funding criteria.
- Fuelbreak (FB) – crown land that is identified as an operational control feature for wildfire suppression activities.

Prior to the establishment of a WRRU surrounding isolated critical infrastructure, it must first be determined if the critical infrastructure meets the program funding criteria outlined in *Appendix A - Additional Prerequisite Information and Tools for Operational Planning*, and if so, FireSmart CI ignition zone principles and design must be considered. Exceeding the 100m ignition zone should only occur with an acceptable rationale. The risk reduction priority for CI should be to complete a CI assessment (more commonly done outside of this process), and FireSmart the structure itself if required.

Operational Fuel Management Units

Fuel Treatment Unit

Fuel Treatment Units fall within identified WRRUs and should rarely be stand alone. Each fuel break or WRRU will need to be assessed to identify current and future fuel treatment opportunities. FTU are established based on the wildfire behaviour potential of the stand and likelihood of achieving desired fire behaviour outcomes and fuel management objectives.

Assessed-Monitor Unit

The expectation is that all areas not identified as an FTU within a fuelbreak or WRRU will be identified as one of the two categories below and will be accompanied by a rationale:

- Non-Productive (NP) - E.g., gravel pit, road surface etc.
- Assessed – Monitor Unit (AMU) with the following categories:
    - Operability Concern – E.g., Slope, saturated soils etc.
    - Lower threat – E.g., Fuel characteristics (e.g., surface, ladder, and crown); position (distance to value, slope position, adjacent treatment/threat etc.); or both.

If an AMU is categorized as an operability concern, the rationale should flag whether this area is considered a wildfire threat. If the threat is high the area should be identified as an FTU and the operability concern flagged. AMUs are to be included in the spatial and output table deliverables.

Prioritization of Planning Units

Given that an AOI has been identified, prioritization of planning and operational fuel management units within the AOI needs to occur and consider the following:

- WMUs – When prioritizing WMUs in an AOI with multiple WUI RC polygons, the highest risk polygons should be the first consideration. If a WMU is a risk class 1 WMU it would be prioritized ahead of a risk class 2 unit. If deciding between two risk class 1 WMUs or between two risk class 2 WMUs the polygon with the greater threat would be prioritized ahead of those with lesser threat.
- WRRUs – Prioritization of WRRUs should consider both wildfire threat and WRRU location. WRRUs closer to values at risk (e.g., WUI) should be prioritized higher than WRRUs farther away. Factors which may mitigate this include wildfire threat factors as fuel type and spotting potential.
- Fuelbreaks and FTUs Prioritization of these units is generally from the value (e.g., WUI) outward so units identified closest to values at risk should be treated first.

A tiered approach for prioritizing units can be used, and in most cases will be the most efficient option, particularly for plans with a considerable number of planning and operational units (e.g., Tier 1, 2 and 3).

Development of Potential Treatment Options

The general process for identifying fuel management opportunities, including prescribed fire, consists of the following key steps:

1. Collection of all relevant data including ecological, other plans, legal requirements, wildfire risk and threat related information, past and current treatment fuel treatments etc.
2. Analysis and ground truthing
3. Development of potential treatment options utilizing values information, prioritization, fire threat and fire behaviour information, etc. to develop potential treatment locations.
4. Consideration of potential practice changes and fuel treatment efficacy.

Data Collection, Analysis and Ground Truthing

The first step in developing a tactical plan for an operational unit is the collection of all data relevant to planning. See Appendix A for a detailed list.

The second step is to complete spatial and data analysis to identify VAR, wildfire risk, and WMUs, followed by ground truthing. Ground truthing consists of validating information obtained during the first step, and may include verifying mapped values, fuel type and fire threat (topography, wind patterns, proximity to value) etc. The analysis and ground truthing process and intensity will vary based on the various factors such as experience, complexity of the AOI etc. Since the level of analysis or survey intensity to determine or validate risk and treatment options will vary and will be left up to the discretion of the forest professional. Survey procedures and intensity should follow the Silviculture Surveys Procedures Manual or any updated guidance provided by BCWS.

Planning and Operational Unit Establishment

Objectives for strategic placement of fuel management units are to locate in consideration of anticipated fire behaviour and weather (e.g., fire spread toward values), to improve suppression opportunity and firefighter safety, and to maximize overall efficiencies through total-chance planning. An example of total-chance planning is the concept of WRRUs where a higher intensity of planning is to occur that includes assessing all stands versus only targeting a specific fuel type or stand impacted by forest health (e.g., beetle killed stands). The latter approach is subjective and may not consider potential threats of stands not historically considered a threat. Another example of total-chance planning is increasing the area (likely width) of a proposed fuelbreak or WRRU to tie into an existing road or other logical feature.

To modify fire behaviour across broad landscapes, fuel treatments need to be strategically located and of adequate size in anticipation of fire movement. This means considering local factors affecting spread patterns including wind patterns and topography. Further, taking advantage of pre-existing low threat conditions as well as ease of access both for treatment as well as fire control can help maximize the effectiveness. Taking this into account, Table 1 summarizes considerations for strategic placement and adequate size of fuel treatments. Factors are further expanded on below.

TABLE 1. CONSIDERATIONS FOR STRATEGIC PLACEMENT AND SIZE OF FUEL MANAGEMENT PROJECTS

Factors	Placement & Size Considerations	Influence		
		Spread	Control	Effectiveness
Wind patterns	Upwind of values at risk	✓		
	Rate of spread and spotting distance for size		✓	
Topography	Treat downhill of values to protect against uphill spread	✓		✓
	Increase size to accommodate topographic influences		✓	✓
Existing fire barriers	Anchored to areas of existing relatively low flammability		✓	✓
Access	Tie in to adjacent roads		✓	✓

Fuel Management Polygon Planning Considerations

There are many considerations that need to occur when planning for and identifying fuel management polygons. These include general design principles, fire behaviour, the potential for prescribed fire and the consideration and incorporation of other values.

General Design Principles:

- Larger areas are generally more effective fuel treatments for moderating fire behavior than smaller areas, dependent upon:
  - Orientation, dimensions, and position in relation to the value.
  - Treatment intensity and efficacy
- Treatment size should dictate the need for creating gaps and openings to further reduce the potential for crown fire.
- Treating in strategic locations can help break up continuity in both horizontal and vertical layers of fuels. For example, reducing fuels adjacent to natural features, such as meadows and rock outcroppings, and manmade features, such as roads, helps fire response personnel connect fire control lines to these locations[3].

[3] Stockmann K.D., Hyde K., Jones J.G., Loeffler D., and Silverstein R.P. 2010. Integrating fuel treatment in ecosystem management: a proposed project planning process. International Journal of Wildland Fire. 19(6): 725-736.

- Treating For priority values, work from the value outward. For example, In the case of WUI identified as at high risk, treatment(s) located immediately adjacent to the value (e.g., structures, etc.) will provide the greatest opportunity to minimize negative impacts to the value from wildfire. The expectation is that the first 100m from the value is managed to the standards outlined in the prescription guidance as soon as possible.
- Treatment unit delineation should be more intensive from the value to the 2.0-2.75km WUI buffer boundary within the highest risk (priority 1) WMU.
- Within lower priority WMUs, focus FTU delineation closest to the value and continue to look for fuelbreak opportunities as you move further out.
- Fuelbreak location and design that considers position on the landscape in terms of wildfire threat and position in relation to the VAR is essential to its effectiveness during wildfire suppression operations.
- Linear, anchored fuelbreaks provide the best opportunity to modify wildfire behaviour. Wildfire should not be able to move around a fuelbreak. If a fuelbreak is not anchored into non-fuel it will limit the effectiveness of the fuelbreak. Work to identify linear fuels break opportunities as much as practical and identify gaps (e.g., OGMA, RRZ, etc.) that may compromise the effectiveness of the fuelbreak.
- All stands within the fuelbreak must be assessed for risk. The entire fuelbreak may be considered one FTU but may contain multiple stand types and risk levels and therefore may contain multiple FTUs and/or AMUs.
- If there are moderate, high or extreme threat fuel type gaps between identified treatment units, a rationale for not treating them is required.
- Within the first 100m of a value, any high threat stand must be included as a treatment unit, this includes recently harvested and existing stocked plantations etc. If not included a rationale should be provided.
- Consider the need for critical infrastructure to be FireSmart and discuss with the local government, Indigenous community, or private entity.
- Assess existing reserves (often ecological values) for fuel management opportunities current or future. Regional or district level guidance may be available for these (e.g., RRZ and OGMA).
- Proposed treatment units should be accessible for suppression operations and for both initial treatment and maintenance. Consideration should be given to associated costs for less accessible treatment units.

Fire Behaviour Modification Considerations

- Treatment opportunity decision making should be consistent with fire behaviour outcomes and guidance provided in the most recent version of the Fuel Management Prescription Guidance.
- For each fuel treatment unit (uniquely identified) specify the rationale and fuel management objectives related to the desired change in fire behaviour that will guide future fuel treatment prescription development.
- Identify opportunities for prescribed fire that under suitable conditions will provide ecological benefits, reduce fuel loading and overall fire behaviour potential.
- The ecological impacts and site conduciveness for proposed fuel treatment outcomes that involve stand conversion to deciduous or more fire resilient species needs to be considered. need to

consider ecological impacts. Sites need to be conducive to the establishment and growth of the (see BEC and/or fire management stocking standard guidance.

Prescribed Fire Considerations

- If prescribed burning is recommended, treatment boundaries should be consistent with logical burn unit planning principles including: utilizing topographical breaks and manmade and natural features (roads, railways, hydro transmission lines, gas pipelines, wetlands, lakes, irrigated fields, non-fuel areas, etc.) especially when prescribed fire is to be implemented.
- Where prescribed (Rx) fire has been determined to be an appropriate treatment tool to meet predetermined objectives identified within a landscape or stand-level prescription, consideration should be made as to whether it will be achievable as part of the initial suite of treatments or better suited as a cost-effective future maintenance treatment. Rx fire implementation is dependent upon a suitable burn window based on weather and site conditions to meet objectives.
- Best practices suggest identifying a contingency plan/treatment to meet treatment targets, outcomes, and legal obligations (i.e., hazard abatement) rather than placing sole reliance upon Rx fire should an appropriate burn window not occur.
- Where natural features and/or constructed control lines are not available to assist in determining logical burn unit boundaries, consideration should be made to developing such lines during mechanical and/or hand-treatment treatment phases. Often, depending on the fuel type and continuity, this can be achieved by simply locating skidding patterns to create adequate soil disturbance in the area defined as the burn treatment boundary.

Additional Considerations

- Consider all potential management options during operational planning, including commercial timber harvesting, ecosystem restoration, etc.
- Consider overlapping objectives (i.e., private land, ecological values, constraints that preclude treatment etc.) in fuelbreak and FTU location, design, and method (commercial timber harvest, mechanical, prescribed fire, etc.).
- Consult with volume and area-based tenure/permit holders to ensure there are not conflicts with proposed WRR planning and to look for opportunities to work together/create partnerships.

Planning Outputs

The primary output from the tactical planning process is the identification and prioritization of planning and operational fuel management units. This must be accompanied by clear rationales for identification of planning and operational units, including key fire weather and behaviour principles specific to the unit, that address location in relation to values with key overlapping objectives and values identified. The plan must also include a concise general description of the analyses performed, assumptions made, and document efforts made to validate the analyses, as well as any necessary information for stands requiring monitoring or post-treatment maintenance. Plan deliverables include spatial data, output table (provincial template), and supporting supplemental text document.

Appendix A - Additional Prerequisite Information and Tools for Operational Planning

The following information items and tools may assist in tactical planning:

Operational Unit Land Management

- Responsibility area prioritization of values
- Operational unit fire management objectives if available
- Land management activities and limitations associated with the operational unit
- Land management activities timing
- Land management practices (hazard abatement, grazing intensity, etc.)
- Land management restrictions
- Fire management stocking standard guidance
- Ministry stocking standard guidance and spreadsheets

Prerequisite Information and Tools for Operational Planning

- Existing relevant plans (as discussed above)
- Relevant spatial layers (e.g., forest cover, PSTA and WUI Risk Class polygons, proposed and completed fuel treatments, jurisdictional boundaries, fire locations and perimeters, BEC zone, RESULTS information etc.)
- Wind/ISI roses
- BurnP3 output (see below)
- Critical infrastructure data and funding criteria:
    - Only provincially owned critical infrastructure data provided (Province of BC does not own critical infrastructure layer).
    - To qualify for funding:
        - Critical infrastructure must be 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, and/or
            - Currently designated as critical to support effective emergency response during a wildfire event. This includes structures designated as Emergency Operations Centres or Emergency Support Services facilities (i.e., reception centres, group lodging locations for evacuees), water pump stations, communications towers, and electrical generating stations, but does not include all critical infrastructure identified through the Local Authority Emergency Plan, and
            - Approved by FLNRORD designate as meeting the above.

Spatial Data Acquisition

Spatial data is available from two locations: from DataBC Data Catalogue (publicly available data for self-serve) and from BCWS (internal data that is not published or public information).

BCWS Spatial Data by Request

Spatial data provided by request from BCWS includes:

- BC Wildfire WUI Eligible Buffer
- Fuel Type
- Structure Density Class polygons and/or Critical Infrastructure buffers
- Publicly available Critical Infrastructure (information on how it's referenced and used in our projects, as well as hyperlinks to download the data from the DataBC Data Catalogue)
- BCWS Infrastructure
- BurnP3 Output – Includes: Burn Probability, Burn Probability over 20years, Simulated Fire Perimeters (used in analysis), Crown Faction (min and max), and Fire Intensity (min and max)

For requests, contact BCWILDFIREGEO@gov.bc.ca. Entry into a Data Sharing and Licensing Agreement is required; the data is only for internal purposes and cannot be shared with a third party unless authorized to do so, in writing, by BCWS. The Data is only to be used within the scope of the designated contract. The Applicant will ensure that each of its directors, officers, employees, contractors, agents, and representatives abide by the terms of this Agreement. Once signed, a WRR data package (supplementary to the self-serve datasets below) that contains the above-mentioned datasets will be provided.

DataBC Data Catalogue

The following datasets can be accessed via self-serve on the DataBC Data Catalogue:

a. Wildfire Risk Reduction (group)
    i. BC Wildfire Fuel Treatments
    ii. BC Wildfire PSTA Fire Density
    iii. BC Wildfire PSTA Fire Threat Rating
    iv. BC Wildfire PSTA Head Fire Intensity
    v. BC Wildfire PSTA Human Fire Density
    vi. BC Wildfire PSTA Lightning Fire Density
    vii. BC Wildfire PSTA Spotting Impact
    viii. BC Wildfire Wildland Urban Interface Risk Class
    ix. BC Wildfire WUI Human Interface Buffer
b. Current Fire Locations and Perimeters
c. Historical Fire Locations and Perimeters
d. BC Wildfire Active Weather Stations
e. RESULTS Completed Fuel Treatments
    i. FESBC Wildfire Projects Activities RESULTS - Activity Treatment Units
        1. Query: GEOMETRY_EXIST_IND = 'Y' AND (SILV_FUND_SOURCE_CODE IN ('CF' , 'FEP' ,'WRR') OR (SILV_FUND_SOURCE_CODE = 'FES' AND FIA_PROJECT_ID LIKE 'WR%'))
    ii. FESBC Wildfire Projects no spatial for Activities RESULTS - Openings svw
        1. Joined to RESULTS - Activity Treatment Units on OPENING_ID Query: SILV_FUND_SOURCE_CODE = 'FES' AND GEOMETRY_EXIST_IND = 'N' AND FIA_PROJECT_ID LIKE 'WR%'

Appendix B – Requirements for Map and Spatial Data

The following deliverables are to be submitted directly to the FLNRORD designate, where they will be uploaded by the responsibility area to \\forwebfiles.nrs.bcgov\ftp\HPR\mof_internal\incoming\HQ\WRR to be processed:

- Georeferenced PDF map(s)
- KMZ (planning and operational units; survey plots)
- Geodatabase (compressed into a zip file)

The spatial deliverables above should be replicated to the ArcGIS Online Prevention Dashboard; there is an automated script that looks for new files nightly from the delivery location on the FTP site and notifies the BCWS Geo staff the next day. If you do not see your data replicated in the Dashboard in a reasonable amount of time, or if you encounter issues, please contact BCWS Geospatial Services FLNR:EX BCWILDFIREGEO@gov.bc.ca.

Specific mapping and spatial requirements, including the planning and operation unit naming conventions (found under the *Attribute Description* column in the *Spatial data layers* section) are outlined below:

A. **Tactical Plan Overview Map –** Required in PDF format at an appropriate scale *(compress map files to reduce unnecessary large file sizes)*. An MXD template is available to assist in meeting a specified standard. The following map content is required:
    - Area of Interest (AOI), WMU, WRRU, fuelbreaks, FTUs, AMUs - labelled by unique ID
    - Land status and tenure overlaps (e.g., range, area-based tenures, woodlots)
    - Relevant Assessment plot locations / labelled by Plot Number
    - Previously completed fuel treatments if applicable (labelled by year)
    - Key overlapping values of interest
    - Descriptive title
    - Project number and proponent name
    - Date
    - Scale (as text or scale bar)
    - Reference data: roads, railways, transmission lines, pipelines, water bodies and rivers/creeks etc.
    - North arrow
    - Legend

B. Spatial data layers (compatible with ESRI ArcGIS 10.6 and accompanied by KMZ format)**:**

Feature Layer Name	KMZ	Feature Layer Description	Mandatory Attributes	Attribute Description	Attribute Details (Data type, length)
AOI	YES	Project boundary defining planning area	PROJECT_NUMBER	Unique CL WRR Project Number; as assigned by BCWS and provided within the Allocation letters. Format: GOVWR<FC><###> e.g.: GOVWRCA001	Text, 10
			DATA_COLLECTION_DATE	Date spatial data was collected	Date (DD/MM/YYYY)
WMU	YES	Wildfire Management Unit: planning unit	PROJECT_NUMBER	As defined above	Text, 10
			WMU_NAME	Unique WM Unit name Format: <Geographic Area> e.g.: "Verdun" or "Green Lake"	Text, 25
			WMU_ID	Unique WM Unit ID Format: <TWO LETTERS of geographic area> e.g.: "VD" or "GL"	Text, 2
			LOCATION_NAME	Tactical Plan Name	Text, 50
			DATA_COLLECTION_DATE	As defined above	Date (DD/MM/YYYY)
			AREAHA	Area in hectares	Double
WRRU	YES	Wildfire Risk Reduction Unit: planning unit	PROJECT_NUMBER	As defined above	Text, 10
			WRRU_ID	Unique WRR Unit ID with WMU ID prefix Format: <WMU ID" "<CATEGORY code>" -"<##> e.g.: "VD-CO-01", "VD-CI-01", "VD-FB-01"	Text, 8
			CATEGORY	Acceptable values: "COMMUNITY" or "CRITICAL INFRASTRUCTURE" or "FUELBREAK" ID codes: *CO*, *CI*, *FB*	Text, 25

			LOCATION_NAME	Tactical Plan Name	Text, 50
			DATA_COLLECTION_DATE	As defined above	Date (DD/MM/YYYY)
			AREAHA	Area in hectares	Double
FTU	YES	Fuel Treatment Unit: operational fuel management unit	PROJECT_NUMBER	As defined above	Text, 10
			FTU_ID	Unique FT Unit ID with WMU ID prefix Format: <WMU ID> "-FTU-"<##> e.g.: "VD-FTU-01"	Text, 10
			LOCATION_NAME	Tactical Plan Name	Text, 50
			DATA_COLLECTION_DATE	As defined above	Date (DD/MM/YYYY)
			DATA_COLLECTION_METHOD	Method of spatial data collection. See *Attribute Value Reference Table*.	Text, 45
			AREAHA	Area in hectares	Double
AMU	YES	Assess and Monitor Unit: operational fuel management unit	PROJECT_NUMBER	As defined above	Text, 10
			AMU_ID	Unique AMU ID with WMU ID prefix Format: <WMU ID>"-AMU-"<##> e.g.: "VD-AMU-01"	Text, 10
			CATEGORY	Acceptable values: "OPERABILITY CONCERN" or "LOWER THREAT" Rationale to be included in output table deliverable	Text, 20
			LOCATION_NAME	Tactical Plan Name	Text, 50
			DATA_COLLECTION_DATE	As defined above	Date (DD/MM/YYYY)
			DATA_COLLECTION_METHOD	Method of spatial data collection. See *Attribute Value Reference Table*.	Text, 45
			AREAHA	Area in hectares	Double
ASSESSMENT_ PLOT	YES	Field assessment plot locations	PROJECT_NUMBER	As defined above	Text, 10
			PLOT_NUMBER	Unique plot number corresponding to Assessment Worksheet	Text, 7
			DATA_COLLECTION_DATE	As defined above	Date (DD/MM/YYYY)

			DATA_COLLECTION_METHOD	As defined above	Text, 45
			COMMENTS	Any comments not included in accompanying table	Text, 255

C. Spatial data requirements:

a. Data Format and Naming Conventions:
   - Data must be in a file geodatabase (GDB) and KMZ format and must conform to the conventions for feature dataset names, feature class names, attribute names, and attribute values as identified in these accompanying tables. It is strongly recommended that you use the template GDB to facilitate meeting this requirement.
   - GDB and KMZ names should adhere to this naming standard: WRR_<NR District>_<Project Number>

b. GDB Projection: *NAD_1983_BC_Environment_Albers (EPSG:3005): https://epsg.org/crs/wkt/id/3005*

c. Data Quality: Submitted data must meet general data quality guidelines to ensure corporate data quality standards are met. Data with slivers, gaps between adjacent polygons, and geometry errors will not be accepted.

d. Submission: The method for spatial data submission is a file geodatabase (GDB) compressed into a zip file and accompanying KMZ file(s).

e. Additional notes:
   - The Area of Interest boundary represents the total Project Area defined by unique Project Number.
   - One single or multi part polygon must be submitted for each Planning or Operational Treatment Unit; multiple single polygons cannot be associated to one Unit.
   - AOI, WMU, WRRU, Fuelbreak, FTU, and AMU spatial hectares must match the hectares stated on the maps and in the corresponding table(s).

D. Attribute Value Reference Table:

DATA_COLLECTION_METHOD	DESCRIPTION
Unknown	The data was acquired without details of the collection method.
Hand Sketch of any type	The data was hand sketched, either on an analog map or on-screen.
Non-corrected ground GPS	The data was captured with a GPS unit, at or in close proximity to ground level, but was not post-processed or was captured with a GPS unit incapable of doing differential GPS.
Non-corrected airborne GPS	The data was captured with a GPS unit, using an airborne UAV or craft, but was not post-processed or was captured with a GPS unit incapable of doing differential GPS.
Corrected ground GPS	The data was captured with a differential GPS unit, at or in close proximity to ground level, or was post-processed with information received from known reference stations to improve data accuracy.
Corrected airborne GPS	The data was captured with a differential GPS unit, using an airborne UAV or craft, or was post-processed with information received from known reference stations to improve data accuracy.
Digitized from aerial photo	The data was delineated from an orthophoto (aerial photography).
Processed IR image	The data was created using GIS analysis.
Processed scanned photo	The data was created using GIS analysis.
Derived from satellite imagery	The data was delineated from a satellite image.

Digitized from image	The data was delineated using photographs or images in stereo pairs.
Digitized other	The data was converted from an analog map into a digital format using a manual digitizing process.
Not Applicable	Use of this method assignment is discouraged unless none of the other methods apply.

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