SPRAY LAKE SAWMILLS

Chapter 7 – Plan Implementation and Monitoring

2021 Forest Management Plan

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One	Executive Summary		
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	Chapter	2	FMP Development
	Chapter	3	Forest Landscape Assessment
	Chapter	4	Summary of Previous DFMP
	Chapter	5	VOITS – Values, Objectives, Indicators and Targets
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1. FMP Components

1.1 Introduction

Previous chapters describe the process that led to the Preferred Forest Management Scenario (PFMS), which prescribes forest management activities for the next 20 years and outlines the general planning direction for the longer term.

Once approved, this FMP will replace the current DFMP, approved in May of 2007. The strategies outlined in this FMP will be followed by Spray Lake Sawmills (SLS) and quota holders within the B12 Forest Management Unit (FMU). This chapter provides details for implementation of the PFMS, including strategies to ensure Objectives and Targets are met.

The forest management strategies focus on the health and resiliency of the forest and its ability to support biodiversity, watershed health, recreation, and a vibrant forest industry.

As knowledge about forest management and forest ecology increases through advances in research and development, and technology, strategies can be adapted and improved with the ultimate goal of creating a healthier and more resilient forest landscape.

1.2 About this Chapter

This chapter summarizes the following information to successfully implement the FMP:

- FMP implementation commitments;
- Alberta's forest management planning hierarchy; and
- Operational planning guidance.

This chapter begins with a review of the planning hierarchy followed by a summary of the products developed during the planning process that will guide FMP implementation. The chapter concludes by addressing:

- Access management;
- Timber harvesting;

- Silviculture;
- Forest protection;
- Protection of forest resources;
- Biodiversity;
- Monitoring; and
- Management strategies.

1.3 Performance Monitoring and FMP Commitments

This chapter focuses on FMP implementation commitments and strategies. The commitments and strategies will become effective upon FMP approval and will remain effective for the duration of the FMP.

1.4 Managing Uncertainty

The FMP implementation period spans 20 years and therefore must be flexible to deal with the uncertainty that is inherent in any long-term planning process. Developments that may affect implementation include:

- New advancements, research results, events, and other changes not accounted for during FMP development; and
- Inaccuracy of long-term predictions.

The FMP includes several strategies to deal with uncertainty, for example:

- Allowable variance levels and associated reporting e.g. Spatial Harvest Sequence (SHS).

Another approach for managing unexpected events is adaptive management (D'Eon, 2008), which is described as a six-step cycle that involves assessing the problem, designing the plan, implementing the plan, monitoring the results, evaluating the outcomes, and then adjusting subsequent plans.

The following examples demonstrate how adaptive management applies to FMP implementation:

- Research and development – new knowledge and improved technology
- Stewardship reporting – produced after the fifth year of FMP implementation and can trigger needed changes for the remaining period.
- Public and First Nations consultation – ongoing engagement with stakeholders allows opportunities to identify and assess issues and design plans to addresses concerns.

Table 1-1. FMP uncertainty and potential responses

Event	Potential Impact and Response
Biodiversity management framework / linear footprint management planning	Regional Land-Use Framework plans may set thresholds and reporting requirements.
Droughts, high severity wildfire, snow damage, floods, insect and disease outbreaks and other natural disasters	In the event of significant natural disasters, plans for the salvage and successful rehabilitation of those areas may include the involvement of other operators. Government of Alberta support and approval will be required for this strategy to be successfully implemented.
Mountain Pine Beetle	Given the age of DFA pine forests, and the proximity to known infestations, there is potential for a future MPB outbreak.
Climate change policies	Forest management in Alberta is a highly regulated industry and changes to policy related to climate change could have a potential impact. Monitoring and developing a process to meet any changes to policy may materialize over the life of this plan.
Species recovery and or species decline	Changes in an individual plant or animal species population could influence changes in forest management approaches.

2. Planning Hierarchy

The Government of Alberta (GoA) is responsible for defining the forest management planning structure in Alberta. In addition to area-based planning, it has also introduced provincial strategies, such as integrated land management (ILM) and regional planning, to guide lower level plans and achieve more coordination between land users, with a view to minimizing environmental impacts and improving forest stewardship.

These concepts are embodied in lower-level plans required of timber harvesting operators within Alberta, including FMA holders: General Development Plans (GDP), Forest Harvest Plans (FHP), Annual Operating Plans (AOP) and Annual Silviculture Plans. GoA approval of these plans authorizes the companies to execute planned forest management activities for the stated timeframe.

Based upon a GoA framework and FMP direction, Spray Lake Sawmills works with the other operators and the GoA to develop timber harvest planning and operating ground rules (OGRs). OGRs guide the content and implementation of all operational plans.

2.1 Integrated Land Management

Integrated Land Management (ILM) is Alberta's strategic planned approach to managing and reducing the human-caused footprint on public land (Government of Alberta, Accessed May 2020). It is an over-arching strategy that guides all levels in the planning hierarchy. The goals of ILM are to foster a stewardship ethic among all land users and reduce land-use disturbances and footprint by requiring shared resource planning. Alberta's ILM policy informed the Land-Use Framework (LUF) regional plans that in turn steer the direction of the FMP and lower level plans.

2.2 Regional Planning

Alberta's LUF regional plans provide direction for ILM throughout the province. The SLS DFA intersects with the Red Deer, North Saskatchewan and South Saskatchewan LUF regions with the majority of the DFA falling within the South Saskatchewan LUF (*Chapter 3 – Landscape Assessment* Section 2.6 for more details). The 2014 – 2024 regional plan for the South Saskatchewan region was released in 2014 and amended in 2017. As these plans are completed, SLS will adjust the plans in its hierarchy, as needed.

2.3 Integrated Resource Plans

The Spray Lake Sawmills DFA is influenced by several sub-regional and local integrated resource plans that intersect with or surround the DFA:

Integrated Resource Plan – Sub-regional plans include:

- Kananaskis Country Sub-Regional Integrated Resource Plan
- Ghost River Sub-Regional Integrated Resource Plan
- Nordegg – Red Deer River Sub-Regional Integrated Resource Plan

Integrated Resource Plan – Local (surrounding the DFA):

- Eden Valley Local Integrated Resource Plan
- Bow Corridor Local Integrated Resource Plan

2.4 Forest Management Plan

The forest management plan (FMP) is a long-term, forest-level plan that:

- Provides long-term, general direction for forest management within the DFA, with more specific guidance for the FMP period;
- Establishes a set of values and objectives for the DFA and identifies indicators and targets (i.e. VOITs) for measuring the success of forest management activities over the FMP period (the preferred forest management scenario (PFMS) is derived from the VOITs);
- Identifies the monitoring requirements necessary to evaluate FMP indicators and targets;
- Determines the annual allowable cut (AAC); and
- Generates the spatial harvest sequence (SHS) for the FMP period that is consistent with the PFMS.

Successful implementation of the FMP relies on coordinated operational planning to translate the forest-level values, objectives and strategies into operational realities. Operational constraints may impact the ability of operators to fully implement the FMP. The impact of these constraints should be evaluated within the context of the overall FMP management objectives.

2.5 General Development Plan

Both FMA holders and quota holders are required to annually submit a General Development Plan (GDP). The GDP provides a comprehensive description of proposed harvest strategies, road building plans and reclamation operations, to assist in the integration of activities.

The GDP provides descriptions of the company's proposed timber harvest sequence, production objectives, summary of variance for existing FHPs and long-term access strategies for a five-year period. The GDP provides direction to GoA for issuing new dispositions in quota areas. It also prepares GoA for administering the integration of timber harvesting with other resource users.

The GDP reflects the objectives of the FMP and yet provides enough operational flexibility to allow changes in order to address emerging situations. There are two major components of the GDP:

1) Schedules:
    - Areas for harvest over the next 5 years and production summaries for each area

- Road planning and construction of Class I – III roads
- Status of current DLO applications
- DLO/LOC road monitoring and reclamation plan (including crossing) (may be submitted with the road plan in the AOP)
- Satellite yard volumes (proposed and actual)
- Variance Summary Table as per Table 2 in Section 4.1 of the Ground Rules

2) Maps should show the following:

- Mill location
- Proposed haul and silviculture access routes (existing and to be constructed)
- Satellite yard locations
- Timber dispositions to be operated (working circles)
- Other forest resource areas or facilities
- General location of planned reclamation and where reclamation has been completed

2.6 Forest Harvest Plan

The Forest Harvest Plan (FHP) details the timber harvesting operations identified for a specified area. FHPs are valid for five timber years. A timber year begins May 1st and ends April 30th the following year. The primary components of an FHP are a map along with a report that clearly documents the harvest area boundaries, roads and water crossings.

The number of hectares and cubic meters of saw logs are specified for each proposed harvest area. The SHS, which identifies where harvesting will occur for the 20-year term of the FMP, guides the preparation of the FHP. Indigenous, public and quota holder concerns identified through the FMP development process (see *Chapter 2 – FMP Development)* are incorporated at this stage of planning. Additional site-specific public consultation is gathered at the FHP level to supplement the FMP consultation.

After carefully considering the stakeholder comments from the June 11, 2013 Mixed Use Workshop, Collaborative Planning Sessions (CPS) were developed by the company. The program was reorganized in 2019 after several years of low interest/attendance due to participants wanting to discuss DFMP or OGR concerns rather than site-specific concerns. CPS's were held as independent sessions until 2019 and are now part of the annual open house in Cochrane.

SLS facilitates interested parties to review preliminary harvest designs on a forest compartment basis using GIS, the Forest Management Plan and General Development Plans. This step provides stakeholders with the opportunity to collaborate with SLS, prior to any field work or harvest plan submission to the government. If necessary, a field tour with stakeholders will be organized to address specific concerns on the ground.

SLS follows up with participants showing how the collaborative planning work was used to develop draft harvest design. Participant comments and SLS response are posted on the company website.

2.7 Annual Operating Plan

The annual operating plan (AOP) details the harvesting and road building activities proposed for the current year. It includes fire control and reforestation plans, which can be submitted individually under separate cover. Plans must be approved by the GoA before timber operations can begin.

2.7.1 Fire Control Supplement

A fire control plan is submitted annually to the GoA. It outlines all activities and preparations related to fire prevention, detection, reporting, pre-suppression and suppression.

The plan describes proposed operations, such as harvesting, planting, and surveying during the fire season, as well as locations of bush inventory and satellite volumes. Suppression training activities and fire equipment inventory are identified and included, along with detailed emergency contact information.

2.7.2 Silviculture Component

The annual silviculture plan (or reforestation program) contains reforestation prescriptions by stratum, and a schedule of treatments for the upcoming year. It identifies silviculture systems, strategies and tactics, and operational silviculture details for all new harvest areas.

It also may describe any silviculture treatments planned for existing regeneration, such as manual tending, as well as any reclamation activities that may be undertaken. The annual silviculture plan is essential to ensuring all blocks receive adequate reforestation within the provincially mandated timeframe of two years following harvest.

2.7.3 Road Use and Reclamation Plan

Roads are one of the most significant components of forest harvesting operations. Coordination and integration of road planning and construction plans with other resource operators will be part of the road planning process. Roads are constructed and reclaimed within the required time period, otherwise a disposition will be applied for.

2.8 Timber Harvest Planning and Operating Ground Rules

Timber Harvest Planning and Operating Ground Rules (OGRs) outline the standards and guidelines used in planning and conducting forest management operations. Their purpose is to provide direction to timber operators, setting standards and guidelines for timber harvest, road development, reclamation, reforestation and integration of timber harvesting with other forest uses.

The standards direct almost all components within the forest management planning hierarchy, including the GDP, FHP, AOP, and silviculture plan. The GoA provides a framework for the OGRs but requires FMA holders to develop FMP area-specific versions, usually within six months of FMP approval. The current set of OGRs was last revised in May of 2020, and after submission of the FMP the current OGRs for the DFA will need to be amended, where appropriate, to reflect the content of this FMP.

2.8.1 Grazing Interests

Spray Lake Sawmills integrates forest and range management by striving to develop co-operative, long-term relationships with grazing disposition holders. FMP VOIT # 29, identifies the requirement to integrate

other forest users, when planning forest management operations, including cattle grazing operations. As such, the Timber Harvest Planning and Operating Ground Rules (OGR's) state: *At the GDP, FHP and AOP stages of planning, the emphasis is to integrate harvesting, silviculture, and grazing schedules to ensure the sustainability of timber, forage, wildlife and watershed values (i.e., wildlife habitat, watershed protection). Specific harvesting and reforestation operations and grazing systems would be identified within components of the AOP. Effective communication between the timber and grazing operators is necessary. Discussions held early in the planning process are intended to enable the grazing disposition holder and the forest operator to work co-operatively minimizing the disruption to their individual operations. Integration of Grazing and Timber Activities (Directive SD 2011-03) or successors, will provide direction to guide the overlapping operations of grazing and timber disposition holders. GROUND RULES 5.4.1 The forest operator shall conduct all operations in accordance with the Grazing Timber Integration Manual and Directive SD 2011-03 – or successors. 5.4.2 Natural meadows and other non-forested rangeland areas > .4 ha not identified by AVI but discovered during operations, shall be treated according to 5.4.1 and External Information Letter 2010-02 Fescue Grassland Information Letter – Principles for Minimizing Surface Disturbance. 5.4.3 The company shall not perform any silviculture treatments on natural meadows and other non-forested rangeland areas occurring within cutblocks unless otherwise approved by Alberta. 5.4.4 The company shall not deck timber within natural meadows or other nonforested rangeland areas, unless otherwise approved by Alberta.*

2.9 Reporting

Performance monitoring and reporting will be conducted at both the operational and strategic levels through Forest Harvest Plans, Annual Operating Plans, General Development Plans and the Stewardship Report. Reporting requirements were established as a component of the VOITS (*Chapter 5 – Values, Objectives, Indicators and Targets*).

Spray Lake Sawmills and the Plan Development Team (PDT), along with First Nations, the Public Advisory Committee, and public stakeholders, all have had roles in developing the VOITs Chapter 5 provides the implementation and monitoring commitments for each VOIT, including details on reporting requirements, responsibilities, and timeframe (i.e. FMP or Stewardship report). For VOITs where it was required, reporting based on the PFMS forecasting can be found in *Chapter 5 – Values, Objectives, Indicators and Targets* Section 4.

Many of the VOITs are addressed through successful implementation of the OGRs but some require specific strategies and procedures to guide successful implementation. All of the VOITs are summarized in Table 2-1, with the specific strategies provided later in this chapter. VOIT reporting is completed by SLS. Where required, all operators will provide the necessary data.

Table 2-1. Overview of VOIT implementation

VOIT	VOIT description	Influences what?	Strategy to implement
1 - 1.1.1.1	Seral stage distribution	FMP – PFMS & SHS	Follow SHS, report at next FMP
2 - 1.1.1.2a	Opening patch sizes	FMP – PFMS & SHS	Follow SHS, report at next FMP
3 - 1.1.1.2b	Landscape fragmentation	FMP – PFMS & SHS	Follow SHS, report at next FMP
4 - 1.1.1.3a	Minimize primary access (DLO)	Access & Road Corridor Plan; OGR	Access strategy (Access & Road Corridor Plan), reporting at next Stewardship report and FMP
5 - 1.1.1.3b	Minimize seasonal/temporary access	OGR - access	Access strategy, annual tracking and reporting at next Stewardship report

VOIT	VOIT description	Influences what?	Strategy to implement
6 - 1.1.1.4	Uncommon plants	OGR - harvesting	Pre-harvest block assessment, annual tracking with reporting at next Stewardship report
7 - 1.1.1.5a	Wildfire habitat	OGR - harvesting	Fire Salvage Planning and Operations - Directive No. 2007-01, reporting at next Stewardship report
8 - 1.1.1.5b	Blowdown habitat	OGR - harvesting	Forest Harvest Plan, reporting at next Stewardship report
9 - 1.1.1.6	Riparian habitat	OGR – harvesting & tending	OGR, reporting at next Stewardship report
10 - 1.1.2.1a	Stand level retention	OGR - harvesting	Structure retention strategy, reported at Stewardship report
11 - 1.1.2.1b	Downed woody debris	OGR - harvesting	OGR, reporting at next Stewardship report
12 - 1.1.2.2	Sensitive sites: mineral licks, nests, dens	OGR – harvesting & silviculture	OGR, SOP, reporting at next Stewardship report
13 - 1.1.2.3	Minimize water crossing impacts	OGR - water crossing	OGR, code of practice for watercourse crossings, reporting at AOP and next Stewardship report
14 - 1.2.1.1	Wildlife species and fish habitats	PFMS – wildlife strategies SHS, OGR: access	Follow SHS, access strategy, wildlife strategies (Grizzly Bear, Barred Owl, marten, songbird, Whitebark and Limber Pine) report at next FMP
15 - 1.3.1.1	In-situ genetic conservation	CPP, SHS	Coordinate with CPP partners, reporting at next Stewardship report
16 - 1.3.1.2	Ex-situ genetic conservation	CPP, seed requirements and collection	Once a controlled parentage program becomes available, collect seeds from underrepresented seed zones and species combination can be reported at next Stewardship report
17 - 1.4.1.1	Transboundary values	PFMS	Summary of consultation (as applicable), at next Stewardship report
18 - 2.1.1.1	Reforest all harvested areas	PFMS, OGR - silviculture	Annual Silviculture Plan, updating ARIS, reporting at next Stewardship report
19 - 2.1.1.2	Obtain MAI targets	PFMS, regenerated yield curves, Annual Silviculture Plan	AOP, FMP Silviculture direction, Annual Silviculture Plan, Reforestation standards of Alberta, updating ARIS, reporting at next Stewardship report
20 - 2.1.2.1	Limit conversion of productive landbase	PFMS	GoA tracking of withdrawals and areas returned to the landbase, reporting at next Stewardship report
21 - 2.1.2.2	Track insect and disease	GoA health surveys	Reporting at next Stewardship report
22 - 2.1.3.1	Control non-native plants	Noxious weed program	Adherence of the OGRs, tracking summary of OGR at next Stewardship report
23 - 3.1.1.1	Minimize roading and bared area	OGR - access	OGR, FHP, reporting of ground rule deviation at stewardship report
24 - 3.1.1.2	Minimize soil erosion	OGR - soil guidelines	OGR, reporting at Stewardship report
25 - 3.2.1.1	Limit water yield increases	PFMS, SHS, OGR	Follow SHS, reporting at next Stewardship report and FMP
26 - 3.2.2.1	Maintain riparian buffers	OGR – riparian, SHS	OGR, reporting at next FMP

VOIT	VOIT description	Influences what?	Strategy to implement
27 - 5.1.1.1a	Appropriate AAC	PFMS	FMP approval
28 - 5.2.1.1	(a) Reduce Fire Behavior Potential (FBP) in community zones (b) Reduce FBP across the DFA	PFMS, SHS PFMS, SHS	Follow SHS, reporting on area harvested at Stewardship report Follow SHS, reporting on area harvested at Stewardship report
29 - 5.2.2.1	Integrating other uses	Operational planning (GDP, FHP, AOP)	FMP Communications Implementation Plan, FMP Chapter 7, reporting at Stewardship report
30- 5.2.3.1	Maintain LRSYA	Regenerated yields, silviculture	Post-harvest transitions, Silviculture plan, RSA program, reporting at next Stewardship report and FMP
31 - 6.1.1.1	Indigenous Consultation	VOITs, Indigenous consultation plan	Consultation plan, Record of Consultation (ROC) log for the GDP, reporting at Stewardship report
32 - 6.2.1.1	Public input opportunities	VOITs, Public consultation plan	Public Involvement Program, reporting at next Stewardship report

2.10 Strategies for Guidance

The following list represents some of the primary strategies and guidance documents that were developed as part of the FMP process:

- Annual Allowable Cut (Section 4.1);
- Communication and Consultation Plans (Annex II);
- Fire Protection Strategy (Section 6.1);
- Forest Health Strategy (Section 6.2);
- Watershed Management Strategy (Section 7.2);
- Structure Retention Strategy (Section 4.6 and Appendix I – Structure Retention Strategy).
- Grizzly Bear Habitat Strategy (Section 8.2.1);
- Barred Owl Habitat Strategy (Section 8.2.2);
- American Marten Strategy (Section 8.2.3)
- Songbird Strategy (Section 8.2.4)
- West Slope Cutthroat Trout and Bull Trout Strategy (Section 8.2.5);
- Whitebark Pine and Limber Pine Strategy (Section 8.2.6)
- Visual Quality Strategy (Section 4.9 and Appendix II – Visual Quality Strategy); and
- FireSmart Strategy (Appendix III – B12 FMU FireSmart Management Process).

2.11 Preferred Forest Management Scenario (PFMS)

The preferred forest management scenario (PFMS) is the outcome of the planning process and represents the forest management objectives and strategies developed for the 2021 FMP. VOITs guide both the development of the PFMS and its implementation.

The PFMS is modeled in the forecasting stage and implemented using strategies and tactics described throughout Chapter 7. The AAC, SHS, road access, and harvesting and reforestation strategies are all part of the PFMS. The PFMS will be successfully implemented through the forest management strategies referenced in this chapter, enabling Spray Lake Sawmills to achieve its sustainable forest management objectives.

2.11.1 Annual Allowable Cut (AAC)

The GoA establishes the annual allowable cut (AAC) based on the timber supply analysis, which is part of the PFMS. Upon approval of the timber supply analysis, an AAC will be established for FMU B12 and allocated to each operator based on their timber rights. The AAC is regulated through 5-year quadrant time periods, determined by the GoA for each operator. Strategies for charging the timber harvested by each operator are included in Section 4.1.5.

2.11.2 Spatial Harvest Sequence

The Spatial Harvest Sequence (SHS) is a key component of the FMP, providing linkages from the FMP to operational planning and implementation on the ground. The SHS file describes the stands that are to be harvested over the first decade (i.e. timber years 2021 to 2031) and the stands that are likely to be harvested over the second decade (i.e. timber years 2031 to 2041). Spray Lake Sawmills, Sundre Forest Products, J.H. Neilson Forest Products, Precision Forest Industries, and Canfor at the time of writing this plan have timber rights within the B12 FMU and have SHS associated with their rights.

There has also been SHS allocated to the Community Timber Program (CTP). The SHS is derived from the PFMS and reflects the selected management strategies, VOITs and the AAC. Adherence to the SHS on the ground ensures that FMP targets can be achieved.

3. Access Planning and Development

The planning, construction, maintenance and reclamation of access roads plays a key role in forest management. Roads provide access for personnel and equipment to plan, harvest, reforest and monitor activities. Road construction, maintenance and reclamation are conducted to minimize erosion, slumping, and to protect water quality.

3.1 Access Planning

Currently, a combination of forestry, oil and gas, municipal and provincial roads provide access to and throughout the FMP area. In keeping with past practices, operators intend to limit construction of new permanent access within the FMP area.

Access planning strategies are utilized by the operators to ensure planned access meets the following objectives:

1. Minimize area of productive forest lost to access development;
2. Integrate road use;
3. Maintain soil and water quality;
4. Maintain habitat, wildlife and other resource values (i.e., limiting open access);
5. Provide safe roads for staff, contractors, other commercial users and the public;
6. Minimize access development costs;
7. Reclaim roads when appropriate; and
8. Minimize impacts to wetlands.

Access planning strategies include:

- Reuse of existing access;
- Improve/upgrade existing access (if required);

- Minimize length of new road construction;
- Joint access development;
- Minimize the number of watercourse crossings;
- Select appropriate watercourse crossing locations and structures;
- Use of best management practices;
- Reclaim temporary roads that are no longer needed; and
- Follow requirements associated with access control, timing constraints, sightability, etc.

Strategies that address safety concerns include:

- Appropriate road signage; and
- Stakeholder consultation/communication regarding log haul.

Evaluation of the of length of time an access road is needed is a part of forest management and situations may arise where existing access options do not meet the needs of SLS. In this situation SLS would review options based on current legislative, forest policy and OGR requirements to determine the best access strategy. Additional details regarding SLS road planning, construction, maintenance, reclamation and monitoring can be found in the SLS Operating Ground Rules.

3.2 Watercourse Crossings

Watercourse crossings, if not properly designed, can create physical barriers to the movement of fish and other aquatic biota along watercourses. Roads and ditches are designed to intercept and transport sediments away from crossing sites to maintain watercourse integrity. For example, bridges and other fish passage compatible crossing structures, along with sediment trapping wing walls, are used to protect the integrity of perennial watercourses.

3.3 Corridor Plan

As part of the FMP, existing access infrastructure throughout the DFA and how the SHS can be accessed was reviewed. Using GIS, we reviewed how the midpoints of different watersheds within the compartments could be accessed.

No permanent roads are anticipated for the current SHS with the current conditions. Figure 3-1 shows the location of existing access infrastructure that will be utilized on the DFA area, including possible new short-term access corridors.

The roads presented on the map below may not be drivable by an on-highway vehicle due to access controls or unmaintained sections. Access management strategy for control of access is a complicated and dynamic process in terms of both implementation and enforcement, involving road reclamation, gates and other physical barriers. As new roads are developed, SLS will work with GoA to ensure that access controls are being put into place as required.

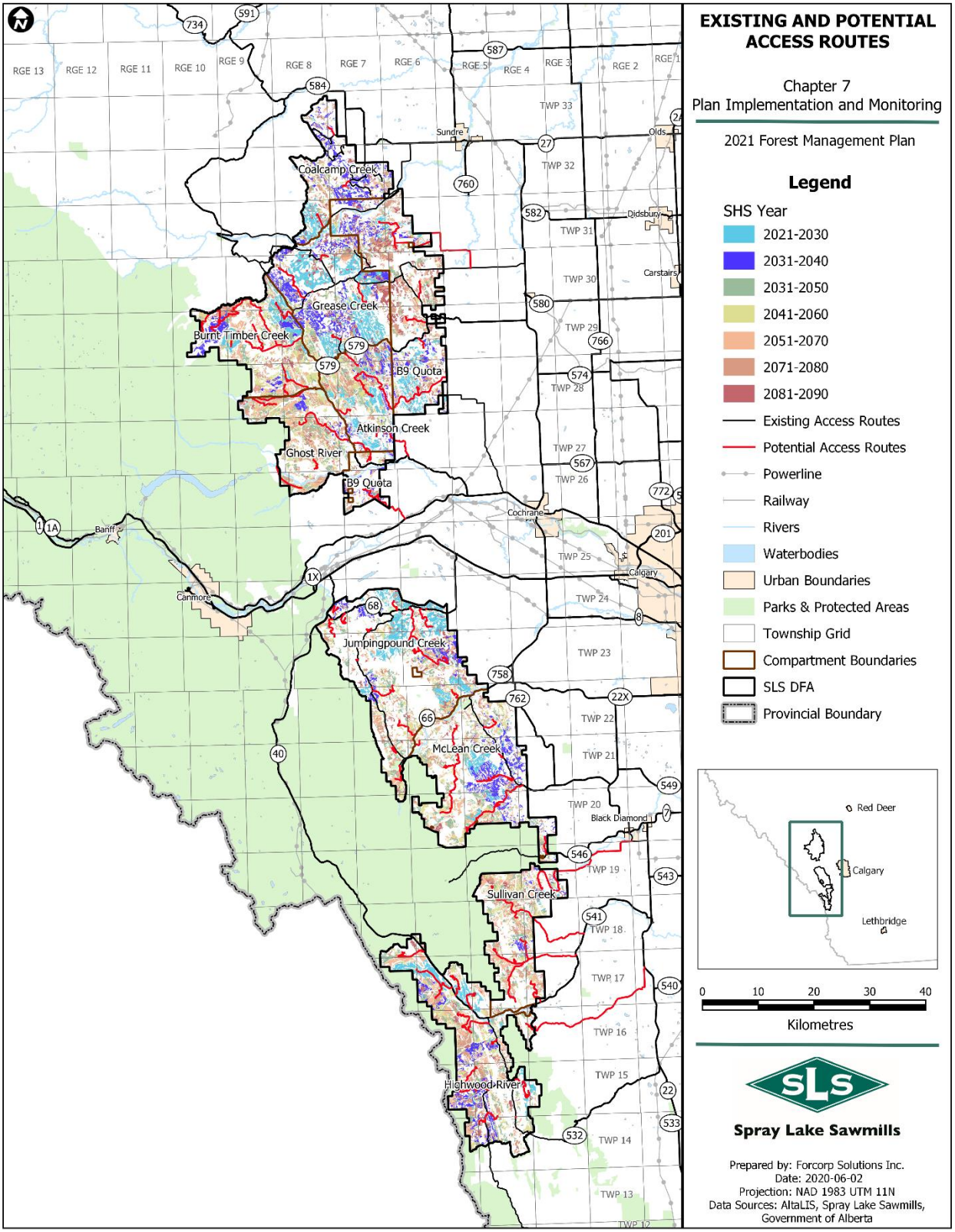

Figure 3-1. Spray Lake Sawmill's main access corridors

4. Timber Harvesting

4.1 Annual Allowable Cut

Upon the GoA's approval of the FMP, the Annual Allowable Cut (AAC) will be established from the recommended harvest levels associated with the PFMS.

4.1.1 Recommended AAC Levels

The recommended coniferous and deciduous AAC levels for the 2021 FMP period (May 1, 2021 to April 30, 2031) for FMU B12, at 15/11/30 utilization for conifer and 15/10/30 for deciduous, are summarized in Table 4-1. Further details on the harvest levels and AAC determination are documented in *Chapter 6 – Preferred Forest Management Strategy*.

Table 4-1. Spray Lake Sawmills 2021 FMP Recommended AAC

Company Name	Disposition ID	FMU	Landbase Management Type	Source	AAC Volume Allocation		Decade 1 [1]		Decade 2 [2] Volume (m^3)
					%	m^3	Unused Volume (m^3)	Decade Volume (m^3) [4]	
Conifer Allocations									
Spray Lake Sawmills (1980) Ltd	FMA0100038	B12	Single Combined	FMA-Only	83.5	346,320	250,000	3,713,200	3,463,200
Spray Lake Sawmills (1980) Ltd.[3]	CTQB120001	B12	Single Combined	Non-FMA	7.9	32,580	-	325,800	325,800
Sundre Forest Products Inc.[5]	CTQB120002	B12	Single Combined	All-FMU	0.8	3,500	-	35,000	35,000
J.H. Neilson Forest Products Ltd.[5]	CTQB120003	B12	Single Combined	All-FMU	0.8	3,500	-	35,000	35,000
Precision Forest Industries Ltd.[5]	CTQB120004	B12	Single Combined	All-FMU	0.8	3,500	-	35,000	35,000
Precision Forest Industries Ltd.[5]	CTQB120005	B12	Single Combined	All-FMU	0.8	3,500	-	35,000	35,000
Canadian Forest Products Ltd.[5]	CTQB120006	B12	Single Combined	All-FMU	3.3	13,810	-	138,100	138,100
Community Timber Program – Old B9 FMU[5]	Permits	B12	Single Combined	All-FMU	0.8	3,500	-	35,000	35,000
Community Timber Program – Old B10 FMU[5]	Permits	B12	Single Combined	All-FMU	1.2	4,790	-	47,900	47,900
Total Coniferous						415,000	250,000	4,400,000	4,150,000
Deciduous Allocations									
Spray Lake Sawmills (1980) Ltd	FMA0100038	B12	Single Combined	FMA-Only	85.1	31,678	21,786	338,566	316,780
Spray Lake Sawmills (1980) Ltd[3]	DTAB120001	B12	Single Combined	Non-FMA	13.6	5,071	-	50,710	50,710
Community Timber Program – Old B10 FMU[5]	Permits	B12	Single Combined	All-FMU	1.3	500	-	5,000	5,000
Total Deciduous						37,249	21,786	394,276	372,490

[1] Decade 1 is Quadrant period: May 1, 2021 - April 30, 2026 and Quadrant period: May 1, 2026 - April 30, 2031.
[2] Decade 2 is Quadrant period: May 1, 2031 - April 30, 2036 and Quadrant period: May 1, 2036 - April 30, 2041.
[3] Quota calculated from 20-year SHS from non-fma area.
[4] Total volume, including Unused Volume.
[5] Volume based license.

4.1.2 Deciduous Volume Management

As identified in the Forest Management Agreement (FMA) 14(4), deciduous timber will be managed for its contribution towards other resource values on a landscape basis. There is no obligation to utilize or salvage the deciduous timber resources until such time as the Company decides to harvest and utilize deciduous timber from the forest management area.

With the lack of a local market for deciduous, SLS has not been utilizing deciduous volume. Utilized, as understood in the FMA, means to make use of for commercial purposes. SLS will need to develop a strategy to track and report merchantable deciduous that is cut, hauled and milled into a commercial product if a local demand develops. Deciduous material used in road building is addressed in section 4.1.5 of this chapter.

There is a requirement, under the FMA, for the sequencing of up to a total combined volume of 500 m^3 of merchantable deciduous timber annually for the deciduous Community Timber Program (CTP). This was accomplished by designating an area within the McLean creek compartment as the deciduous CTP sphere and scheduling approximately 66 ha of deciduous stands and 21 ha of mixedwood stands for harvest in the PFMS. Additionally, 96 ha of deciduous dominant stands were forced into period 1 of the SHS as part of the stand fell within a laid-out harvest area boundary.

Outside of the deciduous CTP sphere and the laid-out block boundary areas, no other deciduous landbase was sequenced in the PFMS. If requested by the Minister, SLS will make available to Sundre Forest Products 15,000 m^3 of merchantable deciduous volume annually. This is available as incidental deciduous volume generated from the conifer landbase.

4.1.3 Previous Quadrant Unused Volumes

As part of the PFMS a prediction of previous quadrant unused volume was spatially accounted for in the SHS and the associated non-timber assessments. At the time of PFMS development, the anticipated unused volume for the 2016-2021 quadrant is approximately 250,000 m^3.

This strategy was supported by the Forest Stewardship and Trade Branch of the Alberta Government on December 16th, 2019, noting that the actual unused volume request needs to be based on the formal timber production audit results, which is anticipated to be completed at the end of the quadrant in 2021.

4.1.4 AAC Reductions in TSA

The following AAC reductions were accounted for in the modeling process during PFMS development:

- Cull (1.23% conifer, 9% deciduous)
- Seismic lines (varies by yield curve approx. 1-2% for existing seismic lines)
- Structure Retention (3%) – refer to the Stand Level Structure Retention Strategy (Appendix I).

4.1.5 AAC Tracking

All timber harvested on the DFA will be charged according to the following procedures:

- Mill Deliveries – each operator must deplete the volume harvested from FMU B12 against their AAC Allocation. This volume is determined through an approved GoA methodology.
- Watercourse and Pipeline Crossings – each disposition holder will tally the number of box cribs built each year. A merchantable volume per crossing will be calculated. Deciduous timber used

counts toward the deciduous AAC depletion. Volume is submitted on a TM-7 at the end of each timber year or other date sanctioned by the GoA, as long as all volume is reported by the end of the quadrant.

4.1.6 Timber Salvage

Periodically, land is removed from the B12 FMU for other Land-Use Dispositions. This process will proceed in accordance with GoA's Directive No. 2008-03: Industrial Timber Salvage Chargeability.

- The timber salvaged from the land withdrawal disposition is charged to the forest tenure holders AAC; for both the FMA and non-FMA portion of the B12 FMU.
- There are three different options for determining timber volumes depending on the situation and the data available:
    - Provincial Timber Damage Volume Tables;
    - FMA/FMU Specific Volume Tables; and
    - Weigh Scale Method.
- The chargeable volume of timber will follow the Scaled Chargeability procedures (B.2) of directive No. 2008-03:
    - Each tenure holder has agreed to accept industrial salvage volume with the volumes being chargeable production based on the amount of timber delivered and scaled at the mill;
    - Only scaled volume for industrial dispositions within the FMA / Non – FMA area in which the tenure holder has rights will be assessed as chargeable production; and
    - When the tenure holder waives or opts not to accept merchantable timber salvage from within the FMA or FMU in which the tenure holder has timber rights this un-used volume will be chargeable production based on one of the two table approaches.
    - Tenure holders will be expected to track and report to the GoA salvage volume received by the end of the timber year on a TM7 form.
- SLS or the other tenure holders may wave their interest in salvage volume and/or agree to the volume being destroyed or directed to another mill.
    - In such a case, since SLS had the opportunity to utilize the wood but opted to not accept the timber, this volume will be chargeable production against SLS's AAC using the Provincial Timber Damage Volume Tables if the salvage is not accepted by any of the tenure holders in the B12 FMU; and
    - The opportunity for salvage must be presented to SLS and then the other tenure holders based on proximity of the disposition to the tenure holders processing facility. If the salvage volume is waved it must be done by SLS or the other tenure holders in writing to be considered valid.
- Companies desiring a disposition within the B12 FMU area must provider notification to SLS and establish a Master Land Withdrawal Agreement Prior to conducting operations. SLS must be notified when the construction or clearing for the activity takes place.

4.2 Harvest System and Methods

Spray Lake Sawmills uses a variable edge, patch harvest system that seeks to follow existing natural stand patterns whereby structure is left standing throughout the harvest areas (structure retention).

Generally, SLS practices stump-side processing, where limbs and branches are removed from the tree (processed) where the tree is felled. This allows for greater retention of moisture on the microsite, more natural seeds, and the accumulation of organic matter and nutrients through the decomposition of the residual material.

Both tree-length and cut-to-length systems are used, but at this time, tree-length is the predominate system.

4.3 Spatial Harvest Sequence (SHS)

The SHS is a product of the FMP process that supports non-timber assessment values that have been modeled (e.g. Grizzly Bear, songbirds). Adherence to the SHS ensures these values are being maintained according to thresholds approved by the GoA. The SHS exists both as a physical paper map within the FMP and in digital format. The SHS is divided into two periods: the first ten years (May 1, 2021 to April 30, 2031) and the second ten years (May 1, 2031 to April 30, 2041). Operators have been assigned SHS stands, dictating where harvesting will occur over the designated timeframes.

Factors outside of SLS control (e.g. Mountain Pine Beetle, forest fires) may lead to SHS variances. If these variances occur, they will be managed through processes outlined in the SLS OGRs.

4.4 Harvest Season

Spray Lake Sawmills conducts its harvest operations year-round with the exception of spring break-up. Harvesting that occurs during the summer months will be conducted in areas that have soil characteristics that are naturally resistant to disturbance. Harvesting efforts in the winter allows SLS to operate in a greater variety of sites because of the frozen ground conditions.

4.5 In-block Roads

Conducting forest harvesting operations requires development of temporary roads within harvest blocks. Spray Lake Sawmills will attempt to minimize the amount of area that is disturbed during operations. In-block roads that are reclaimed, are considered part of the block for silviculture operations and when RSA surveys are completed.

The total area covered by temporary roads, bared processing areas, and soil displaced during timber harvesting operations shall not exceed 5% of each harvest area without Alberta's approval. Blocks less than 7 ha or narrow blocks (averaging less than 100 metres from boundary to boundary) may exceed 5% with these blocks reported on the as-built.

4.6 Structure Retention

Emulating natural disturbances is a key component of sustainable forest management. For the rocky mountain and foothills forest of Alberta, the predominant natural disturbance agent is fire. Historical fire patterns and the forest structures and patterns they produce are commonly used as a guide for replicating natural disturbance.

Retention of structure is a component of natural disturbance, since wildfire often leaves patches of standing trees throughout the disturbance. Spray Lake Sawmills, in conjunction with the PDT, developed a Structure Retention Strategy to guide retention placement, measurement and reporting, and

reconciliation of merchantable timber volumes harvested in the DFA. The Structure Retention Strategy applies to all timber operators harvesting in the DFA (see *Appendix I – Structure Retention Strategy*).

4.7 Harvest Opening Inspections

Companies carry out inspections of active timber operations and report this information to GoA, to demonstrate compliance with the OGRs. Minimum inspection criteria includes:

- Area associated with in-block roads and landings;
- Presence of rutting;
- Adherence to utilization requirements;
- Maintenance of riparian buffers;
- Adherence to structure retention targets; and
- Adherence to any special conditions.

Spray Lake Sawmills continually monitors its harvest and silviculture operations, to ensure compliance with the Timber Harvest Planning and OGRs and conducts formal post-harvest inspections.

4.8 Non-Timber Assessment (NTA) Values

Non-timber assessment (Government of Alberta, 2019) values were modelled during SHS development but must also be addressed during forest harvest plan development. In addition to OGRs, FMP specific strategies were developed to guide harvest planning. These strategies are described in Sections 6, 7 and 8.

4.9 Visual Quality

The Spray Lake Sawmills approach to visual quality is to plan forest activities that are compatible with the character of the DFA landscape. A healthy forest ecosystem depends on a continuous cycle of renewal. Disturbances such as fire, insects, disease and blowdown are natural events that create forest renewal and ecosystem diversity.

In a managed forest, such as the DFA, harvesting emulates natural disturbance patters because harvesting removes merchantable trees to create forest renewal. A well-managed forest compliments natural disturbance with wise use of forest resources. Many of the areas within the DFA are at risk to Mountain Pine Beetle infestation and high severity wildfire. Both disturbances present the most significant threat to visual quality.

4.9.1 Visual Quality Mitigation

Visual quality management measures are to be considered for high visual sensitivity harvest areas, located within the foreground. As operational forest harvest plans are drafted; harvest areas with high foreground visual quality rankings will be assessed and consulted on to identify mitigation measures and to reduce potential adverse visual quality impacts.

4.9.2 Visual Quality Measures:

The following measures will be taken:

- High sensitivity visual quality inventory and consultation as completed as part of the 2021 FMP;
- High mid-ground and background areas will not be considered visually sensitive unless re-designated as sensitive during operational planning and public consultation;
- The primary means by which visual quality measures will be accomplished is through operational planning. Visual quality was not incorporated into SHS development.
- Mitigation measures to reduce the impacts to 'high sensitivity visual quality' foreground harvest areas may include (FHP process):
    - modification of harvest boundaries;
    - utilization of topography;
    - application of various structure retention approaches;
    - modification of road locations; and
    - use of visualization computer modeling to evaluate various layout options.

Full details on the Visual Quality Strategy can be found in *Appendix II - Visual Quality Strategy*.

4.10 Seismic Lines

Historical footprints that are adjacent to or within a harvest block will be evaluated for reforestation capacities. As part of the timber supply analysis, seismic lines were not assumed to regenerate (see *Annex VI – Timber Supply Analysis* Section 4.6). The decision is a precautionary approach as several of the linear features are used by ATVs when the Public Land Use Zone (PLUZ) permits motorized recreation. Operationally, SLS will evaluate seismic lines on a case-by-case basis and reforest seismic lines that are not active trails as practicable. Legislated regeneration surveys (RSA) will be applicable to both reclaimed and un-reclaimed seismic lines within harvest areas.

5. Silviculture Program

This section formalizes Spray Lake Sawmills' reforestation objectives for the DFA. Silviculture strategies are aligned with harvesting and strata transitions used in the PFMS (*Chapter 6 – Preferred Forest Management Scenario*) and Timber Supply Analysis (TSA, *Annex VI – Timber Supply Analysis*).

5.1 Reforestation

5.1.1 Objectives

The reforestation objectives are twofold:

- To ensure that harvested areas are prepared to establish and grow conifer seedlings according to the assumptions used in forecasting and the PFMS; and
- To ensure that the legislated requirements are met as per the Forests Act, the Timber Management Regulations and the Forest Management Agreement.

Lodgepole pine and white spruce cones are sourced from local forests, suited to harvest site growing conditions. Cones are processed, the seed is extracted and then stored at the Alberta Tree Improvement and Seed Center. The seed is used as required to grow seedlings in Alberta tree nurseries. Presently, no chemicals, herbicides or pesticides are used by SLS in the forest.

During the harvest process, treetops and limbs are retained on site for nutrient cycling. Scarification creates favorable seed beds for natural regeneration and ideal planting spots for planted seedlings. The seedling microsites provide added moisture and shade as well as wind and frost protection. Native herbaceous plants, hardwoods and shrubs also benefit from scarification, thereby increasing harvest area biodiversity.

Scarification also has added benefits in breaking down fuel continuity, thereby enhancing fire prevention and control efforts. Every June, when soil temperatures and soil moisture are favorable, trees are planted by hand in microsites, to promote reforestation success.

Establishment surveys are legislated requirements detailed in the Timber Management Regulation. The surveys must be completed no sooner than four years and no latter than eight years after the end of the timber year of harvest. Reforested areas must achieve both a specified stocking level and a minimum level of growth performance.

Performance surveys are also legislated requirements detailed in the Timber Management Regulation. The surveys must be completed by the fourteenth year after harvest.

5.1.2 Responsibilities

The Timber Management Regulation 141.1(1) requires reforestation treatment within two years, beginning after the end of the year of harvest. Reforestation levels must meet GoA reforestation standards.

5.1.3 Growth Targets

PFMS reforestation targets were developed following the GoA Reforestation Standard of Alberta (RSA) policies. Targets are expressed as Mean Annual Increment (MAI) values for each of the reforested strata (Table 5-1). All operators are required to adhere to the currently approved RSA program to manage MAI targets.

Table 5-1. RSA MAI performance targets

BCG	Regen. Stratum	Yield Curve	Yield Type	Culm. Age	Culmination MAI (m^3/ha/yr)		
					Conifer	Deciduous	Total
D	Hw	N_HW	DEC - Basic	90	0.65	1.29	1.94
CD	PlHw	N_MIX_PL	CON - Basic	100	1.16	0.79	1.95
DC	HwPl	N_MIX_PL	CON - Basic	100	1.15	0.79	1.94
CD	SwHw	N_MIX_SX	CON - Basic	100	1.15	0.79	1.94
DC	HwSx	N_MIX_SX	CON - Basic	100	1.15	0.79	1.94
C	Sw	N_SW	CON - Basic	100	2.00	0.14	2.14
C	Pl	R_PL	CON - RSA	100	2.94	0.12	3.06

In addition to the MAI targets, the operators are expected to meet species proportions for conifer and deciduous, as detailed in each of the regenerated stand trajectories documented in the silviculture matrix (Table 5-2).

5.2 Treatments

5.2.1 Silviculture Systems

Harvest systems are designed to maximize sunlight for the establishment of regeneration. Sequence patch cutting (also known as clear-cut with retention) is the primary system.

Silvicultural systems focus on both the harvest and reforestation components of forest operations. Both are carefully chosen with sustainability as the key consideration. Harvesting addresses all of the steps from cutting the trees to moving the logs to roadside for loading and hauling. Selected systems must match the biological needs of the tree species planned for harvesting and the specific growing conditions of the harvest site.

The amount of light, moisture, and frost exposure of the forest floor following harvest are key factors that can affect reforestation success. The goal is to ensure each area harvested can be successfully regenerated so that new forests can grow.

Lodgepole pine leading stands are the dominant forest cover type found on the DFA. As such, sequenced patch cutting is the preferred harvest method. This approach best emulates stand replacement fire dominated natural disturbance regimes, provides the conditions preferred by Lodgepole pine, and ensures growth and yield targets are met.

Lodgepole pine seedlings have a biological need for direct sunlight in order to survive and thrive. A disturbance that removes the forest canopy, such as patch cutting or fire, will promote lodgepole pine regeneration.

Spruce grows in either full sunlight or partial shade and harvest systems can be adapted to address this characteristic. Regardless of species, appropriate harvest systems must consider the other values to be protected as well as promoting rapid regeneration of the harvested area.

Most harvested areas will be replanted to ensure adequate stocking of the site. Generally planting relies on a mix of white spruce and lodgepole pine, collected from mature trees within the same seed zone.

For the CTP program, regeneration strategies will be the responsibility of the owner of the harvest area, who have the option of paying the reforestation levy to the Forest Resource Improvement Association of Alberta to complete the silviculture requirements.

The operators are to meet the harvesting and seedling density commitments made in Table 5-2 for FMU B12. In some cases, harvesting and seedling density commitment adjustments may be made for a variety of reasons, such as:

- Ecological site conditions;
- Reforestation strata balancing requirements;
- Insect or disease considerations;
- FMP strata transitions assumptions; and
- Availability of seedlings.

A summary of the proposed silviculture treatments, by strata, is presented in Table 5-2 and the current seed supply inventory is provided in Table 5-3. Table 5-3 represents the minimum density when planting, actual densities planted are often higher, typically around 1600 stems / ha.

Table 5-2. Silviculture Matrix for FMU B12

Important Note	SLS makes all silviculture treatment decisions for each block harvested based on a post harvest assessment. These are ideal, general silviculture strategies. Local site conditions may require different site-specific strategies.
FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**Hw**
FMP Yield Strata Transition Sources (Regenerating Strata)	N_HW
Managed FMP Yield Strata Landbase Designation Code	TBD
Stand Structure (Species Proportions)	Deciduous (D) by stocking at Establishment and by crown closure/density at Performance.
Limitations to Crop Establishment (Site, Climate)	Shallow soils, winter desiccation, moisture deficit, drying winds, feral horses, livestock, wildlife, grass.
Silviculture System	Clear-cut. Clear-cut with retention. Understorey avoidance where feasible. Stumpside harvesting. Little harvesting of deciduous planned.
Site Preparation	Mechanical site prep to create microsites and expose mineral soil for existing seed on site to germinate. Debris required on site to provide micro sites for seedling establishment and nutrient availability. Site preparation is planned for all areas but may not be completed due to extreme steepness or sensitive areas. Site preparation may not be completed where there are specific conflicting land uses or direction from the government.
Seedling Establishment (includes LFN)	LFN
Seedling Density (SPH target per species type)	Deciduous = expect natural growth dynamics of pioneer deciduous to yield densities >10,000 sph from suckering to capture site and reduce effects of competition
Reforestation Phase Intervention (Post-seedling establishment)	Vegetative competition may be a factor affecting survival in the regenerating stand. May fill-in plant conifer if required to meet 80% minimum stocking standards (RSA). Let it Grow (LIG) strategy is viable where under height seedlings occur. Density controls may be used if required.

FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**HwSx**
FMP Yield Strata Transition Sources (Regenerating Strata)	N_MIX_SX
Managed FMP Yield Strata Landbase Designation Code	TBD
Stand Structure (Species Proportions)	Mixed coniferous (DC) by stocking at Establishment and by crown closure/density at Performance.
Limitations to Crop Establishment (Site, Climate)	Shallow soils, winter desiccation, moisture deficit, drying winds, feral horses, livestock, wildlife, grass.
Silviculture System	Clear-cut. Clear-cut with retention. Understorey avoidance where feasible. Deciduous avoidance where possible. Stumpside harvesting.
Site Preparation	Mechanical site prep to create microsites and expose mineral soil for existing seed on site to germinate. Debris required on site to provide micro sites for seedling establishment and nutrient availability. Site preparation is planned for all areas but

	may not be completed due to extreme steepness or sensitive areas. Site preparation may not be completed where there are specific conflicting land uses or direction from the government.
Seedling Establishment (includes LFN)	Deciduous LFN, plant Sw. Manage site preparation to promote natural seed germination.
Seedling Density (SPH target per species type)	Coniferous = Plant between 1200 and 1800 sph of conifer, Deciduous LFN.
Reforestation Phase Intervention (Post-seedling establishment)	Vegetative competition may be a factor affecting survival in the regenerating stand. May fill-in plant conifer if required to meet 80% minimum stocking standards (RSA). Let it Grow (LIG) strategy is viable where under height seedlings occur. Density controls may be used if required.

FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**HwPl**
FMP Yield Strata Transition Sources (Regenerating Strata)	N_MIX_PL
Managed FMP Yield Strata Landbase Designation Code	TBD
Stand Structure (Species Proportions)	Mixed coniferous (DC) by stocking at Establishment and by crown closure/density at Performance.
Limitations to Crop Establishment (Site, Climate)	Shallow soils, winter desiccation, moisture deficit, drying winds, feral horses, livestock, wildlife, grass.
Silviculture System	Clear-cut. Clear-cut with retention. Understory avoidance where feasible. Deciduous avoidance where possible. Stumpside harvesting.
Site Preparation	Mechanical site prep to create microsites and expose mineral soil for existing seed on site to germinate. Debris required on site to provide micro sites for seedling establishment and nutrient availability. Site preparation is planned for all areas but may not be completed due to extreme steepness or sensitive areas. Site preparation may not be completed where there are specific conflicting land uses or direction from the government.
Seedling Establishment (includes LFN)	Deciduous LFN, Plant Pl. Manage site preparation to promote natural seed germination.
Seedling Density (SPH target per species type)	Deciduous LFN. Coniferous = Plant between 1200 and 1800 sph of conifer.
Reforestation Phase Intervention (Post-seedling establishment)	Vegetative competition may be a factor affecting survival in the regenerating stand. May fill-in plant conifer if required to meet 80% minimum stocking standards (RSA). Let it Grow (LIG) strategy is viable where under height seedlings occur. Density controls may be used if required.

FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**SwHw**
FMP Yield Strata Transition Sources (Regenerating Strata)	N_MIX_SX
Managed FMP Yield Strata Landbase Designation Code	TBD
Stand Structure (Species Proportions)	Mixed coniferous (CD) by stocking at Establishment and by crown closure/density at Performance.

Limitations to Crop Establishment (Site, Climate)	Shallow soils, winter desiccation, moisture deficit, drying winds, feral horses, livestock, wildlife, grass.
Silviculture System	Clear-cut. Clear-cut with retention. Understorey avoidance where feasible. Deciduous avoidance where possible. Stumpside harvesting.
Site Preparation	Mechanical site prep to create microsites and expose mineral soil for existing seed on site to germinate. Debris required on site to provide micro sites for seedling establishment and nutrient availability. Site preparation is planned for all areas but may not be completed due to extreme steepness or sensitive areas. Site preparation may not be completed where there are specific conflicting land uses or direction from the government.
Seedling Establishment (includes LFN)	Plant Sw as leading species. Manage site preparation to promote natural seed germination. Deciduous LFN.
Seedling Density (SPH target per species type)	Coniferous = Plant between 1200 and 1800 sph of conifer, Deciduous LFN.
Reforestation Phase Intervention (Post-seedling establishment)	Vegetative competition may be a factor affecting survival in the regenerating stand. May fill-in plant conifer if required to meet 80% minimum stocking standards (RSA). Let it Grow (LIG) strategy is viable where under height seedlings occur. Density controls may be used if required.

FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**PlHw**
FMP Yield Strata Transition Sources (Regenerating Strata)	N_MIX_PL
Managed FMP Yield Strata Landbase Designation Code	TBD
Stand Structure (Species Proportions)	Mixed coniferous (CD) by stocking at Establishment and by crown closure/density at Performance.
Limitations to Crop Establishment (Site, Climate)	Shallow soils, winter desiccation, moisture deficit, drying winds, feral horses, livestock, wildlife, grass.
Silviculture System	Clear-cut. Clear-cut with retention. Understorey avoidance where feasible. Deciduous avoidance where possible. Stumpside harvesting.
Site Preparation	Mechanical site prep to create microsites and expose mineral soil for existing seed on site to germinate. Debris required on site to provide micro sites for seedling establishment and nutrient availability. Site preparation is planned for all areas but may not be completed due to extreme steepness or sensitive areas. Site preparation may not be completed where there are specific conflicting land uses or direction from the government.
Seedling Establishment (includes LFN)	Plant Pl as leading species. Manage site preparation to promote natural seed germination. Deciduous LFN.
Seedling Density (SPH target per species type)	Coniferous = Plant between 1200 and 1800 sph of conifer, Deciduous LFN.
Reforestation Phase Intervention (Post-seedling establishment)	Vegetative competition may be a factor affecting survival in the regenerating stand. May fill-in plant conifer if required to meet 80% minimum stocking standards (RSA). Let it Grow (LIG) strategy is viable where under height seedlings occur. Density controls may be used if required.

FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**Sw**

FMP Yield Strata Transition Sources (Regenerating Strata)	N_SW
Managed FMP Yield Strata Landbase Designation Code	TBD
Stand Structure (Species Proportions)	Pure coniferous (Sw) by stocking at Establishment and by crown closure/density at performance. Minimum SW > 50%
Limitations to Crop Establishment (Site, Climate)	Shallow soils, winter desiccation, moisture deficit, drying winds, feral horses, livestock, grass.
Silviculture System	Clear-cut. Clear-cut with retention. Understorey avoidance where feasible. Deciduous avoidance where possible. Stumpside harvesting.
Site Preparation	Mechanical site prep to create microsites and expose mineral soil for existing seed on site to germinate. Debris required on site to provide micro sites for seedling establishment and nutrient availability. Site preparation is planned for all areas but may not be completed due to extreme steepness or sensitive areas. Site preparation may not be completed where there are specific conflicting land uses or direction from the government.
Seedling Establishment (includes LFN)	Plant SW as leading species. Manage site preparation to promote natural seed germination. Leave for natural only considered on request from government for unique situations (FireSmart). Areas may be scarified and left for natural seed if post-harvest survey assessment and conditions are favorable.
Seedling Density (SPH target per species type)	Coniferous = Plant between 1200 and 1800 sph of conifer. May plant higher densities in unique situations (straight plant). Densities may be supplemented with natural ingress from seed remaining on site using harvest system of stump side processing and from adjacent SW stands.
Reforestation Phase Intervention (Post-seedling establishment)	Vegetative competition may be a factor affecting survival in the regenerating stand. May fill-in plant conifer if required to meet 80% minimum stocking standards (RSA). Let it Grow (LIG) strategy is viable where under height seedlings occur. Density controls may be used if required.

FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**Pl**
FMP Yield Strata Transition Sources (Regenerating Strata)	R_PL
Managed FMP Yield Strata Landbase Designation Code	TBD
Stand Structure (Species Proportions)	Pure coniferous (Pl) by stocking at Establishment and by crown closure/density at performance. Minimum Pl > 50%
Limitations to Crop Establishment (Site, Climate)	Shallow soils, winter desiccation, moisture deficit, drying winds, feral horses, livestock, grass,
Silviculture System	Clear-cut. Clear-cut with retention. Understory avoidance where feasible. Deciduous avoidance where possible. Stumpside harvesting.
Site Preparation	Mechanical site prep to create microsites and expose mineral soil for existing seed on site to germinate. Debris required on site to provide micro sites for seedling establishment and nutrient availability. Site preparation is planned for all areas but may not be completed due to extreme steepness or sensitive areas. Site preparation may not be completed where there are specific conflicting land uses or direction from the government.

Seedling Establishment (includes LFN)	Plant Pl as leading species. Manage site preparation to promote natural seed germination. Leave for natural only considered on request from government for unique situations (firesmart). Areas may be scarified and left for natural seed if post-harvest survey assessment and conditions are favorable.
Seedling Density (SPH target per species type)	Coniferous = Plant between 1200 and 1800 sph of conifer. May plant higher densities in unique situations (straight plant). Densities may be supplemented with natural ingress from seed remaining on site using harvest system of stumpside processing.
Reforestation Phase Intervention (Post-seedling establishment)	Vegetative competition may be a factor affecting survival in the regenerating stand. May fill-in plant conifer if required to meet 80% minimum stocking standards (RSA). Let it Grow (LIG) strategy is viable where under height seedlings occur. Density controls may be used if required.

FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	Sb
FMP Yield Strata Transition Sources (Regenerating Strata)	-
Managed FMP Yield Strata Landbase Designation Code	TBD
Stand Structure (Species Proportions)	Black Spruce is not targeted for harvest and not sequenced in the SHS. However, because of differences between the AVI and actual stand edge (AVI stand boundary vs. boundary identified during operation), fringe areas appear to be harvested. The intent is to manage these areas with the adjacent stand.
Limitations to Crop Establishment (Site, Climate)	Shallow soils, winter desiccation, moisture deficit, drying winds, feral horses, livestock, grass.
Silviculture System	Clear-cut. Clear-cut with retention. Understorey avoidance where feasible. Deciduous avoidance where possible. Stump side harvesting.
Site Preparation	Mechanical site prep to create microsites and expose mineral soil for existing seed on site to germinate. Debris required on site to provide micro sites for seedling establishment and nutrient availability. Site preparation is planned for all areas but may not be completed due to extreme steepness or sensitive areas. Site preparation may not be completed where there are specific conflicting land uses or direction from the government.
Seedling Establishment (includes LFN)	Plant SW as leading species. Manage site preparation to promote natural seed germination. Leave for natural only considered on request from government for unique situations (FireSmart). Areas may be scarified and left for natural seed if post-harvest survey assessment and conditions are favorable.
Seedling Density (SPH target per species type)	Coniferous = Plant between 1200 and 1800 sph of conifer, May plant higher densities in unique situations (straight plant). Densities may be supplemented with natural ingress from seed remaining on site using harvest system of stump side processing.
Reforestation Phase Intervention (Post-seedling establishment)	Vegetative competition may be a factor affecting survival in the regenerating stand. May fill-in plant conifer if required to meet 80% minimum stocking standards (RSA). Let it Grow (LIG) strategy is viable where under height seedlings occur. Density controls may be used if required.

FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	Temporary in-block roads and landings
FMP Yield Strata Transition Sources (Regenerating Strata)	Based on exterior stand (as identified above).

Managed FMP Yield Strata Landbase Designation Code	TBD
Stand Structure (Species Proportions)	Based on exterior stand (as identified above).
Limitations to Crop Establishment (Site, Climate)	Shallow soils, winter desiccation, moisture deficit, drying winds, feral horses, livestock, grass, compaction.
Silviculture System	Clear-cut.
Site Preparation	Decompaction of road surface, recontour to natural slope conditions, rolling back topsoil and debris. Use debris to limit motorized access.
Seedling Establishment (includes LFN)	LFN / Plant or direct seeding if feasible.
Seedling Density (SPH target per species type)	Coniferous = Plant between 1200 and 1800 sph of conifer. May plant higher densities in unique situations (straight plant). Densities may be supplemented with natural ingress from seed remaining on site using harvest system of stump side processing.
Reforestation Phase Intervention (Post-seedling establishment)	Roads and landings are surveyed as part of the block. May fill-in plant conifer if required to meet 80% minimum stocking standards (RSA). Let it Grow (LIG) strategy is viable where under height seedlings occur.

FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	**X_STRATA (non- forested areas)**
FMP Yield Strata Transition Sources (Regenerating Strata)	-
Managed FMP Yield Strata Landbase Designation Code	TBD
Stand Structure (Species Proportions)	Non-Forested area (i.e. without a stratum) are not sequenced in the SHS. However, because of differences between the AVI and actual stand edge (AVI stand boundary vs. boundary identified during operation), fringe areas appear to be harvested. The intent is to manage these areas with the adjacent stand.
Limitations to Crop Establishment (Site, Climate)	Shallow soils, winter desiccation, moisture deficit, drying winds, feral horses, livestock, grass.
Silviculture System	Clear-cut
Site Preparation	Mechanical site prep to create microsites and expose mineral soil for existing seed on site to germinate as well as creating micro sites for planted seedlings Debris required on site to provide micro sites for seedling establishment and nutrient availability. Where steep slopes limit equipment operability, straight plant without site preparation.
Seedling Establishment (includes LFN)	When fringe area harvested seedling establishment will be completed as the stratum associated with the adjacent harvested stand.
Seedling Density (SPH target per species type)	Coniferous = Potentially plant between 1200 and 1800 sph of conifer. May plant higher densities in unique situations (straight plant). Densities may be supplemented with natural ingress from seed remaining on site using harvest system of stump-side processing.
Reforestation Phase Intervention (Post-seedling establishment)	Vegetative competition may be a factor affecting survival in the regenerating stand. May fill-in plant conifer if required to meet 80% minimum stocking standards (RSA). Let it Grow (LIG) strategy is viable where under height seedlings occur. Density controls may be used if required.

Table 5-3. Seed supply Matrix for FMU B12

Base 10 Strata	Operator (SHS)	Sp.	Seed Zone	Current Inventory (kg)	Seedlings in Current Inventory (#)	Area from Current Inventory (ha)	10 Year Spatial Harvest Seq. (ha)	Min. density (sph)	Seedlings Required[1]	Seed Required for Next 10 yrs (kg)	Collection Required for Next 10 yrs (kg)
SW/SWHW/HWSW	SLS	SW	LF2.3	31.5	3,739,964	3,117	1,569	1,200	1,882,616	15.86	0.00
		SW	M4.3	35.5	4,214,880	3,512	119	1,200	142,303	1.20	0.00
		SW	M4.4	19.9	2,362,707	1,969	256	1,200	307,240	2.59	0.00
		SW	M5.3	39.4	4,677,923	3,898	343	1,200	411,989	3.47	0.00
		SW	M5.4	22.9	2,718,894	2,266	2,168	1,200	2,602,112	21.92	0.00
		SW	SA3.1	0.2	23,746	20	213	1,200	256,026	2.16	1.96
		SW	SA3.2	15.9	1,887,791	1,573	765	1,200	918,025	7.73	0.00
		SW	SA4.2	4.9	581,772	485	272	1,200	326,006	2.75	0.00
		SW	UF1.5	11	1,306,019	1,088	2,285	1,200	2,742,167	23.10	12.10
		SW	UF2.5	9.8	1,163,544	970	317	1,200	380,710	3.21	0.00
	QH Canfor	SW	A1.4	-	-	-	25	1,200	30,000	0.07	0.07
		SW	SA4.2	9.4	4,272,287	3,560	200	1,200	240,000	0.53	0.00
		SW	SA3.2	-	-	-	132	1,200	158,400	0.35	0.35
		SW	M5.4	19.7	8,945,975	-	37	1,200	44,400	0.10	0.00
	CTP South (FRIAA)	SW	SA4.2	0.041	4,868	4	4	1,200	4,800		
		SW	SA3.2	0.041	4,868	4	4	1,200	4,800	0.04	0.00
		SW	M5.4	1.223	145,206	121	121	1,200	145,200	1.22	0.00
	QH Precision (FRIAA)	SW	LF2.3	0.981	116,473	97	97	1,200	116,400	0.98	0.00
	QH Nielson (FRIAA)	SW	UF1.5	3.613	428,968	357	9	1,200	10,800	0.09	0.00
		SW	LF2.3	0.84	99,732	83	83	1,200	99,600	0.84	0.00
	QH Sundre	SW	LF2.3	36.474	4,330,522	3,609	8	1,200	9,600	0.08	0.00
	CTP D South (FRIAA)	SW	M4.4	0.021	2,493	2	2	1,200	2,400	0.02	0.00

[1] Conversion to seedlings are based on greenhouse averages. 118,729 seedlings / 1 kg of spruce seed; 1.45 hL Sw = 1 kg of seed. 77,390 seedlings / 1 kg of pine seed; 3.5 hl PL = 1 kg of seed. Canfor used their own conversion numbers.

Base 10 Strata	Operator (SHS)	Sp.	Seed Zone	Current Inventory (kg)	Seedlings in Current Inventory (#)	Area from Current Inventory (ha)	10 Year Spatial Harvest Seq. (ha)	Min. density (sph)	Seedlings Required[1]	Seed Required for Next 10 yrs (kg)	Collection Required for Next 10 yrs (kg)
PL/PLHW/HWPL	SLS	PL	LF2.3	14.7	1,137,633	948	2,170	1,200	2,603,880	33.65	18.95
		PL	M4.3	6.3	487,557	406	82	1,200	97,830	1.26	0.00
		PL	M4.4	30.8	2,379,743	1,983	133	1,200	160,022	2.07	0.00
		PL	M5.3	14.0	1,083,460	903	206	1,200	247,426	3.20	0.00
		PL	M5.4	31.8	2,461,002	2,051	2,501	1,200	3,000,727	38.77	6.97
		PL	SA3.1	0.6	46,434	39	333	1,200	399,318	5.16	4.56
		PL	SA3.2	83.1	6,427,549	5,356	1,870	1,200	2,243,722	28.99	0.00
		PL	SA4.2	3.3	255,077	213	333	1,200	399,841	5.17	1.87
		PL	UF1.5	7.5	584,062	487	4,784	1,200	5,740,524	74.18	66.63
		PL	UF2.5	0.6	47,982	40	802	1,200	962,005	12.43	11.81
	QH Canfor	PL	SA4.2	3.2	809,968	675	80	1,200	96,000	0.38	0.00
		PL	SA3.2	6.8	1,718,114	1,132	181	1,200	217,200	0.86	0.00
		PL	M5.4	-	-	-	53	1,200	63,600	0.25	0.25
		PL	M4.4	-	-	-	5	1,200	6,000	0.02	0.02
	CTP South (FRIAA)	PL	SA3.2	4.743	367,061	306	54	1,200	64,800	0.84	0.00
		PL	M5.4	0.73	56,495	47	47	1,200	56,400	0.73	0.00
	QH Precision (FRIAA)	PL	LF2.3	3.32	56,935	214	214	1,200	256,800	3.32	0.00
	QH Nielson (FRIAA)	PL	UF1.5	0.475	36,760	31	7	1,200	8,400	0.11	0.00
		PL	LF2.3	1.07	82,807	69	69	1,200	82,800	1.07	0.00
	QH Sundre	PL	LF2.3	107.239	8,299,226	6,916	146	1,200	175,200	2.26	0.00
	CTP Nouth (FRIAA)	PL	UF2.5	UF2.5	1.63	126,146	105	105	1,200	126,000	0.00
		PL	LF2.3	LF2.3	0.791	61,215	51	51	1,200	61,200	0.00

Notes from Operator: FRIAA has some of its own seed but relies heavily on GOA seed to meet the needs of the Community Reforestation Program CTPP holder reforestation requirements. FRIAA has verified that there is adequate seed with the GOA to meet the needs as indicated in the table.
SLS does not has enough wild seed inventory to meet reforestation objectives for all of the seed zones identified, as indicated in the table above. SLS intend to collect the seed required to ensure there is adequate supply in both the seed zones where there is a deficit as well as seed zones with a lower current inventory. Canfor also has a deficit of M5.4 and M4.4, however they are very small. Operators are required to ensure they have adequate seed to meet reforestation obligations.

6. Forest Protection

Wildfire and insect infestations are natural disturbance events that establish forest renewal. The DFA forests are comprised of predominately fire origin stands. Presently, surveys indicate insect populations to be at endemic levels. However, severe infestations by insects such as Mountain Pine Beetle (MPB) could reach outbreak levels, particularly if changing environmental conditions (e.g. drought) create conditions suited for rapid spread.

Spray Lake Sawmills forest protection strategies are aimed at reducing the risk, occurrence and severity of wildfire and insect infestations, primarily by harvesting old stands before they are lost to insects and/or fire. The company also addresses the risk associated with windthrow, which has the potential to affect standing timber adjacent to forest harvesting operations.

6.1 Fire Protection Strategy

Ecosystems change over time, driven by natural and anthropogenic disturbances. Wildfire suppression is known to have changed the natural fire regime across the DFA, changing the timing and nature of fire as a natural disturbance factor. Due to this reduction of fire on the landscape, some ecosystems have 1) become more susceptible to fire disturbance due to factors such as fuel loading and in-growth and 2) have a reduced capacity to provide habitat for Species at Risk (SAR) or forage for wildlife or cattle (AAF, 2016).

The main trends that will influence wildfire risk over the next few years include:

- Climate change – impacts wildfire incidence, wildfire behavior and fuel conditions, including warming and drying trends and a reduction in fire return intervals; and
- Forest fuels – result in increased probability of larger wildfires due in part to effectiveness of historic fire suppression.

The key values at risk to high severity wildfire include:

- Human life – residences, facilities;
- Communities – community infrastructure;
- Watersheds – drinking water and sensitive soils;

- Natural Resources:
  - terrestrial species at risk;
  - plants/vegetation at risk;
  - fish species at risk;
  - critical habitat;
  - indigenous and historical/cultural sites;
  - timber; and
- Infrastructure – transmission lines, highways, railroads, oil and gas assets.

The SLS forest protection strategy is to:

- reduce the risk, occurrence and severity of wildfires, by harvesting old coniferous stands and replacing them with young resilient forests;
- integrate AAF FireSmart initiatives (Section 6.1.2); and
- adhere to prevention and salvage measures (Section 6.1.4).

6.1.1 Calgary Source Water Risk Management

The city of Calgary has two source watersheds; the Bow River watershed and the Elbow river watershed. There is strong seasonal variation and periodic wet and dry cycles in these watersheds and climate change is increasing the frequency and magnitude of extreme events, such as drought and flash flooding. Wildfire is identified as one of the top two key risks for Calgary's source watersheds, particularly in terms of water quality, and therefore managing wildfire risk is a priority (City of Calgary, 2019). Spray Lake Sawmills have been identified as a key stakeholder in this process (City of Calgary, 2018) and harvesting activities can be used to reduce wildfire risk.

Approximately 32% of the SLS DFA is within the Calgary source watersheds (12% of the total source watersheds area). Of this, 44,013 ha (42% of the area inside the DFA) is considered high or very high vulnerability (City of Calgary, 2020).

6.1.2 FireSmart

The FireSmart program aims to use forest management planning as a tool to minimize catastrophic wildfire risk. As part of this initiative, fire behaviour potential has been mapped for the DFA by Alberta Agriculture and Forestry (AAF). Fire behaviour potential describes how fuel ignites, flame develops, and fire spreads and exhibits other related phenomena. Fuels, topography, fire weather and climate are the major influences. The assessment was made using the Canadian Forest Fire Weather Index (FWI) System. A Wildfire Threat Assessment model was developed, using the FWI values at the 90th percentile (very dry) based on historical weather, fuels, and topography. Ratings (low to extreme) of the average of Crown Fraction Burn (CFB) and Head Fire Intensity (HFI) were then assigned (Alberta Agriculture and Forestry, 2020). For further details on the assessment, see *Chapter 3 – Landscape Assessment* Section 5.5.2.

6.1.3 Reporting

As part of the SLS commitment to FireSmart, and to the protection of Calgary's source watersheds, SLS has incorporated the fire behaviour potential assessment into the modeling process used to develop the PFMS. It is forecasted that the 20-year SHS will remove a total of approximately 16% of the high, very high and extreme risk stands, thereby reducing wildfire risk (Table 6-1, Figure 6-1). Further details are available in *Chapter 5 – Values, Objectives, Indicators, and Targets (VOITs)* Section 4.3.2.

Table 6-1. Area harvested in the SHS, classified by summer fire behavior potential risk category

Risk Category	Area (ha)	%	Decade 1 Harvest		Decade 2 Harvest	
			Area (ha)	% of Initial	Area (ha)	% of Initial
Extreme	65,214	20	3,531	5	4,593	7
Very High	66,982	20	4,628	7	4,951	7
High	55,387	17	5,859	11	5,668	10
Moderate	60,207	18	7,347	12	7,949	13
Low	78,523	23	1,110	1	1,601	2
Non-Fuel / No Value	7,933	2	-	-	-	-

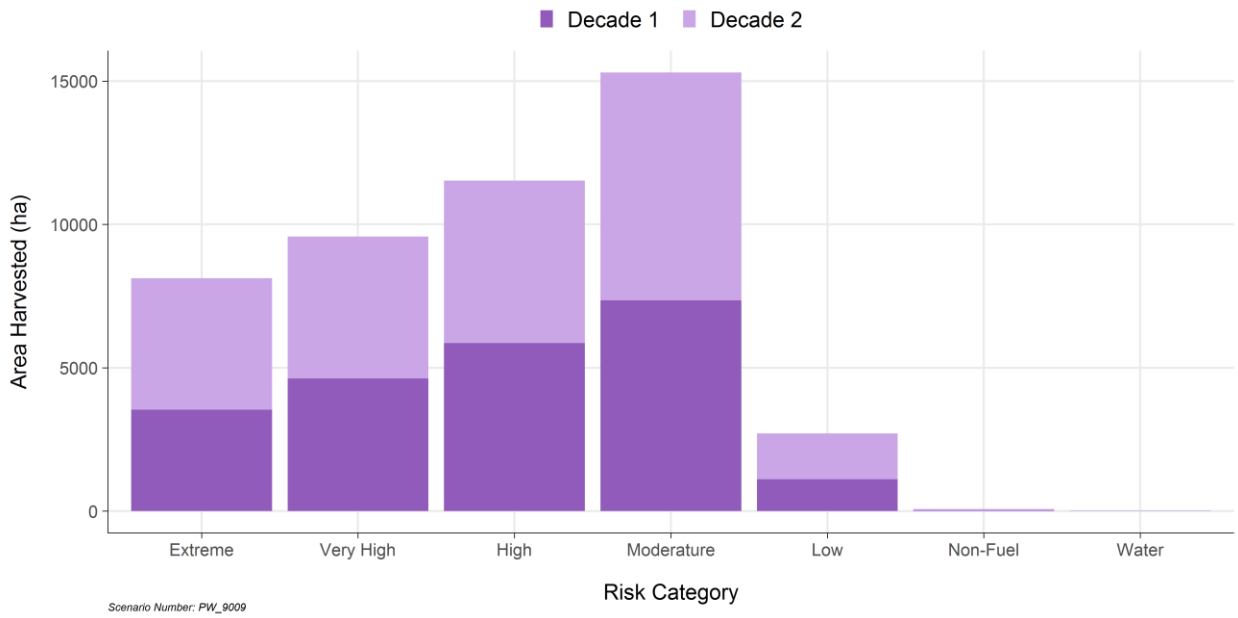

Figure 6-1. Area harvested in the SHS, classified by summer fire behavior potential risk category

6.1.4 Prevention and Salvage

As per the OGR and the Forest and Prairie Protection Act and associated regulations, SLS develops and submits an annual Fire Control Plan to AAF. SLS also continues to work with Forest Protection on FireSmart initiatives. The SLS Emergency Response Plan (ERP) identifies the process and procedures used to handle Forest Protection emergencies.

SLS transitioned from roadside pile and burn methods to stump-side processing in 1998. Stump-side processing is a harvest practice that leaves treetops and limbs spread throughout the harvested area. Known as slash, this material has tremendous value for reforestation. Slash helps retain snow during the winter and provides shade to moderate soil temperatures during summer. Coarse woody debris can also shelter seedlings from chinook winds, and act as protection from opportunistic herbivores. The slash helps to maintain higher soil moisture levels and allows nitrogen, potassium and phosphorous, which are important for forest health and productivity, to leach into the soil.

Areas identified with a high volume of slash and debris will be disposed of as per the Alberta Forest and Prairie Protection Act as well as the Forest Protection Debris Disposal Guidelines and the OGR.

The objective of Spray Lake Sawmills is to support the GoA forest fire protection activities. Strategies to achieve this include:

- Follow the Forest and Prairie Protection Act;
- Continue to review fire protection requirements with logging contractors and woodlands staff;
- Continue to provide contractor and staff wildfire suppression training;
- Continue discussions with the Forest Protection Division toward establishing a Fire Control Agreement;
- Work with AAF on implementation of FireSmart initiatives. Key staff will be trained in Wildfire Threat Assessment. SLS will work with AAF to refine data for the WTA specific to the FMA. Sequencing of timber harvest will consider AAF Fire Smart Community Zone Planning; and
- Work with AAF in the development of fire salvage plans in accordance with provincial policy.

FireSmart initiatives may require unique solutions to meet site-specific objectives. Silviculture and harvesting operations may deviate from traditional operational practices and therefore may deviate from the ground rules. SLS will work closely with AAF in the planning and operational delivery of AAF's program. Where SLS is involved in the timber harvesting phase, detailed block plans will be developed.

Direction in the B12 Forest Management Unit Annex 3 FireSmart Management Process report (Appendix III) provides the following recommendations:

- Areas with continuous coniferous fuel types are susceptible to large wildfires. Where possible, harvesting should be designed to reduce the continuity of these coniferous fuel types;
- Harvest should align with community protection objectives and harvest sequencing should occur early within the SHS; and
- Work with Wildfire Management Staff to identify priority areas within the contributing landbase and explore opportunities to mitigate high risk stands in the non-contributing landbase.

In order to prevent fire starts, SLS focuses on three prevention strategies:

- Conducting operations in accordance with the fire control plan;
- Incorporation of FireSmart modeling in the FMP; and
- Strict procedures related to burning of debris piles, if applicable.

Wildfire events are a natural part of the ecosystem. They create unique habitats and are important from a biodiversity perspective. SLS will follow "*Fire Salvage Planning and Operations - Directive No. 2007-01*" when harvesting fire salvage. Additionally, the following strategies will be implemented in the DFA when harvesting burned areas, to comply with VOIT #7 (1.1.1.5a):

- Live trees: Retain unburned trees in green islands and retain patches, while recognizing timber condition, access and non-timber needs according to the directive.

6.2 Forest Health Strategy

6.2.1 Mountain Pine Beetle

Insects and diseases are a natural part of the DFA ecosystem. Changing environmental conditions such as warmer winter temperatures, aging forests, declines in forest health and droughts can lead to significant increases in pest populations, such as the Mountain Pine Beetle (*Dendroctonus ponderosae*, MPB). MPB is one of the most destructive pests affecting mature pine. Adults emerge from host trees and attack

green trees in midsummer, inflicting serious damage in the form of blue stain and checking. Infested trees usually die within a year. Since the mid-1990s MPB is estimated to have killed 730 million m^3 (approximately 55%) of the merchantable pine in British Columbia, and since the mid-2000s large outbreaks have occurred throughout northwestern Alberta (Bleiker, Boisvenue, & Erbilgin, 2019).

The susceptibility of lodgepole pine stands can be measured using the a Stand Susceptibility Index (SSI), developed by the Canadian Forest Service (Shore & Safranyik, 1992). The SSI is calculated based on stand age, density, and percentage of susceptible pine basal area (derived from % pine in the stand, tree height and growth and yield data). All stands are rated between 1 and 100 where stands rated as 100 have the highest amount of suitable host trees. It is a relative measure of the attributes of the stand and its suitability as MPB habitat without considering the location of the stand or the climate the stand experiences. Rather than an indicator of MPB probibility, SSI becomes a factor when environmental conditions promote active MPB growth within the DFA. Approximately 32% of the DFA has an SSI value of greater than 40 (*Chapter 3 – Landscape Assessment* Section 5.2.1).

Mature and over-mature pine under stress are the preferred host, but as beetle populations increase, smaller-sized and healthy trees can also be attacked. Outbreaks continue as long as a food source is available and climatic conditions are favourable.

Climate change and warmer winter temperatures have allowed MPB to spread further north and to higher elevations. The expansion potential has raised new threats to Alberta's Lodgepole pine, Limber pine and Whitebark pine ecosystems. A large-scale outbreak could put many forest resources and socio-economic values at risk, including watersheds, high value riparian areas, sensitive sites and important wildfire habitat. Resulting MPB outbreak mortality dramatically increases fuel loads adding potential for more wildfires, with greater size and intensity (Alberta Sustainable Resource Development, 2007).

MPB is now established in lodgepole–jack pine forests in northern Alberta and threatens to spread east across Canada's boreal forest if conditions are favorable (Government of Canada Factsheets).

A total of 35 MPB attacks were recorded in the DFA, in 2007, 2008 and 2009, when there were large infestations in the southern portion on the DFA. At of the time of writing this document, the following endemic MPB populations are located immediately adjacent to the DFA. Most, if not all, are receiving annual level one control measures:

- Crowsnest Pass;
- Bow Valley;
- Exshaw;
- Bow Valley Wildland Provincial Park; and
- Barrier Lake.

Additional MPB populations are present near the DFA:

- Lake Minnewanka,
- Banff National Park; and
- The Red Deer River Valley.

Treatment Priorities

- Stand level predicted r-value – an estimate of female MPB productivity as determined by tree size, stand location and weather;
- Compartment risk – the probability that a compartment will be attacked based on existing MPB populations; and

- Stand Suceptibility Index – the physical characteristics of a stand that determines its MPB habitat suitability, without considering the climate, or location of the particular stand.

Rank 1 stands are the highest priority for susceptibility reduction but are not currently found in the SLS DFA. Rank 2 stands are also important but are lower priority than rank 1 stands. Rank 3 stands can be attacked and MPB can survive in these stands, but the brood production is significantly lower than in Rank 1 and 2 stands (Government of Alberta, 2007). **Error! Not a valid bookmark self-reference.** identifies the area of stands in each priority ranking, along with the amount of these stands planned for harvest in the PFMS. Overall, 18% of risk category 2 stands and 20% of risk category 3 stands are planned for harvest in the 20-year PFMS.

Table 6-2. MPB Rank and associated reduction

Risk Category	Area (ha)	%	Decade 1 Harvest		Decade 2 Harvest	
			Area (ha)	% of Initial	Area (ha)	% of Initial
2	23,738	7	2,451	10	1,849	8
3	166,983	50	15,614	9	18,671	11
None	143,524	43	4,451	3	4,308	3

If MPB populations increase within the DFA, existing government-issued procedural guidance (Alberta Sustainable Resource Development, 2007) will be applied for operational strategies and, if applicable, ground surveys.

There is a suite of control tactics for MPB, including single and multiple tree treatments. If MPB becomes a threat, additional forest management planning, may be required to address risk areas that are not part of the 2021 FMP spatial harvest sequence.

6.2.2 Strategies

The SLS Forest Health Strategy focuses on early detection of insect and disease outbreaks and has the following objectives:

- Assist AAF in assessing the status and control of insect and disease concerns. Examples include Spruce Budworm, Spruce Beetle, Dwarf Mistletoe and Mountain Pine Beetle (MPB);
- Increase forest health awareness among staff and contractors;
- Reduce the spread of insect species that can kill trees;
- Reduce the impact of insects and diseases that cause reduced growth, tree deformities or mortality; and
- Assist in the prevention, detection and control of noxious and prohibited noxious plant species.

The SLS Forest Health Strategy includes the following actions:

- Continue to review forest health survey data;
- Continue insect and disease training for logging contractors and woodlands staff;
- Address forest health issues through the harvest/silviculture planning process;
- Spruce Beetle is currently at endemic levels. However, should Spruce Beetle become a concern, control strategies will be developed in consultation with AAF;
- If MPB populations increase, additional harvest areas not identified in the PFMS may be planned;
- Use only weed-free seed for reclamation projects; and

- Communicate emerging forest health concerns to the public.

6.3 Windthrow

Windthrow, also known as blowdown, is a natural event in which trees are uprooted. It can occur in any forest and is influenced by factors including:

- Winds speed and direction;
- Tree form and size;
- Topography;
- Soil type;
- Soil moisture levels;
- Forest health (root rot and stem decay); and
- Tree species.

Generally, the likelihood of windthrow increases as stands age and grow taller. There is little that can be done to prevent windthrow from occurring in natural origin stands. However, forest operators can address the potential of increased windthrow associated with forestry operations using strategies such as:

- Incorporation of windthrow concerns into the structure retention strategy, considering distribution and placement to promote wind firmness; and
- Designing harvest areas to reduce potential windthrow by considering topography, soil types and tree species selection.

Significant natural windthrow events will be reported in the stewardship report.

6.4 Noxious and Prohibited Noxious Weeds

All land-use dispositions that are held by Spray Lake Sawmills are subject to noxious weed legislation. The Operating Ground Rules have a series of procedures to minimize the impact and spread of noxious and prohibited noxious weeds. All forestry operators in the DFA must ensure that their contractors are aware of the obligations under the OGRs.

The SLS has established a weed management plan that specifies the following:

- Education and training for staff in order to increase awareness of weed concerns within the companies' sphere of interest; and
- Full time & seasonal staff and contractors will receive information regarding weed control and awareness. Training components may be included in contract start-up meetings and orientation. Items covered may include weed identification, biology, spread prevention, disposal and the Weed Control Act and Regulations.

Prevention, Inventory and Control of noxious and prohibited noxious weeds classified by the Alberta Weed Control Act and Regulation.

- The companies will implement where practical the recommended 'Good Standards of Practice for Prevention' outlined in Forestry Directive 2001-06. Prevention measures will focus on clean equipment, limited disturbance and clean seed usage.
- As SLS's area of interest consists of a large landbase of approximately 350,000 ha, it is not feasible to inventory the entire area. In consultation with the AAF, FMA and Quota Foresters, the Forest

Health Officer, and SLS staff, the inventory will be concentrated on company access routes, with a primary focus of those held under DLO and on areas with current year activities. The Road Use and Reclamation plan contains a monitoring schedule of company dispositions to be completed.

Monitoring will occur at various stages of the operating process. During pre-harvest and preliminary work stages (planning and layout), field staff will note if weed species are encountered within planned harvest blocks or along proposed access routes. These comments will be forwarded to the AAF Forest Health Officer and documented for follow-up in the Road Use and Reclamation plan.

- Control measures are not included in this weed management plan. Cost effective and environmentally friendly control measures can be tailored for the weed problems within the companies' sphere of interest. Areas targeted for control will implement where practical the recommended 'Prioritizing Areas for Control Measures' outlined in Forestry Directive 2001-06 and will be based on weed classification, location, and size.

  Cooperative control opportunities will be pursued if practical in areas where weed infestations span multiple dispositions or border of responsibility. These areas will be targeted for control once cooperative efforts have been agreed upon so that effective control of weed populations can be achieved. Control of only part of a larger infestation is often a futile approach and a containment strategy to prevent further spread is more practical.

  Following training of full-time and seasonal staff, weeds that are controlled and need to be removed from a site will be properly disposed of to prevent further spread. Infestation size and priority for treatment may be determined in discussion with the Forest Health Officer, and/or the M.D. Weed Inspector or as designated by the Weed Control Guidelines when developed by the Province.

7. Protection of Forest Resources

7.1 Forest Soils

Soil conditions influence nutrient and water storage and capacity, directly impacting the productivity of forests. Therefore, maintenance of forest soil quality is crucial.

Forestry staff and contractors annually attend Timber Harvest Planning and Operating Ground Rules (OGRs) training. The operational soil conservation training module includes:

- Soil characteristics and identification;
- Importance of soil fertility and conservation;
- Identification of sensitive soils;
- Stump-side processing procedures;
- Road maintenance and erosion control practices;
- Techniques to minimize soil compaction and rutting; and
- Stop work procedures.

Woodlands staff are trained to practice soil conservation practices including:

- Designation of harvest season;
- Identification of sensitive sites and development of protection plans;
- Site inspections;
- Initiation of stop work procedures as necessary; and
- Development of action plans to mitigate unsatisfactory soil disturbance levels.

High severity wildfire presents a significant threat to forest soils. Severe wildfire events are known to burn up the organic matter soil surface and organic soil horizon. Both soil horizons are important for soil moisture holding capacity and nutrient exchange required for healthy plant growth. After a high severity wildfire, soils often become hydrophobic, increasing erosion and releasing dissolved carbon into the watershed. It can take many decades for soils to recover from high severity wildfire (Flannigan M., 2007). The PFMS is expected to help reduce fire behaviour potential across the DFA (see Section 6.1).

7.1.1 Nutrient Conservation

SLS practices stump-side processing, where limbs and branches are removed from the tree where the tree is felled. The tree tops (including needles, small branches and twigs) contain a large proportion of the nutrients in the tree. By using this system, important nutrients such as nitrogen, phosphorous and potassium that promote healthy tree growth are maintained on-site for nutrient cycling.

7.1.2 Soil Compaction

SLS conducts its forest harvesting and site preparation operations during frozen or dry ground conditions. Avoidance of wet conditions reduces the risk of compaction and rutting from equipment. In-block roads and landings are subjected to repeated machine traffic and are more likely to be compacted compared to other areas of the harvest block. In cases where compaction occurs, the affected areas will be treated to enable reforestation.

7.1.3 Erosion and Slumping

Within harvest areas, there are a number of potential strategies for reducing the risk of soil erosion and slumping:

- Conducting forestry operations during frozen or dry ground conditions;
- Stump-side processing – retention of limbs and tops distributed across the harvest area;
- Maintaining effective erosion control on access roads;
- Use of wing walls and sediment traps at water course crossings;
- Avoidance of steep slopes and skid trail construction;
- Avoidance of unbalanced over steepened fills;
- Avoidance of leaving trees or stumps within clearing limits;
- Avoidance of building roads on steep slopes;
- Rapidly regenerating harvested areas;
- Scarification practices that minimize soil disturbance and retain coarse woody debris; and
- Use of temporary roads and effective road reclamation procedures.

7.2 Watershed Management

7.2.1 Hydrologic Regime

The DFA has a dry, cold climate, with snow dominated watersheds, averaging about 600 mm of total precipitation per year (24 inches). The Montane and Foothills subregions make up approximately 69% of the DFA and are not prone to deep snowpack development.

Unique to the snow dominated watershed regimes of Southwestern Alberta, as compared to the neighboring Intermountain Region of British Columbia, Montana, Idaho and Washington, approximately 65% of the annual precipitation in the Montane and approximately 70% of the annual precipitation in the Upper and Lower Foothills is rain rather than snow (Natural Regions Committee, 2006).

The shallow snowpack that does develop is often in sparse patches due to frequent chinook winds (Alberta Tourism, Parks, and Recreation, 2015). The DFA's Montane, Lower and Upper Foothills subregions display a distinctly peaked, summer high precipitation pattern, occurring in June, July, and August, typically long after snowmelt. The Upper Foothills subregion only averages approximately 4.3 centimeters (1.6 inches) more annual precipitation than the drier Montane subregion (Natural Regions Committee, 2006). The Montane, Lower and Upper Foothills also overlap in terms of their elevation profile. The drier Montane subregion upper elevation limit (1850m) is only 100 m higher than the upper limit (1750m) of the Upper Foothills (Alberta Tourism, Parks, and Recreation, 2015).

Harvest openings within areas known to have low spring snowpack present a significantly lower risk of localized flooding, triggered by rain on snow and/or snowmelt desynchronization, as compared to harvest openings within high snowpack areas.

7.2.2 ECA Analysis

Forest hydrology research has demonstrated a direct correlation of hydrologic recovery with leaf area index (LAI). LAI in turn depends on above ground primary productivity (Brabender, 2005), which is influenced largely by water and nutrient availability. Reduction in LAI is therefore used as a surrogate for hydrologic disturbance and recovery. SLS carried out hydrologic disturbance evaluation using the Equivalent Clearcut Area (ECA) method (Silins, 2003; Winkler & Boon, 2017). This approach is based on the timing of a tree's maximum periodic annual increment (PAI) (Silins, 2003; Brabender, 2005).

The literature has shown that maximum growth coincides with maximum LAI at a particular time in a tree's lifecycle (Watertight Solutions, 2009). Other factors including tree species and site variability create multiple growth curves that create net primary production variability across the landscape. Equivalent Clearcut Area (ECA) is used as an index of disturbance for the watershed. The process of hydrologic recovery occurs annually. This process initiates after reforestation. As an example, if 1 hectare of land was reforested 15 years ago, the hectare of land is functioning at approximately 50% of the full hydrologic level, assuming maximum LAI is achieved at 30 years. There are different growth curves that result in varying ECA ages potentially applied across the DFA (Watertight Solutions, 2009).

ECA analysis used in Alberta is extremely precautionary. Although projections have been made 200 years into the future, this modelling work is repeated, with updated data, every 10 years. Significant efforts have been made to adjust the Spatial Harvest Sequence in the 20-year PFMS to minimize impacts to watersheds. This was conducted in an iterative process, whereby we tested the impacts of harvest on different watersheds and adjusted the harvest patterns and timing as required.

In addition, an analysis of Alberta Hydrologic Unit Code 10 HUC10 watersheds was conducted and the PFMS was designed to also minimize impacts to watersheds by this definition.

Important facts in consideration of the PFMS ECA analysis and the watershed risk assessment include:

- The area-weighted DFA average 10-year ECA risk percentage for all watersheds is 11.5%.
- The area-weighted average 10-year ECA risk for moderate ECA risk watersheds is 35.0%.
- Approximately 4.9% of the 10-year SHS is located within moderate ECA risk watersheds.
- In the context of evaluating rain on snow and/or desynchronization snowmelt flooding risk within the snowpack prone subalpine and alpine subregions, it should be noted that only 11 hectares or 0.05% of the 10-year SHS is planned within alpine/subalpine moderate ECA risk watersheds.
- As a point of reference, the PFMS resulted in only low risk (<30% ECA) Alberta Hydrologic Unit Code 10 watersheds.

Additional details on how the ECA analysis was conducted are available in Chapter 6 – *Preferred Forest Management Scenario* Section 4.11 and results of the analysis are available in Chapter 5 – *Values, Objectives, Indicators, and Targets* Section 4.2.

7.2.3 Drinking water

In 2018, the City of Calgary's Water Source Protection Plan identified high severity wildfire as one of the most significant threats to the City's water supply (City of Calgary, 2018). After a wildfire, dissolved carbon and other contaminates enter headwaters fouling water purification plants, critical for generating clean water for downstream communities. As described in Section 6.1, the SLS PFMS is forecasted to considerably reduce the risk of wildfire in the DFA.

In addition, ongoing University of Alberta research (University of Alberta, Accessed May 2020) demonstrates no detectable increases in sediment production or other key nutrients such as phosphorus or nitrogen resulting from forestry operations (*Uldis Silins, personal communication, 2019*). While this work is ongoing, the preliminary results indicate careful application of erosion control best management practices can result in minimal to no impact on water quality in both Rocky Mountain headwaters streams and further downstream at larger watersheds scales operations (*Uldis Silins, personal communication, 2019*). This is similar to conclusions drawn in other research in the Northwestern United States (Cristan, et al., 2016).

7.2.4 Regional flood events

Forest soils are capable of reducing run-off on a local scale, through enhanced infiltration and storage capacities. However, forests generally have only a limited influence on major downstream flooding, such as the large-scale 2013 floods in Southern Alberta (City of Calgary, 2014). During a major rainfall event (like those that result in massive flooding), especially after prolonged periods of preceding rainfall, the forest soil becomes saturated and water no longer filters into the soil but instead runs off along the soil surface (FAO & CIFOR, 2005).

7.2.5 Mitigation measures

We are confident that the PFMS results in extremely conservative and balanced harvest levels, placing the highest priority on watershed protection. Furthermore, ECA levels will be monitored annually and the results will be included in the 5-year stewardship report.

There are two general approaches to mitigation used within the DFA to protect watershed processes:

Strategic Mitigation:

- Iterative development of the Spatial Harvest Sequence to ensure low to moderate risk ECA model outputs, with particular focus on the first 20 years;
- GoA and AVI identified watercourse buffers have been excluded from the active landbase including:
    - Large and small permanent watercourses; and
    - Lakes.
- To the fullest extent possible, use of temporary, rather than permanent roads.
- Alter season of harvest operations (winter vs. summer); and
- Alter location of proposed harvest areas to avoid sensitive areas (e.g. riparian buffers incorporating Wet Areas Mapping (WAM) coupled with ground-based reconnaissance).

Operational Mitigation:

- Ensuring that watercourse crossings adhere to OGRs and Code of Practice;
- Use of bridges and other fish passage compatible crossing structures, to protect the integrity of perennial watercourses;
- Use of watercourse, waterbody and water source vegetation buffers as classified in the OGR's;
- Rigorous erosion control measures:
    - Avoidance or timing restrictions of sensitive and wet soil areas, in order to minimize site disturbance associated with road construction and skidding (using tools such as wet areas mapping);
    - Suitable timing and location of proposed operations in order to minimize the risk of erosion; and
    - Timely reclamation of temporary roads.
- Incorporate watershed values when locating structure retention;
- Minimize ground disturbance during operations; and
- Enhance operations around stream crossings (e.g. prescribed selection of crossing structures identified under the Operating Ground Rules).

Additional precautionary measures to address moderate risk 10-year SHS ECA risk watersheds (ECA's exceeding 30%) include:

- ECA analysis will be recalculated at the forest harvest plan (FHP) level, to verify moderate risk would result at the time of completion of the FHP harvest;
- For FHPs resulting in watersheds exceeding 30% ECA, the following strategic and/or operational mitigation options may include, but are not limited to, one or more of the following measures:
    - Arrange size, elevation and aspect of harvest areas to minimize potential for changes to the streamflow regime;
    - Use best practices for road construction, maintenance and reclamation to reduce road related risks to fish habitat and survival;
    - Access management (seasonal closure, partial closure and/or gated (closed) routes);
    - Selection of road corridors to avoid sensitive fish-bearing watercourses;
    - Assessment by qualified professionals (third party) to adequately address identified risk(s); and

- Voluntary enhanced monitoring by the company, in collaboration with Alberta, in areas deemed to be sensitive with the goal of demonstrating results-based management frameworks are being achieved.

7.3 Historical Resources and Unique Features

Spray Lake Sawmills works to identify and protect unique resources within our planning areas. Historic features, sites with archaeological potential, rare plants or plant communities and other unusual natural attributes are considered during planning and operations.

Alberta Culture and Tourism maintains a provincial GIS database that records sites that contain or have a high potential to contain historic resources. These include archaeological sites, paleontological sites, Aboriginal traditional use sites of a historic resource nature (burials, ceremonial sites, etc.), and/or historic structures. For further details on classifications and known locations in the SLS DFA, see *Chapter 3 – Landscape Assessment* Section 6.7.

OGR 5.6 Historical Resources, pursuant to the Forest Act, Timber Management Regulations requires:

- A process to identify and protect historical resources protected under the Historical Resources Act and;
- That historical resource records be confidential and not shared with the public.

In recognizing the valuable and non-renewable nature of historic resources, Section 37 of the HRA provides the framework for Historic Resources Impact Assessments (HRIA) and mitigation studies. As historic resources are often not visible, the potential for forestry activities to impact these resources may not be apparent.

Within the HRIA framework, SLS submits its proposed harvest and road building data for review by subject-area experts prior to commencement of operations. The HRIA requires block and road specific locations, which are not determined or required in the GDP. If any potentially impacted historical resource sites are identified, the sites are documented, submitted for HRIA Approval, field reviewed, and protected as necessary.

Should any historic resources be encountered during harvest and/or road development activities, Historic Resources Management Branch will be contacted immediately.

7.4 Wetlands

In 2013 the Government of Alberta released *Alberta's Wetland Policy* in order to provide strategic direction and the tools to make informed management decisions regarding wetlands. Initially the Policy was applicable only to the White Area of the Province but was expand to the Green Area in spring of 2016. The primary means by which Forest management activities are affected is through the Alberta Wetland Mitigation Directive which is applicable to operations that result in permanent loss of wetland area. Most Forestry operations are temporary in nature where reclamation and reforestation is regulated. Additionally, avoidance and minimization are core considerations in forest planning and operations. Permanent loss of wetlands as a result of forestry operations are subject to the replacement requirements as described in the Directive. The most common example of this is through a permanent road (DLO) develop. However, most of the time wetlands are avoided. Operating Ground rules and applicable Directive provide the standards to protect wetlands.

7.5 Climate Change

During a fire event, greenhouse gases such as carbon dioxide, and to a lesser extent methane, long-chain hydrocarbons, nitrogen compounds and carbon particulate matter are emitted. Similarly, to carbon, forest soils sequester and store mercury. During large fire years, volatilized mercury released into the atmosphere approached industrial mercury emissions equal to those across all of North America. The bulk of the fire-related mercury emissions are likely transported to the Polar Regions, presenting long term consequences to the health of northern food chains (Flannigan M., 2007).

According to Natural Resources Canada, in recent years Canada's forests have become carbon sources rather than sinks as they typically release more carbon into the atmosphere than they are accumulating in any given year. Key reasons for this are increased wildfire activity, unprecedented insect outbreaks.

The Intergovernmental Panel on Climate Change (IPCC) recognizes sustainable development as the overarching context for climate change policy. The IPCC has identified sustainable forestry management as a cost-effective climate change mitigation and adaptation strategy to conserve existing carbon pools by reducing deforestation, forest degradation, and preventing wildfire.

In 2014, the IPCC recommended policy support in favor of sustainable forestry and forest certification programs. Existing forests can only provide reliable greenhouse gas (carbon) mitigation, if there's a forest management policy that supports an aggressive fire prevention program and a perpetual removal of carbon (wood). In turn, the forests are renewed, promoting sustainable carbon capture, building watershed resiliency and enhancing biodiversity (IPCC).

At present Alberta Agriculture and Forestry does not have a climate change directive for Forest Management Planning available. SLS will ensure that its operations stay up to date with provincial policies, recommendations and directives in regard to climate change.

8. Biodiversity

Spray Lake Sawmills has the following biological diversity goals:

- Renew forests to promote broad species diversity in balance with social and economic needs and;
- Continue building knowledge of ecological relationships through research.

In 1995, the Canadian Council of Forest Ministers recognized three distinct yet interrelated components of biodiversity:

- Ecosystem diversity deals with species distribution and community patterns. Ecosystems are, to some extent, dictated by regional landforms and climate and their interactions. Diverse landforms occur across the DFA, setting the stage for a wide range of vegetation and related wildlife communities. This is the least understood component of biodiversity, due to the complexity of interactions within the natural environment.
- Species diversity refers to the range of plant and wildlife species present within an area. Maintaining species diversity is important, as species can be considered to have a particular "role" in the ecosystem, so the addition or loss of single species may have consequences for the system as a whole.
- Genetic diversity addresses the inherent variability within the genes of an individual species. Genetic diversity reflects the evolutionary history of a species and its historic and current distribution. Species can demonstrate significant genetic variability. More genetic diversity in a species or population means a greater ability for some of the individuals in it to adapt to changes in the environment. Less diversity leads to uniformity, which can adversely affect their ability to adapt to changing conditions.

8.1 Ecosystem Diversity

Over the last 20 years, Spray Lake Sawmills has expanded its knowledge of ecological relationships through supporting research on the FMA.

The FMA's forest ecology is dominated by wildfire disturbance. Before fire suppression programs were established, fires shaped our forest, wetland and grassland landscapes. This time in ecological history is

referred to as the pre-industrial period. Pre-industrial landscapes were generally comprised of younger vegetation and significantly more area was occupied by early seral species including aspen forests, mix-wood and lodgepole pine forests. Without a disturbance agent on the landscape, forests tend to move toward older age classes and more shade tolerant species such as spruce. This leads to increased fuel loading across the landscape, which creates additional wildfire risk.

Deciduous, mixedwood and riparian forests are known to be the most biologically diverse forests on the DFA. In the absence of wildfire, or some form of vegetation management, our most ecologically important and productive forest lands are at risk to high severity wildfire.

Carbon dioxide emissions, public health concerns, public safety concerns and lack of funding largely disqualify prescribed fire as a viable approach to managing a healthy landscape in the SLS DFA. However, careful forest management promotes forest renewal, ecosystem diversity and enhances ecological functioning at all scales.

Non-timber forested and rangeland ecosystems are experiencing encroachment due to the reduced frequency of fire on the landscape when compared to historical conditions. Due to the lack of natural and or anthropogenic disturbance, the ecosystems are losing both resiliency (more susceptible to stand replacing fire events) as well as the ability to provide a range of socioeconomic and ecological benefits such as habitat for Species at Risk (SAR) or forage for wildlife or cattle.

The encroachment issues within these ecosystems are quite complex and influenced by a wide range of factors, including but not limited to fire regime, extent of grazing or other land use activities, invasive species and climate change.

An example of these encroachment or ingrowth conditions include:

- Open Forest Douglas fir ecosystems;
- Aspen Stands – both aspen encroachment into grasslands and aging Aspen stands that would generally renew with disturbance;
- Fescue-grassland dominated areas that are now forested to varying degrees. Fire will not restore fescue on its own, but will restore ecologically important grasslands over time and also in concert with other disturbances; and
- Willow – fire as a disturbance regime can cause willow to maintain its vigor and successional status, both control of willow and enhancing its vigor could be completed in part by fire.

8.1.1 Landscape Biodiversity

Approximately 70% of Southern Alberta Forests are formally protected in parks and protected areas. Protected areas representative of regional DFA ecosystems are an important component of a credible conservation plan (HAB-TECH Environmental & Spray Lake Sawmills, 2013)

In 2013, as part of SLS' internationally accredited forest certification program, a protected area gap analysis was completed to determine the adequacy of the current protected areas within and surrounding the DFA (HAB-TECH Environmental & Spray Lake Sawmills, 2013). The analysis adhered to standard approaches for representation gap analysis used by the Secretariat for the Convention on Biological Diversity (CBD) and World Wildlife Fund (WWF). The approach compares the distribution of key biodiversity areas with the distribution of protected areas as a means of finding where important elements of biodiversity (i.e. habitat, ecosystems) remain unprotected or under-protected.

Alberta Natural Subregions were used as a coarse-filter surrogate for landscape, community and species-level biodiversity in the SLS FMA/B9 Quota area. In the SLS FMA/B9 region Provincial targets for Natural

Subregion protection range from a low of 2.5% in the Lower Foothills to a high of 7.1% in the Montane. These targets have all been overachieved for the FMA. SLS has adopted a 12% protection level target proportionate to the occurrence of the natural subregions in alignment with the United Nations Sustainable Development's Brundtland Commission recommendations. Figure 8-1 shows the distribution of functional protected areas within the regional vicinity of the SLS DFA.

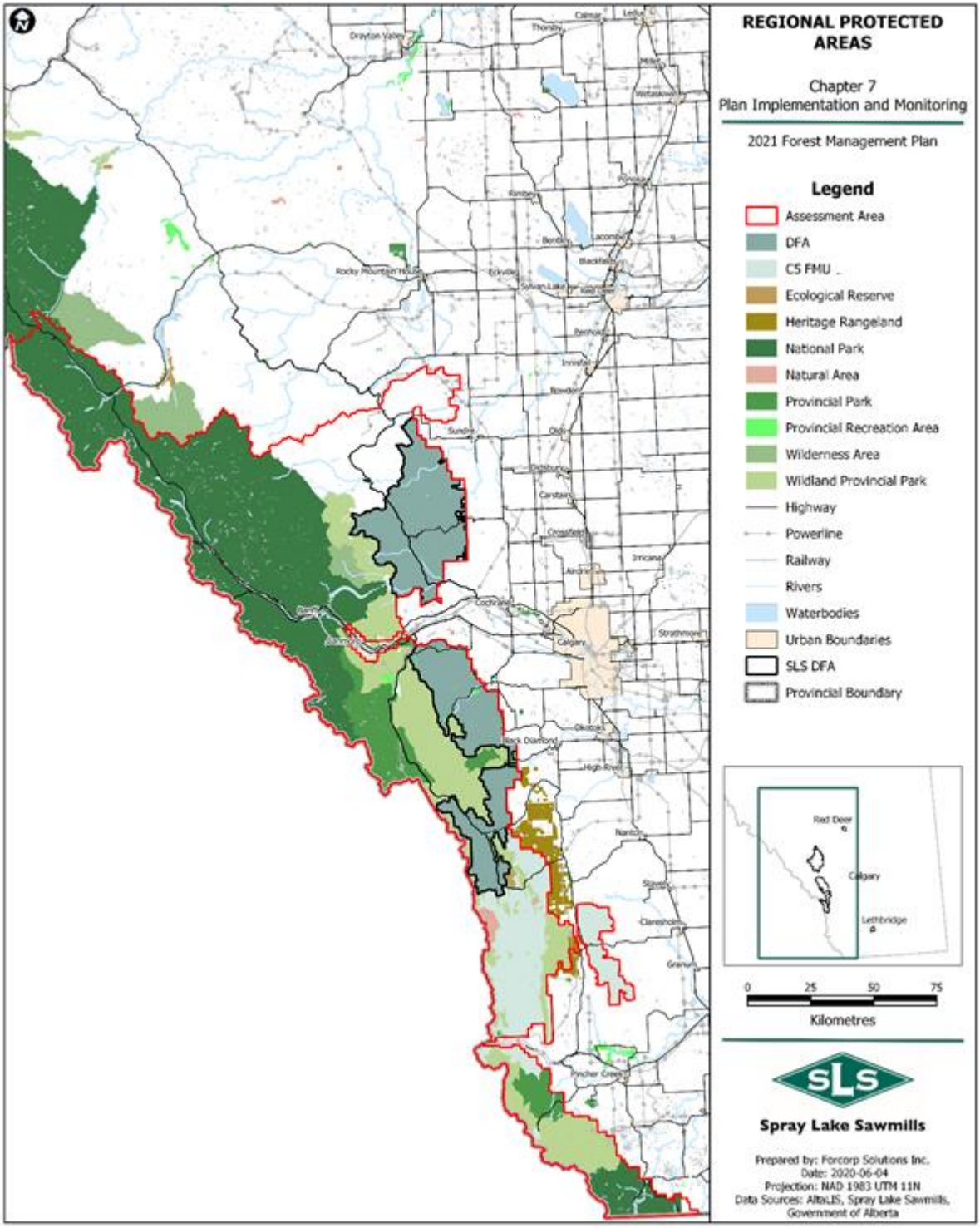

Figure 8-1. Protected areas adjacent to the DFA

Approximately 37% of the area within and surrounding the FMA is comprised of formally protected areas, including the Wildland Provincial Parks (WPP) and Provincial Parks (PP) (Don Getty WPP, Elbow-Sheep WPP, Bluerock WPP, Sheep River PP). These areas occur immediately adjacent to and functionally within the FMA. As a participating member of the Special Places 2000 committee, SLS voluntarily contributed approximately 18,889 hectares (189 km^2) of its timber quota areas to be incorporated into the Sheep River Provincial Park and adjacent Bluerock Wildland Provincial Parks.

At that time, approximately 329 km^2 of protected lands also occur along the Sheep River and Bow River valleys in what was considered Foothills natural subregions and there were no FMA protected areas gaps (having a 12% target) protected. In 2006, GoA re-designated the area from Foothills to Montane Natural Subregion areas creating a technical/administrative protected areas gap (HAB-TECH Environmental & Spray Lake Sawmills, 2013).

In January of 2017, the Protected Area Representation Gap Analysis Blue Rock/Sheep River Fine Scale Assessment was completed to compare FMA lower foothills natural subregions to the reclassified Blue Rock/Sheep River Montane natural subregion (Birdseye Environmental Ltd., 2017). Field aspects of the study focused on standardized sampling and comparisons of breeding songbirds and vegetation composition within three common forest cover types (aspen, lodgepole pine and white spruce) sharing the same age, aspect and elevations between local study areas (LSA) located in areas south and north of the Bow River.

Field inventories were completed in June 2016 and consisted of Breeding Songbird Point Counts and Plot Level Botanical Surveys completed at identical sites. The desktop component of the study consisted of review and analysis of available sub-regional biogeoclimatic data including vegetation cover, climate, surficial geology, prevailing winds, and topography (slope, aspect and elevation).

The work indicated that the previously identified lower foothills areas reclassified as Montane serve ecologically as Lower Foothills/Montane hybrid classification and that Upper Foothills areas are closer to Montane Natural Subregions. The assessment concluded the following findings:

- The Blue Rock/Sheep protected areas, as well as deciduous and riparian forests provide high quality biodiversity attributes closely matching Lower Foothills Natural Subregions biodiversity characteristics.
- The Blue Rock/Sheep protected areas demonstrate an incomplete suite of key diagnostic attributes common to Montane Natural Subregion in the Bluerock Sheep area; such as the absence of Douglas fir and Limber pine.
- Several key indicators are present that hint to a Lower Foothills setting, indicating a transitional status; mainly the presence of relatively high proportion of deciduous and mixedwood forest types that all contain high plant and songbird species richness.
- Upper Foothills lands do not tend to be as diverse as Lower Foothills and Montane lands because of the relative scarcity of deciduous and mixedwood forests, riparian forests, and marsh wetlands (Natural Regions Committee 2006).
- Regardless of whether the Bluerock Sheep area is Montane or Lower Foothills, it does possess a varied deciduous, mixedwood and riparian forest assemblage with high species richness.

The Protected Area Representation Gap Analysis Blue Rock/Sheep River Fine Scale Assessment demonstrates there are likely no FMA protective area gaps when using the SLS adopted 12% DFA protected area targets such that:

- More than 188 km^2 of currently protected lands were former timber quota lands (originally classified as Lower Foothills), were voluntarily contributed by SLS to the Crown for the purpose of protecting lower elevation Foothills landscapes in support of biodiversity.
- DFA Regional Assessment Area Natural Subregion percentages formally protected are as follows: Alpine 91%, Subalpine 50%, Montane 17%, Upper foothills 1%, Lower foothills 0%.
- The following areas are set aside within the DFA's passive landbase including approximately 20 km^2 (95%) within the Alpine natural subregion; 497 km^2 (18%) within the subalpine subregion; 178 km^2 (20%) within the Montane Natural Subregion; 107 km^2 (19%) within the Lower Foothills and 173 km^2 (23%) within the Upper Foothills Subregions. These areas comprise approximately 975 km^2 or 30% of the DFA.

8.1.2 Seral Stage Representation

The PFMS modeling process, described in *Chapter 6 – Preferred Forest Management Strategy*, addresses the distribution of representative seral stages over the 200-year planning horizon. Seral stage targets were included in PFMS development and reported on in *Chapter 5 – Values, Objectives, Indicators and Targets*.

8.1.3 Old Interior Forest

Maintenance of old interior forest over the 200-year planning horizon was addressed through the PFMS. An old interior forest target was included in PFMS development and reported on in *Chapter 5 – Values, Objectives, Indicators and Targets*.

In addition, to better understand the DFA's historical forest ecology process, a pre-industrial condition evaluation (PIC) was completed (Rogeau, 2013). The evaluation presents a view into the past of what the DFA likely looked like prior to modern forest management practices (i.e. approximately 70 years of fire suppression).

Mean Fire-Return-Interval and fire cycle were calculated for each natural subregion within the FMA. Extensive modelling revealed that the forest we see today is in great contrast to the forest of the recent past. In fact, as indicated in Figure 8-2 and Figure 8-3, current old growth levels are within or greater than 15% of the natural (pre-fire suppression) mean old growth levels and projected old growth levels will greatly exceed modelled natural (pre-fire suppression) old growth levels for all seral stage groups across all natural subregions.

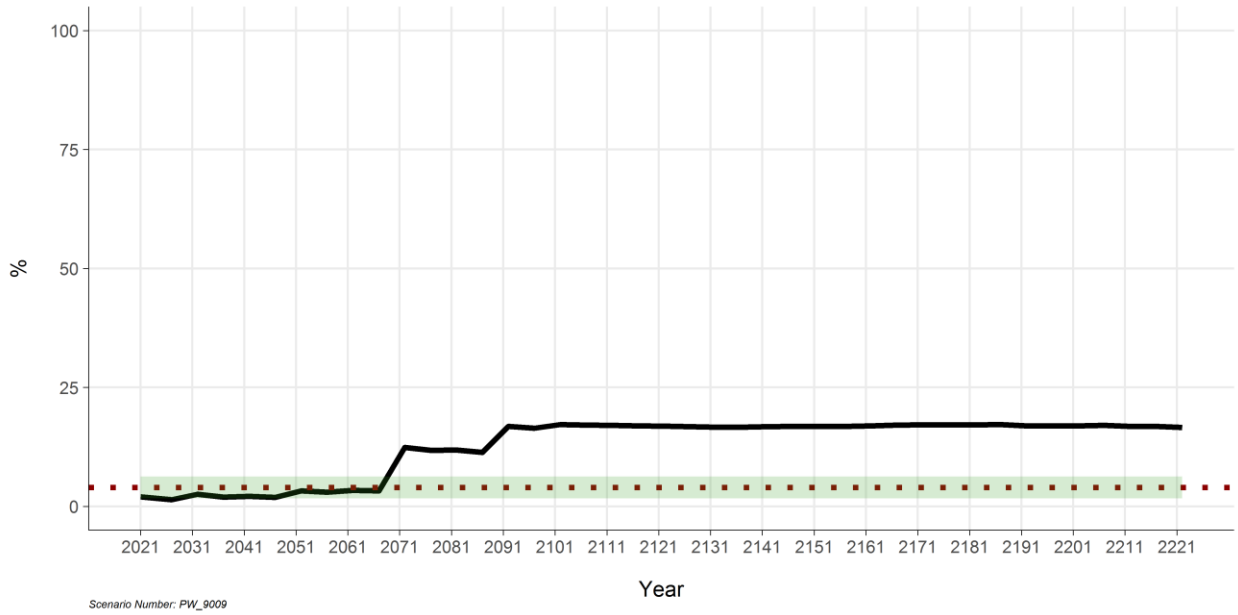

Figure 8-2. PIC results for Old Growth: North (Upper Foothills-Lodgepole pine 51,141 ha).

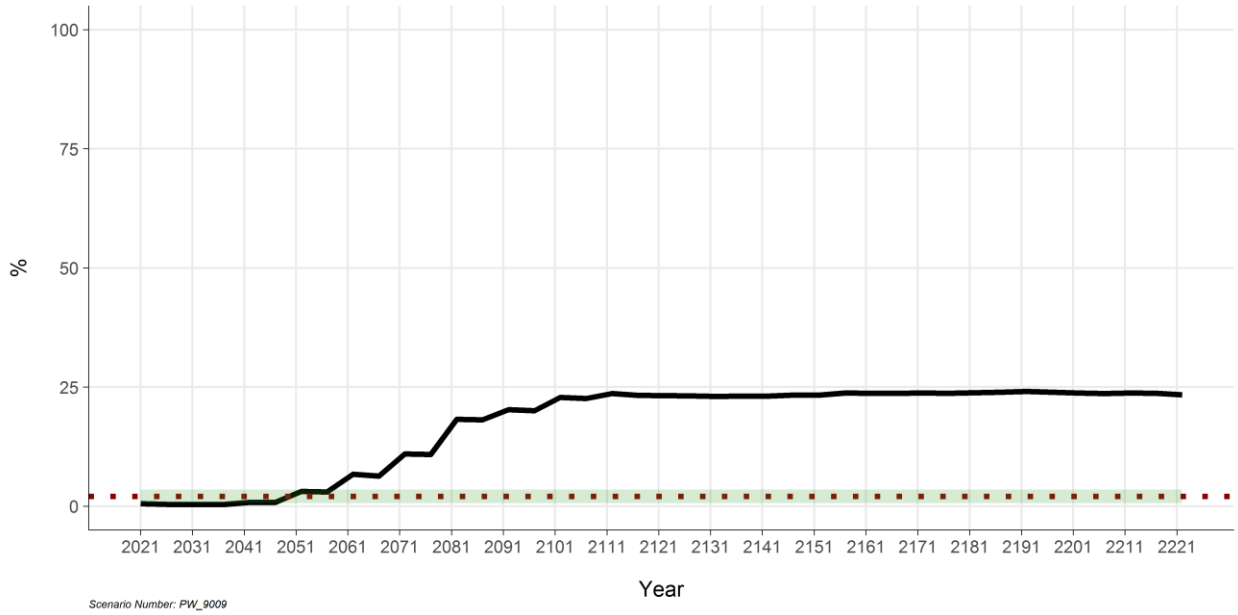

Figure 8-3. PIC results for Old Growth: South-Upper (Montane-Lodgepole pine. 31,180 ha).

PIC Graph Interpretation: The y axis represents the percentage of the total DFA forested area; the x axis represents time in years; the red dotted line indicates the modelled natural forest condition (pre-fire suppression); the green area indicates percentage of old growth area within 15% of the natural (pre-fire suppression) mean; and the black line indicates the modelled PFMS old growth levels over 200 years.

8.1.4 Stand Level Biodiversity

fRI Research Natural Disturbance Program Quicknote #23 (Nov 2003) concluded, after a forest burned, approximately 1% of the burned area remained green. The 1% stand level retention is further enhanced by connectivity with edge islands and old seral landscapes that join parks and protected areas.

Quicknote #23 concluded that approximately 66% of the landscape burned and that 34% of the forested landscape contained matrix, edge Island and interior detached remnants. The Company can demonstrate that past and current forest management practices are emulating that general landscape disturbance pattern proportion of 66% and 34% respectively and will continue to do so into the future.

All of Spray Lake Sawmills harvest areas connect to undisturbed forested landscapes comprised of both the passive and active landbase. The passive and active landbases connect with millions of hectares of undisturbed forest comprised of both Provincial and Federal parks.

Definitions:

- Retention – Standing trees left after harvest (live and dead).
- Single Stem Retention – Individual trees left standing in a harvest area.
- Interior Patches, Clumps, Islands – un-harvested groups of trees detached from the harvest boundary.
- Edge Islands and Peninsular Islands – un-harvested groups of trees protruding into the harvest area and attached to the harvest boundary.
- Matrix Remnants – undisturbed individuals and groups of trees both detached and unattached from the disturbance event.

Stand-level biodiversity considerations for harvest openings:

- Harvest boundaries follow natural vegetation patterns, containing significant edge island remnant;
- There is connectivity with the harvest opening structure retention via the edge island remnants, the forested active landbase, the matrix retention (the passive landbase) and the geographically dominant protected areas network;
- The DFA is immediately connected to a significant protected areas biodiversity network including but not limited to: Don Getty Wildland Provincial Park, Elbow Sheep Wildland Provincial Park, Bluerock Wildland Provincial Park (former SLS quota), Bow Valley Provincial Park, Plateau Mountain Ecological Reserve , Sheep River Provincial Park (former SLS quota), Macabee Creek Natural Area, Bragg Creek Provincial Park, Bragg Creek Natural Area, OH Ranch Heritage Rangeland, multiple Provincial Recreation Areas located within the DFA boundary, Moose Mountain and IRP Zone 1 Prime Protection; and
- Natural Disturbance Program Quicknote #23 Nov 2003 research indicates for blocks less than 100 hectares: retention of individual trees and detached island remnants of approximately 1% of the area/volume is sufficient. For the 2021 FMP, SLS will be retaining at least 3% representative of the pre harvest stand.

The following list of important stand level biodiversity structure is generally ranked in order of greatest importance to biological diversity values in consideration of regulatory and biological diversity characteristics. Retention will include as available within the harvest opening, trees representative of the preharvest stand including:

- Cultural site buffers;

- Mature and immature Whitebark Pine;
- Mature and immature Limber pine;
- Watercourse buffers;
- Sensitive site buffers (e.g. bird nests, dens, hibernacula, mineral licks);
- Springs and ground water seepage/source area buffers;
- Wildlife trees such as Green culls (rotten, broken tops, forked tops, dry sides, severe sweep and crook);
- Sufficiently large patches of standing dead trees (e.g grey attack snags) during salvage, where possible, are retained;
- Snags – in the absence of natural or safe snags, as safety permits, top 2 to 6 green culls or dead trees per hectare, preferably 30 cm or greater DBH to 3-5 m tall;
- Wolf trees, with heavy branching or poor form (snag replacement);
- Deciduous patches and forested stands;
- Mature and immature Balsam Poplar (dispersed);
- Mature and immature Aspen (dispersed);
- Mature and immature White Birch (dispersed);
- Douglas fir remnants, patches and stands (snag replacement);
- Mature and immature Douglas Fir Trees (dispersed, snag replacement);
- Mature and immature Tamarack;
- Treed rocky outcrops;
- Advanced regeneration and sub-merchantable coniferous trees;
- Shrubs (willow, dogwood, alder, buffalo berry, rose, Labrador tea etc.);
- 100% of the tops are retained and well distributed via stump-side processing;
- 100% of the pre-harvest levels of coarse woody debris, including stumps well distributed across the harvest opening are retained.

A structure retention strategy that outlines structure retention accounting and reporting procedures is available in *Appendix I – Structure Retention Strategy*.

8.1.5 Uncommon Plant Community

Identified sites will be handled through the harvest planning process. The Alberta Conservation Information Management system (ACIMS) plant community classification and tracking list data will be assessed to identify uncommon plant communities within the DFA. ACIMS data will be updated at the time of harvest planning.

Strategic Mitigation:

- Map and list known location of uncommon plant communities.

Operational Mitigation:

- Reference ACIMS and other available rare ecosite data during design and layout of Forest Harvest Plan development (FHP);
- At the pre-FHP review stage, the local Forestry Division can alert SLS to any local knowledge for rare or uncommon plants;
- Note Species in preharvest assessment (PHA) should they be identified; and

- Contractors are trained on rare/uncommon plants.

Sensitive sites (which includes rare plants) are discussed in the FHPs. The Stewardship report will summarize action taken based on direction received from ACIMS, in areas where uncommon plant communities have been identified (VOIT#6).

8.1.6 Disturbance Patterns

The PFMS contains specific targets for the creation of a range of disturbance patches, and the outcomes are reflected in the SHS. Implementation of the SHS will create a distribution of disturbance patches that meets management objectives and targets (see *Chapter 5 – Values, Objectives, Indicators and Targets* Section 4.1.2.)

8.1.7 Downed Woody Debris

During harvest operations, trees are processed at the stump, maximizing the amount of coarse woody debris on site post-harvest. Current levels of forest snags and coarse woody debris are generally at much higher levels as compared to Pre-industrial forest conditions. SLS acknowledges the importance of these structural attributes at both the landscape and at the stand level. Coarse woody debris and snags are particularly important for Marten and Fisher, cavity nesting birds, biodiversity, soil conservation and for reforestation success.

8.2 Species Diversity

Both coarse and fine filter management approaches will be relied upon to promote species diversity. Species specific management strategies address provincially identified at risk, threatened or species of concern relevant to forest management, as identified below.

8.2.1 Grizzly Bear Habitat Management Strategy

The Grizzly Bear (*Ursus arctos horribilis*) was officially classified as Threatened in Alberta in 2010. The main sources of mortality for Grizzly Bears are poaching, accidental collisions with highway vehicles or trains, self-defence kills, and mistaken identity kills from black bear hunters (Government of Alberta, 2016).

The SLS DFA and surrounding region offers primary habitat for grizzly bears (Herrero, 2005; AESRD & ACA, 2010) and the DFA lies within two Grizzly Bear population units; the Clearwater and the Livingstone. Further details are available in *Chapter 5 – Values, Objectives, Indicators and Targets* Section 4.1.8.1.

The effects of timber harvest on grizzly bears involves a trade-off between habitat quality and mortality risk. Generally, there are positive effects on forage availability and use in early-seral cutblocks, yet potentially negative effects relating to increased human-caused mortality. Resource Selection Functions (RSFs) show that radio-collared grizzly bears select clearcuts (mainly edges) and areas adjacent to roads (Nielsen, Boyce, & Stenhouse, 2004; Roever, Boyce, & Stenhouse, 2008), primarily due to increased food resources.

Grizzly Bears are often used as a coarse-filter focal or umbrella species for biodiversity conservation (Carroll, Noss, & Paquet, 2001; Hannon & McCallum, 2004). Carnivores with large area requirements are suggested to be umbrella species using the assumption that the area of habitat required to support viable populations will protect sufficient habitat for other species with lesser area requirements (Noss, Quigley, Hornocker, Merrill, & Paquet, 1996). For example, Carroll, Noss & Paquet (2001) showed that the habitat

requirements of grizzly bears overlap significantly with those of wolverines. Hence, regional management approaches intended to protect grizzly bear populations should have positive benefits for wolverines.

Grizzly Bear habitat state was assessed using tools provided by fRI Research (fRI Research Grizzly Bear Program, 2019). Road density on the DFA was also assessed and is below target thresholds in both population units. Habitat state results were mixed and varied by population unit. Detailed results are provided in *Chapter 5 – Values, Objectives, Indicators and Targets* Section 4.1.8.1. Additionally, it has been noted by the fRI Grizzly Bear Program lead that in Alberta there is no evidence of Grizzly Bears being limited by habitat supply, but rather by human caused mortality, so focusing on motorized access control is the best mitigation action to pursue when new areas are planned (*Gordon Stenhouse, personal communication, June 03 2020*).

To minimize impacts on Grizzly Bears, SLS has identified the following mitigation measures:

Strategic Mitigation:

- Implement recovery plan recommendations through implementation OGRs, including targeting open road densities at or below 0.6 km/km^2 in core habitat and 1.2 km/km^2 in secondary habitat.
- Clustering and minimizing footprint from the PFMS (harvest and access); and
- Incorporate existing plans, zones, other resource values (e.g. fish, wildlife, recreation and other commercial interests) and consultation with government authorities regarding access.

Operational Mitigation:

- Pursuit of joint Road Use Agreements with energy sector companies and other forest users to reduce the overall access footprint;
- Reduction harvest block parallel road sightlines for permanently open roads;
- Avoidance of loop roads; and
- Reclamation of unused access.

8.2.2 Barred Owl Habitat Strategy

The Barred Owl (*Strix varia*) has been listed as a *Species of Special Concern* in Alberta (Alberta Environment and Parks, 2016). Barred Owl nesting pair habitat is one of four fine filter old growth species habitats modelled for development of the 2021 FMP. Barred Owls are numerous across North America and considered a low concern in terms of conservation risk with a rating of 7 (low concern) out of 20 on the 2016 State of North America's Birds Report (North American Bird Conservation Initiative, Accessed May 2020). The North American Breeding Bird Survey estimates their populations increased by 3% per year between 2005 and 2015 (USGS, Accessed May 2020).

Until the twentieth century, Barred Owls were residents of old, undisturbed forests in eastern North America and were likely restricted from moving into northwestern boreal forests because of frequent forest fires. A combination of successful boreal forest fire suppression and Great Plains tree planting programs allowed for northward and westward habitat expansion. This allowed the species to expand across the west coast, where they compete and hybridize with Spotted Owl (*Strix occidentalis*) populations (The Cornell Lab, Accessed May 2020).

Predicted habitat value and the potential number of breeding pairs over the 200-year timeframe were assessed using GoA models. Methodology and detailed results are available in *Chapter 5 – Values, Objectives, Indicators and Targets* Section 4.1.8.2.

There is little deciduous harvest (incidental only) on the DFA and most Barred Owl habitat occurs on the eastern edge of the DFA. Over the 20-year timeframe, an increase in mean habitat value and number of potential breeding pairs is forecasted. Over the 200-year timeframe, there is minimal overall change from current conditions.

Although modeling suggests that Barred Owls will not be unduly impacted by the PFMS, SLS will still enact certain mitigation strategies to minimize any potential impacts to Barred Owls.

Strategic Mitigation:

- Adjusted spatial harvest sequence to minimize modelled breeding pair habitat impacts;
- Reduce wildfire risk on the DFA (16% of the high, very high and extreme risk stands over 20 years, see Section 6.1); and
- Explore mixedwood silvicultural treatments to promote old forest development characteristics at younger age classes.

Operational Mitigation:

- Avoid the harvest of aspen and poplar trees;
- From March 14 to July 15 avoid harvest operations within 500m of known nesting sites;
- If a known nest site is within a harvest opening, then retain a 100m buffer, as practicable; and
- Adhere to the structure retention strategy.

8.2.3 American Marten Habitat Strategy

The American Marten (*Martes americana*), also referred to as the pine marten, is a shy weasel-like mammal found throughout Canada in coniferous and mixedwood forests. It is listed as *secure* in Alberta (Government of Alberta, 2017). Marten have traditionally been prized by trappers for its high value fur, sometimes referred to as Canadian sable (Natural Resources Canada, Accessed May 2020) and is often used as an indicator of forest ecosystem integrity.

American Marten are a focal species known to prefer mature coniferous forest habitat and is one of four fine filter old growth species habitats modelled for development of the 2021 FMP. The important focal species habitat is also known to be important for Northern Goshawk, Pileated Woodpecker, Northern Pygmy Owl, Barred Owl, Bay-breasted Warbler, Cape May Warbler, and Lynx (HAB-TECH Environmental Ltd., 2014).

There are knowledge gaps concerning the long-term impacts of forest management on Marten. Canadian research indicates Marten avoid young stands in boreal forests, generally preferring mature and older conifers and mixedwood forest. Research indicates that past silvicultural practices likely decreases Marten habitat in the short-term, because it reduces coarse woody debris and standing dead wood, habitat features important to Marten (Natural Resources Canada, Accessed May 2020).

A large field study was initiated in 2000 by the Canadian Forest Service, the Ontario Ministry of Natural Resources and the University of Guelph to investigate marten populations in managed and unmanaged forests. Marten responded positively, but in low numbers, in managed areas that had been replanted with conifer trees about 50 years previously, suggesting that basic silviculture can eventually provide habitat favorable to marten. Marten populations also showed a higher susceptibility to commercial trapping in managed forests, likely due in part to the higher density of road networks that provide increased access to trappers. They conclude that populations can also persist at lower levels in mature regenerating forests, but only if trapping is controlled. The authors also suggest that a range of forest ages distributed across

the landscape with varying sizes of uncut areas is likely the best method to ensure viable marten populations (Natural Resources Canada, Accessed May 2020).

A Habitat Suitability Index (HSI) model was directly incorporated into the modeling framework in order forecast habitat state change over time. Methodology and detailed results are available in *Chapter 5 – Values, Objectives, Indicators and Targets* Section 4.1.8.2. Over 20 years, a decline in HSI is forecasted, but this decline remains within the 15% change from current levels threshold that is considered low risk. Over the 200-year timeframe, the forecast indicates a decline in HSI between 30% and 15%, considered medium risk. The timber supply model used to develop the PFMS was constrained in order to make sure that the decline in HSI was less than 30%.

In addition, in order to reduce any potential impacts to marten habitat, SLS will enact the following mitigation measures, falling in two major categories.

Strategic Mitigation:

- The timber supply analysis was constrained to reduce impacts to American Marten over time;
- Increase the area of old interior forest over time (see *Chapter 5 – Values, Objectives, Indicators and Targets* Section 4.1.3);
- Reduce wildfire risk on the DFA (16% of the high, very high and extreme risk stands over 20 years, see Section 6.1); and
- Explore coniferous silvicultural treatments to promote old forest development characteristics at younger age classes;

Operational Mitigation:

- Adherence to Timber Harvesting and Operating Ground Rules section 7.4;
- Retain as many natural snags as safety permits. In the absence of natural or safe snags, retain top 1-3 green or dead trees per ha that are greater than 3-5m tall and greater than 20cm DBH, as safety permits;
- Within harvest openings retain stumps, limbs and tops, including pre- and post-harvest large organic and coarse woody debris;
- Identify and retain special sites including springs, seeps, weeps and other water source areas. Also retain wildlife trees and treed rocky outcrops; and
- The option of debris pile retention, as per the Debris Disposal Strategy Part C.

8.2.4 Songbirds

Three species were selected by the PDT to be modeled – the Varied Thrush (*Ixoreus naevius*), the Ovenbird (*Seiurus aurocapilla*), and the Brown Creeper (*Certhia americana*). Both the Varied Thrush and the Ovenbird are listed as *secure* in Alberta, while the Brown Creeper is listed as *Sensitive* (Government of Alberta, 2017). Varied Thrush and Brown Creeper habitats are two of the four, fine filter old growth species habitats modelled for development of the 2021 FMP. Each of the identified species was incorporated into the PFMS model based on coefficients provided by the GoA. Detailed results are available in *Chapter 5 – Values, Objectives, Indicators and Targets* Section 4.1.8.5.

The North American Breeding Bird Survey states that the Varied Thrush is common, but that populations have declined by over 2.5% per year between 1966 and 2015, resulting in a cumulative decline of 73% (USGS, Accessed May 2020). The Varied Thrush is listed as a common bird in steep decline in the 2014 State of the Birds Report. It prefers mature old-growth forests, containing large trees and forest patches greater than approximately 20 hectares (The Cornell Lab, Accessed May 2020).

Ovenbird and Brown Creeper relative abundance are forecasted to remain steady or increase over a 20-year and 200-year timeframe. For the Varied Thrush, over 20 years, a decline in relative abundance is forecasted, but this decline remains within the 15% change from current levels threshold that is considered low risk. Over the 200-year timeframe, the forecast indicates a decline in relative abundance between 30% and 15%, considered medium risk.

The timber supply model used to develop the PFMS was constrained in order to make sure that the decline in varied thrush relative abundance was less than 30%. It should also be noted that the on-par analysis (*Chapter 6 – Preferred Forest Management Scenario* Section 4.4.1) and patch size distributions show that patches of old conifer growth remain on the landscape and these provide Varied Thrush habitat on the un-managed (passive) landbase.

In addition, in order to reduce any potential impacts to Varied Thrush populations, SLS will enact the following mitigation measures, falling in two major categories.

Strategic Mitigation:

- The timber supply analysis was constrained to reduce impacts to Varied Thrush habitat over time;
- Permanent road density will be minimized (see *Chapter 5 – Values, Objectives, Indicators and Targets* Section 4.1.4);
- Increase the area of old interior forest over time (see *Chapter 5 – Values, Objectives, Indicators and Targets* Section 4.1.3);
- Reduce wildfire risk on the DFA (16% of the high, very high and extreme risk stands over 20 years, see Section 6.1); and
- Explore spruce leading silvicultural treatments to promote old forest development characteristics at younger age classes.

Operational Mitigation:

- Adhere to structure retention strategy;
- Temporary roads density will be minimized (see *Chapter 5 – Values, Objectives, Indicators and Targets* Section 4.1.5); and
- Timing of tree felling within old growth spruce stands, will aim to avoid the nesting and fledgling periods between May 15-August 15th, as practicable, with meeting required operational constraints, such as: road reclamation timelines and log delivery targets etc.

8.2.5 Westslope Cutthroat Trout and Bull Trout Habitat Strategy

The Westslope Cutthroat Trout (*Oncorhynchus clarkii lewis*) is a sub-species of Cutthroat Trout, a salmonid species native to western North America. They are considered a *Threatened* species in Alberta (Alberta Environment and Parks, Accessed May 2020). The species has evolved to live in cold freshwater environments with clean water and abundant in-stream cover. They are sensitive to changes in temperature and sediment loads and are viewed as an indicator species of general ecosystem health (COSEWIC, 2006). In Alberta, pure Westslope Cutthroat trout are extirpated throughout most of their historic range in the Bow and Oldman drainages of the South Saskatchewan River basin. Existing populations are threatened by hybridization with non-native subspecies of Cutthroat Trout and Rainbow Trout, over-fishing, population fragmentation and land-use activities that alter or deplete aquatic and riparian habitats, and.

Native populations have been marginalized and are generally found in steep, forested headwater basins (Costello, 2006) . Maintenance of the genetic purity of the remaining populations is usually due to the

presence of a natural barrier to migration (Alberta Westslope Cutthroat Trout Recovery Team, 2013). Headwater basins typically experience the most extreme seasonal fluctuations in discharge and temperature in a stream network (Schlosser, 1995) and therefore there is concern about the long-term viability of these remnant populations.

It can be difficult to visually distinguish pure Westslope Cutthroat Trout from introduced Cutthroat Trout and Rainbow-Cutthroat Trout hybrids. The only way to be certain about identification is by genetic testing. The AEP has collected DNA from suspected Westslope Cutthroat Trout in Alberta to map pure strains and populations exhibiting low levels of genetic introgression (hybridization) within each watershed. This information has been used to develop a recovery plan for Alberta pure-strain populations (Alberta Westslope Cutthroat Trout Recovery Team, 2013). Recommendations in this recovery plan include protecting and enhancing habitat, restricting development in areas with critical habitat, installing barriers to protect pure-strain populations, and angler management in critical habitat areas.

Bull Trout (*Salvelinus confluentus*) populations have declined in both distribution and abundance and are considered a *Threatened* species in Alberta (Alberta Environment and Parks, Accessed May 2020). Bull Trout is the only char species to have occupied all drainages on the eastern slopes of Alberta (Berry, 1994; Nelson & Paetz, 1992). However, populations have been extirpated in three core areas, with 81% of core areas at risk of extirpation (AESRD & ACA, 2009). Bull Trout spawn in small streams and the young inhabit their natal stream but may move to other waters as they mature.

Bull Trout are viewed as an indicator species for environmental disturbance due to their specific habitat requirements that influence their distribution and abundance. They are sensitive to increased water temperature, poor water quality and low flow conditions. They require stable stream channels, clean spawning and rearing gravel, complex and diverse cover, and unblocked migratory corridors (AESRD & ACA, 2009; Fraley & Shepard, 1989).

Many of the actions intended to protect Westslope Cutthroat Trout may also benefit Bull Trout. Stream and habitat protection and restoration, reduction of siltation from roads and other erosion sources, proper sizing and installation of stream crossing structures to provide habitat connectivity, and modification of land management practices to improve water quality and temperature are all important.

Modern SLS forestry operations are conducted in a manner that minimizes negative effects on the health, diversity and natural distribution of aquatic biota and the quantity and productive capacity of the aquatic environment, including fish habitat. SLS Forest management practices adhere to the Timber Harvest Planning and Operating Ground Rules (OGRs) that include best management practices (BMPs), such as, use of temporary roads, protective watercourse and waterbody buffers, use of arched water course crossings and rigorous erosion control measures. Temporary forestry roads, including stream crossing structures, are promptly removed and reclaimed upon commencement of reforestation operations.

Ongoing University of Alberta forest hydrology research (University of Alberta, Accessed May 2020) demonstrates no detectable increases in sediment production or other key nutrients such as phosphorus or nitrogen resulting from forestry operations (*Uldis Silins, personal communication, 2019*). While this work is ongoing, the preliminary results indicate careful application of erosion control best management practices can result in minimal to no impact on water quality, in both Rocky Mountain headwaters streams and further downstream at larger watersheds scales (*Uldis Silins, personal communication, 2019*). These findings are similar to conclusions drawn from other research in the Northwestern United States (Cristan, et al., 2016).

A major literature review of forestry best management practices in North America indicates that water quality effects of forest operations are minimized when best management practices are followed (Cristan, et al., 2016).

A number of threats are identified in the Westslope Cutthroat Trout and Bull Trout recovery strategies (Alberta Westslope Cutthroat Trout Recovery Team, 2013; AESRD, 2012). While many of these threats are not under SLS control, the relevant forest management practices that SLS employs to minimize risk are presented in Table 8-1.

Table 8-1. Threats to Westslope Cutthroat / Bull Trout and relevant SLS forest management practices

Threat	Species	Response
Hybridization	Westslope Cutthroat Trout	GoA has responsibility for managing fisheries.
Harvest (fishing)	Westslope Cutthroat Trout, Bull Trout	No new public access will result from the 2021 PFMS. SLS strives to minimize access during all of its operations by using access controls.
Habitat Degradation	Westslope Cutthroat Trout, Bull Trout	Buffers are applied to watercourses in which no forestry operations can occur. Fish passage compatible structures are used for stream crossings. Water quality monitoring indicates waters within the FMA are in a natural state. Research demonstrates forestry BMPs protect water courses from sedimentation (Cristan, et al., 2016).
Competition with introduced non-native species	Westslope Cutthroat Trout and Bull Trout	GoA has responsibility for managing fisheries.

SLS identifies the following mitigation measures, falling in two major categories.

Strategic Mitigation:

- Watercourses avoidance planned for all forestry operations;
- AVI generated watercourses and lakes were buffered and excluded from the SHS;
- Avoidance of new permanent roads; and
- Reduce wildfire risk on the DFA (16% of the high, very high and extreme risk stands over 20 years, see Section 6.1).
- Adherence to finalized 2020 Westslope Cuthtroat Trout Recovery plans with approved operational forest management guidelines (presently ongoing with DFO).

Operational Mitigation:

Current Forest management practices protect the aquatic environment and fish habitat with Timber Harvest Planning and Operating Ground Rules (OGRs) including:

- To the fullest extent possible, avoidance of permanent roads and permanent watercourse crossings;
- Road location practices and the use of tools such as wet areas mapping and LiDAR bare earth model (this is especially important for non frozen operations);
- Protection of natural stream bed and banks;
- Ensuring that watercourse crossings adhere to the OGRs and Code of Practice;
- Avoidance or timing restrictions of sensitive and wet soil areas, in order to minimize site disturbance associated with road construction and skidding (using tools such as wet areas mapping);
- Suitable timing and location of proposed operations to minimize erosion risk;

- Use of watercourse, waterbody and water source vegetation buffers as classified in the OGRs;
- Rigorous erosion control measures; and
- Timely reclamation of temporary roads.

8.2.6 Whitebark and Limber Pine

Whitebark pine (*Pinus albicaulis*), listed as *Endangered* under Alberta's Wildlife Act, grows in high mountains forests at treeline and in upper subalpine forests. It is considered a keystone species in supporting biodiversity (AESRD, 2014). Limber Pine (*Pinus flexilis)*, also listed as *Endangered*, grows in the montane and lower subalpine natural subregions of western Alberta. It is also considered important for biodiversity, particularly in its close link to the Clark's nutcracker (AESRD, 2014). Both species have been assessed at the Federal level as *Endangered* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2006). Additionally, Alberta has released a Whitebark Pine Recovery Plan (AESRD, 2014).

The most significant threats to Whitebark pine include climate change, wildfire and wildfire suppression, blister rust and Mountain Pine Beetle (Environment and Climate Change Canada, 2017). Both Whitebark pine and Limber pine trees are found almost entirely within the portion of the DFA south of Highway 1 (see *Chapter 3 – Landscape Assessment* Section 5.2.6). As described in Section 6.1 and Section 6.2, the PFMS is expected to reduce wildlfire risk and MPB risk, which can be expected to benefit both species. In addition, SLS has identified the following strategies to minimize impacts to these species. Pa/Pf information from the province was used in the development of the AVI to improve photo interpretation identification. Stands with 30% and less Whitebark pine or Limber pine content (overstorey or understorey) were retained as part of the contributing land base. This amounted to 730 ha. Operational management strategies will avoid these tree species within the stand.

Strategic Mitigation:

- 4,055 ha out of a total 4,785 ha of known Whitebark pine and Limber pine stands were removed from the active (managed) landbase;
- Reduce wildfire risk on the DFA (16% of the high, very high and extreme risk stands over 20 years, see Section 6.1); and
- Explore opportunities to reduce interspecies competition.

Operational Mitigation (for the remaining 730 ha within the active landbase):

- Establish spatially identified protective retention areas on the ground, as most Whitebark pine and Limber pine tend to grow along ridge tops and rock outcrops;
- Identify spatial area within the FHP;
- Protect and retain mature and healthy individuals and small groups as encountered during harvest operations;
- Follow the Alberta Whitebark Pine Recovery Plan (AESRD, 2014); and
- Follow the Spray Lake Sawmills Timber Harvest Planning and Operating Ground Rules.

With the combination of operational avoidance and deletions, SLS has reduced the risk of negative impacts on Whitebark pine and Limber pine populations. VOIT 14e specifies indicators and targets for Whitebark and Limber pine (*Chapter 5 – Values, Objectives, Indicators, and Targets (VOITs)*.

8.3 Genetic Diversity

Genetic diversity of the coniferous tree species within the DFA are maintained as:

- Natural regeneration is promoted by practicing stump-side processing that retains wild cones/sees on site, evenly distributed across the harvest opening; and
- Wild seeds are collected broadly across the DFA to support the planting program.

9. Monitoring Program

The 2021 FMP is a long-term, forest-level plan that sets the general direction for forest management within the DFA for the FMP period (May 1, 2021 through April 30, 2031). Successful implementation of the 2021 FMP relies, in part, on ongoing monitoring to ensure that the targets established for the FMP are attained.

Monitoring is an important tool in adaptive forest management because it links forest management activities with their outcome. This ensures forest management techniques improve and also increase the ability to predict outcomes for forest management activities which, in turn, leads to improved forecasting.

Spray Lake Sawmills is committed to implementing monitoring programs to track progress toward attainment of FMP targets, as well as to ensure efficacy of its forest management activities. Monitoring programs are required to:

- Maintain Forest Certification accreditation;
- Meet regulatory requirements;
- Achieve FMP objectives; and
- Meet FMP reporting requirements.

FMA quota holders are also required to conduct monitoring associated with regulatory requirements and to meet commitments of the 2021 FMP.

The following sections outline the monitoring commitments associated with implementation of the 2021 FMP for the DFA.

9.1 Regulatory Requirement Summary

To meet the GoA's regulatory requirements, several sampling and/or monitoring programs are completed by Spray Lake Sawmills and the FMA quota holders. These reporting requirements are linked but are not specific to the 2021 FMP.

Regulatory reporting is required at ongoing periodic specified intervals, such as during AOP and the GDP submissions. While the 2021 FMP does not alter these reporting requirements, a few products developed

as part of the 2021 FMP process clarify regulatory reporting and are identified in this section. The information provided below is intended to serve as a listing of the requirements and to guide the reader to the relevant portion of the FMP.

9.1.1 Timber Volume Harvested

Procedures to charge all timber harvested on the DFA were developed and summarized in Section 4.1.5.

9.1.2 RSA Targets

Reforestation targets were developed following the policies described in the Reforestation Standards of Alberta (RSA). Targets are expressed as Mean Annual Increment (MAI) values for each of the reforested strata. All operators are required to adhere to the RSA program to manage MAI targets. Refer to Section 5.1.3 for more information.

9.1.3 Seed Requirements

In order to ensure an adequate supply of seed is available to carry out the reforestation requirements as a result of this harvesting plan, refer to Section 5.2.1 for a summary by seed zone. Included are the amount of seed available and the amount of seed requirements.

9.1.4 Tree Improvement Program

Not applicable at this time.

9.2 FMP Monitoring Requirements

Monitoring requirements derived from the 2021 FMP are identified in Table 2-1. VOIT implementation. Each VOIT provides a detailed description of the values, objectives, indicators and targets, as well as its reporting requirements. Refer to *Chapter 5 – Values, Objectives, Indicators, and Targets (VOITs)* for more information.

9.3 Growth and Yield Program

The Spray Lake Sawmills Growth and Yield Program is outlined in a separate document and included in *Annex VIII – Growth and Yield Plan*. The program describes required commitments for Growth and Yield as outlined in the Forest Management Planning Standards. The Growth and Yield Program is a working document and will be periodically updated as the program is implemented, or cooperative commitments change (e.g. Provincial Growth and Yield Initiative).

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Appendix I – Structure Retention Strategy

Overview

All tenure holders' operations within the B12 FMU will plan and carry out operations to achieve an interior harvest area, structure retention target of 3% for harvest areas as specified below. A harvest area is defined as one opening with a corresponding opening number. The 3% structure retention requirement has been applied to the timber supply analysis.

All of the Spray Lake Sawmills harvest areas connect to undisturbed forested landscapes comprised of both the passive and active landbase. The passive and active landbases connect with millions of hectares of undisturbed forest comprised of both Provincial and Federal parks[2]. Research from the Foothills Model Forest (now FRI Research) Natural Disturbance Program Quicknote #23 (Nov 2003), indicated that areas under 100 ha generally have 1 % retention, and areas over 100 ha require a 4 ha patch. This research was the foundation of the previous DFMP's retention strategy and was proposed to be used for the 2021 management plan. The Executive Directors direction was the strategy shall consist of a minimum area target of 3-5%.

Definitions:

- Retention – Standing trees left after harvest (live and dead).
- Single Stem Retention – Individual trees left standing in a harvest area.
- Interior Patches, Clumps, Islands – un-harvested groups of trees detached from the harvest boundary.
- Peninsular patch- un-harvested groups of trees protruding into the harvest area and attached to the harvest boundary. Peninsular patches can contribute to the retention target if the unharvested area has a 3:1, length to width ratio.
- Matrix Remnants- undisturbed trees and groups of trees both detached and attached from the disturbance event. Undisturbed means the retention is intact and left standing and are outside of the block. These areas are functional landscape retention however they do not count toward the 3% target as they are connected to but outside of a harvest area.

Procedures

Structure retention shall be internal to each harvest area, be representative of the pre-harvest stand composition and reported annually as a component the spatial data directive requirement and in the 5-year Stewardship Reports.

[2] Evaluating the Forested region from Banff park all the way down to Waterton National park, there is approximately 1.74 million hectares of land, of which approximately 500,000 (30%) is zoned for forest management.

Structure retention targets will be achieved using the following objectives:

1. Safety is a primary concern when leaving structure retention standing in a harvest area.
2. Structure retention will include pre-harvest layout and or contractor selected.
3. Candidates for structure retention include merchantable and non-merchantable trees representative of the pre-harvest stand:
    a. Green culls (rotten, broken tops, forked tops, dry sides, severe sweep and crook);
    b. Snags (as safety permits);
    c. Wolf trees (with heavy branching or poor form);
    d. Deciduous trees and patches;
    e. Sub-merchantable trees;
    f. Advanced regeneration;
    g. Whitebark pine, Limber pine and Alpine larch;
    h. Tree patches within inoperable areas (inoperable areas cannot be reasonably operated due to environment and safety considerations such as rock outcrops, steep slopes, wet areas etc.);
    i. Tree patches for source water areas, such as springs and ground water seepage areas, ephemeral or intermittent watercoursed (can be considered peninsular patch);
    j. Tree patches for cultural sites (e.g. cultural artifacts);
    k. Tree patches for sensitive sites (e.g. bird nests, dens, hibernacula, mineral licks);
    l. Tree patches to screen important recreational view sheds;
    m. Tree patches along permanent public roads (DLOs, LOCs, and numbered highways) to screen within block grizzly bear habitat or visual resources (see visual quality strategy for details); and
4. Deciduous areas, areas with higher moisture content, areas of non-merchantable size and/or dead standing trees, or trees that appear to have survived multiple fire cycles are good examples of candidate structure retention.
5. For single stem retention, in the absence of natural or safe snags, as safety permits, top 2 to 6 green culls or dead trees per hectare, preferably 30 cm or greater DBH to 3-5 m tall.
6. On an individual harvest unit basis (i.e. opening number), think about changing peninsular patches can only contribute up to two thirds of the target (i.e. 2%).
7. Harvest areas smaller than 10 ha in size may have less the 3% area of structure retention (including as low as 0%), due to operational realities (i.e. long narrow blocks).
8. The minimum target is 3% of the harvest area annually, but a wide range in variability in harvest area retention levels is acceptable, as long as the annual target is achieved or exceeded.
9. To be consistent with spatial data directive reporting requirements and cutover photography acquisition and interpretation, retention levels will be tracked annually, but be calculated by the end of the timber year, two years after the skid clearance date[3].

[3] Final Cutblock Digital Data Submission, ESRD, Land and Forest Policy, 2015, No 3.

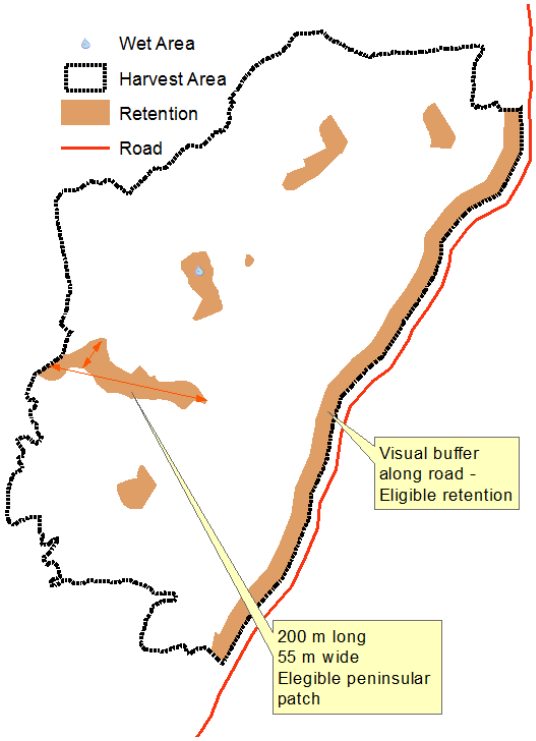


Figure I-1: Example of structure retention

Stand Level Structure retention targets

The 3% of the area target shall be achieved and reported in the 5-year Stewardship Report. Annual and landscape variation are permitted, provided the 5-year target is achieved (refer to VOIT #10, 1.1.2.1a).

Monitoring measuring and reporting structure

Structure retention is measured on an area basis. All tenure holders on the FMA must calculate the amount of area harvested and area left for structure retention by operator's sphere. The results will be reported at the DFA level.

The primary means of identifying structure retention levels will be through following the Spatial Data Directive, Final Cutblock Policy which depend on the *Disturbance Updates - Standards and Specifications for Timber Harvesting (2015).* Minimum polygon size for leave areas (retention) has been dropped from 0.5 ha in the standard to 0.04 ha.

If single stem retention is employed in a harvest area, an estimate of retention area will need to be completed and tracked for the block. This should be completed around the time of skid clearing for the block. The following formula can be used:

$$Area = \frac{Number\ of\ standing\ trees}{Block\ Predicted\ Piece\ Size} \div Average\ gross\ volume\ per\ ha$$

e.g. if there are 100 live cull trees left behind, and the predicted piece size for the block was 3.7 trees/m^3, and the average gross volume was 180 m^3/ha, then:

$$\frac{100\ trees}{3.7\ trees/m^3} \div 180\ {}^{m^3}/_{ha} = 0.15\ ha$$

The spatially identified structure retention will be removed from the contributing landbase for the next FMP for the length of one rotation (typically 80 years).

Appendix II – Visual Quality Strategy

Introduction

The strategy's objective is to plan forest activities that are compatible with the character of the DFA landscape.

The DFA's visual landscape is characterized by patches of large and small forested areas, along with large and small openings including grasslands, meadows, bog areas, shrub lands and rock-strewn areas.

The forests are predominately closed canopy, made up of dense lodgepole pine and white spruce with the occasional patch of aspen and balsam popular.

The DFA's western side is dominated by forested and large open areas interrupted by treeless rocky mountain tops. Often, the most scenic portions of the DFA are the broad vistas from roads, looking west toward the treeless Rocky Mountain Front Range. The eastside is a combination of large grassland meadows, and a patchwork of forested foothills and regenerating cutblocks.

The DFA has a long history of integrated resource management, also known as mixed use and the forest is predominately a patchwork of regenerating cutblocks, roads, seismic lines, well pads, power lines, pipelines, compressor stations, and fence lines.

The recreational footprint also has had a significant impact on the natural appearance including areas cleared for roads, parking lots, picnic areas and campgrounds. A myriad of designated and non -designated trails, which include historical coal exploration roads and traditional linear seismic work are also present. This extensive trail network includes both legal and illegal trails and is frequented by motorized users, equestrian enthusiasts, mountain bikers and hikers as specified in the various public land use zones.

Designated camping areas known as Public Recreation Areas (PRA's) and random camping areas are also heavily used and common throughout the DFA. Cattle roam free throughout the DFA including the recreational areas. The PRA's and random camping areas are characterized by roads and pullouts and generally surrounded by clumps of trees, meadows, and or riparian areas. Many of the forested areas within the PRA's are comprised of patches of over mature trees with high levels of fuels and blow-down.

A healthy forest ecosystem depends on a continuous cycle of renewal. Disturbance such as fire, insects, disease and blow down are natural events that create forest renewal and a diversity of forest ecosystems.

In a managed forest, such as the DFA, harvesting emulates natural disturbances where harvesting removes merchantable trees to create forest renewal. A well-managed forest, compliments natural disturbance with wise use of forest resources. Many of the areas within the DFA are at risk to mountain pine beetle infestation and are at risk to high severity wildfire.

Given the history of integrated resource management on the DFA and the nature and condition of its visual features, timber harvesting is visually compatible with the existing vegetation patterns. However, specific areas have been inventoried that presently do not have a recent history of cutblocks, are frequented by large numbers of the public and potentially have high foreground visual sensitivity. These

potentially high visual sensitivity areas within the foreground will be consulted on at the operational planning level to address appropriate site-specific visual mitigation measures.

Visual Quality Inventory

In 2019, a visual quality inventory was completed using the viewshed toolbar through ESRI ArcMap Spatial Analyst. The DFA has been designated into three visual zones[4] as follows:

- Foreground 0-.8 kms;
- Middle ground .8 kms to 5 kms; and
- Background greater than 5 kms.

Given the general suitability of forestry to blend with the DFA's landscape, the inventory focuses on high sensitivity visual quality areas located within the unobstructed viewable foreground. Areas of high visual quality from this inventory are shown in Appendix II Figure 1.

AVI polygons, not identified as having high visual sensitivity with the inventory may later be assigned as having high visual sensitivity as discovered through FMP consultation and through Forest Harvest Plan (FHP) consultation process as described in the Timber Harvest Planning and Operating Ground Rules.

Visual Sensitivity Inventory

ESRI ArcMap Spatial Analyst was used to designate viewpoints, (a-d):

a) Within, adjacent to or viewed from all designated DFA recreational sites and tourist developments. Designated DFA recreation areas, include designated random camping areas and are defined as: 1) are identified on Alberta published maps and or are designated by Alberta with signage;

b) Viewed from *Designated viewpoints;*

c) adjacent to or viewed from lakes, major rivers Ghost, Elbow, Sheep and Highwood Rivers; rural/urban forest interface areas (small private property home sites <20 acres); and

d) adjacent to primary and secondary highways in Alberta.

Determination of Visual Quality

The general process of determining visual quality can be summarized in 4 steps:

1. Determine viewer locations;
2. Calculate viewsheds of each viewer;
3. Tabulate the number of times a location is observed (visibility); and
4. Summarize observed areas by proximity to viewer.

This simplistic description to determine visual quality contains many details that require clarification:

1. What are the viewer locations;
2. What is the value of each viewer location to the observer; and

[4] Foreground, mid-ground and background distances based on: *USFS Forest Landscape Description and Inventories a Basis for Landscape Planning and Design*

3. How does proximity affect quality?

Determination of Viewer Locations

The points along or within viewer locations are determined by a 50m point spacing analysis. Potential viewer locations are placed every 50m along linear features. Viewer locations are placed using a 50m spacing grid within area-based features. Points were removed if they are surrounded by vegetation greater than 2m and moved along the road or river up to 25m for a better vantage point (higher elevation).

Value of Viewer Locations

A viewer location's value is dependent upon the proximity of what is being observed when compared to other viewing points in the vicinity and the amount of time that the viewer has to observe. When travelling down a road, each location is not as 'valuable' as the next – coming out of a densely enclosed forest road to a segment of road overlooking a valley, the valley viewscape is of more inferred value and hence must be considered as such while factoring the time that the viewer has to observe.

A road can be said to have high 'opportunity' to observe as there are many viewing locations along the road (availability) and roadways are highly accessible. Opportunity here refers to the relative number of viewer locations within an area and their availability and accessibility. Comparing this high opportunity along a roadway to a viewer location on a ridge in a recreational area where time to observe increases but its relative opportunity to observe is limited, the value of the ridge in the recreational area increases.

Locations where there are fewer viewpoints become more valuable compared to higher density of viewpoints, such as found along roads and rivers. When a viewer travels on a roadway, each viewpoint is observed for a short period of time when compared to more stationary viewpoints, such as campgrounds. In the analysis, the relative value of viewer locations change depending on the density of each viewpoint compared to its neighbours. The first pre-processing step calculates the density of viewpoints, and then creates an inverse relationship between the highest density and lowest density, where the lowest density has the highest value. The second pre-processing step determines how much area each viewpoint can 'see' using the foreground distance of 800m, where viewpoints that can 'see' more landscape are weighted higher. The two pre-processing products are then combined to generate a final weighted value for each viewpoint. Value equates to increased viewers at a location in analyses of visibility.

To process the visibility, each viewpoint then assigns its value to each position on the landscape that it can 'see'. Each position on the landscape is the sum of values for all viewpoints that can see it. In processing the midground and background, we use the value of visibility from the previously calculated foreground to remove the lowest 50% of viewpoints. This was done to improve the processing speed of the mid- and background layers.

Visual Quality Mitigation

Visual quality management measures are to be considered for high visual sensitivity harvest areas located within the foreground. As operational, Forest Harvest Plans are drafted; harvest areas having high foreground visual quality rankings will be assessed and consulted on to identify mitigation measures and to reduce potential adverse visual quality impacts.

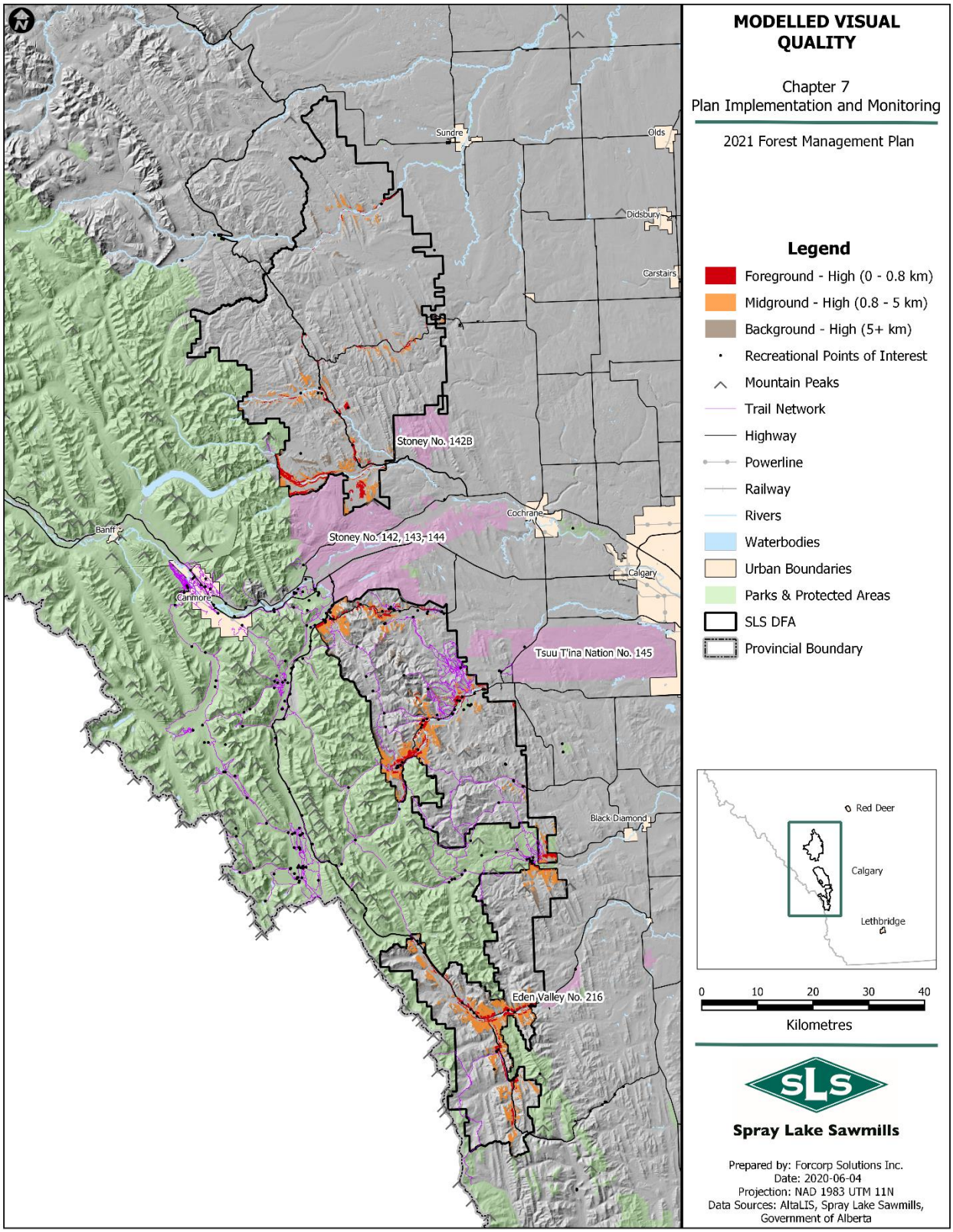
Visual Quality Measures:

- High sensitivity visual quality inventory and consultation as completed as part of the 2021 FMP;
- High Mid-ground and background areas will not be considered visually sensitive unless re-designated as visually sensitive during operational planning and public consultation;

- Mitigation measures to reduce the impacts to 'high sensitivity visual Quality' foreground harvest areas may include (FHP process):
    - modification of harvest boundaries
    - utilization of topography
    - application of various structure retention approaches
    - modification of road locations
    - use of visualization computer modeling to evaluate various layout options

Reporting

- Documentation of high visual sensitivity block strategies as identified in the FHP.



Appendix II Figure 1. Modelled areas of high foreground, midground and background visual quality on the DFA

Appendix III – B12 FMU FireSmart Management Process

B12 Forest Management Unit

Annex 3 FireSmart Management Process

Alberta Wildfire

March 2020

Alberta

B12 Forest Management Unit: Wildfire Threat Assessment

Published by Alberta Agriculture and Forestry

March 2020

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Introduction

Wildfires are part of the natural disturbance regime of the Canadian landscape. They shape and form the landscape inheritance. Wildfire management aims to balance the ecological role of fire while protecting human life, communities, watersheds and sensitive soils, natural resources, and infrastructure.

The goal of FireSmart forest management planning is to create a landscape in which catastrophic fire is minimized. This is accomplished through a combination of:

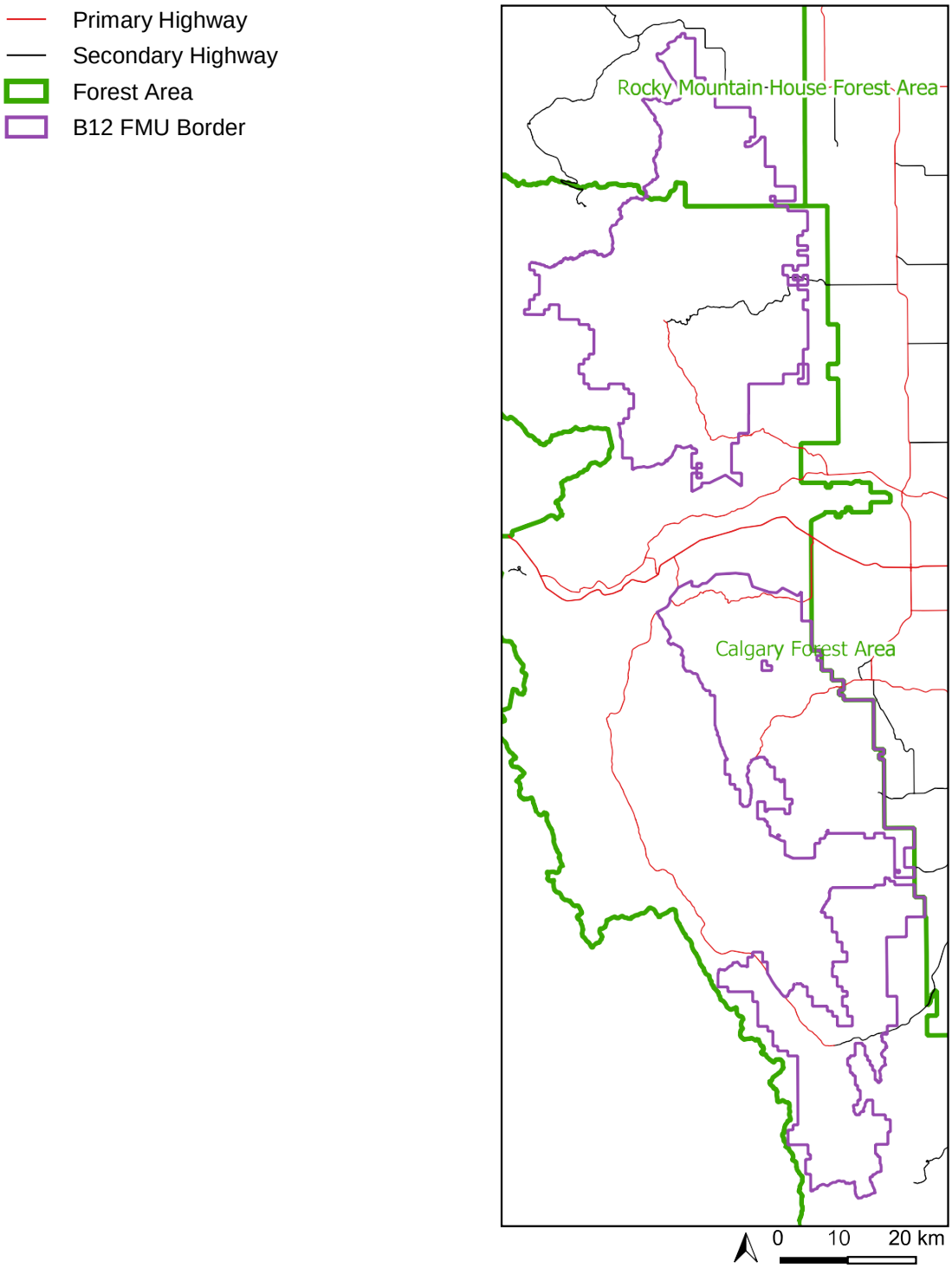
- Reducing the fire behaviour,
- Reducing the exposure of resources and assets to the negative impacts of wildfire,
- Targeted timber harvest in locations with problematic forest fuel types,
- Consideration of species conversion and reduce coarse wood debris retention in locations harvested near communities, and
- Ensuring linkages to other FireSmart strategies succeed as Community Wildfire Mitigation Strategies.
- FireSmart landscapes are managed with the recognition of the interaction between ecological, economic, and social impacts of fire while identifying opportunities for the use of timber harvest and other disturbances strategies build resilient communities and healthy, productive ecosystems.

FireSmart seeks to mitigate large, high intensity, high severity wildfires and incorporate natural disturbance emulation. Designing FireSmart by integrating fire, forest and land management planning activities is the cornerstone of protecting a multitude of values, achieving safety, meeting planning objectives and ultimately attaining *sustainable forest management*. FireSmart also identifies opportunities to use prescribed burning as a natural disturbance management strategy to meet ecological objectives through ecological restoration. FireSmart is a building block of all elements of wildfire prevention (engineering, education, enforcement).

Area of Interest

The B12 Forest Management Unit (FMU) overlaps the Calgary Forest Area and the Rocky Mountain House Forest Area (Map 1).

Map 1. B12 Location of the B12 FMU to the Calgary and Rocky Mountain House Forest Areas.



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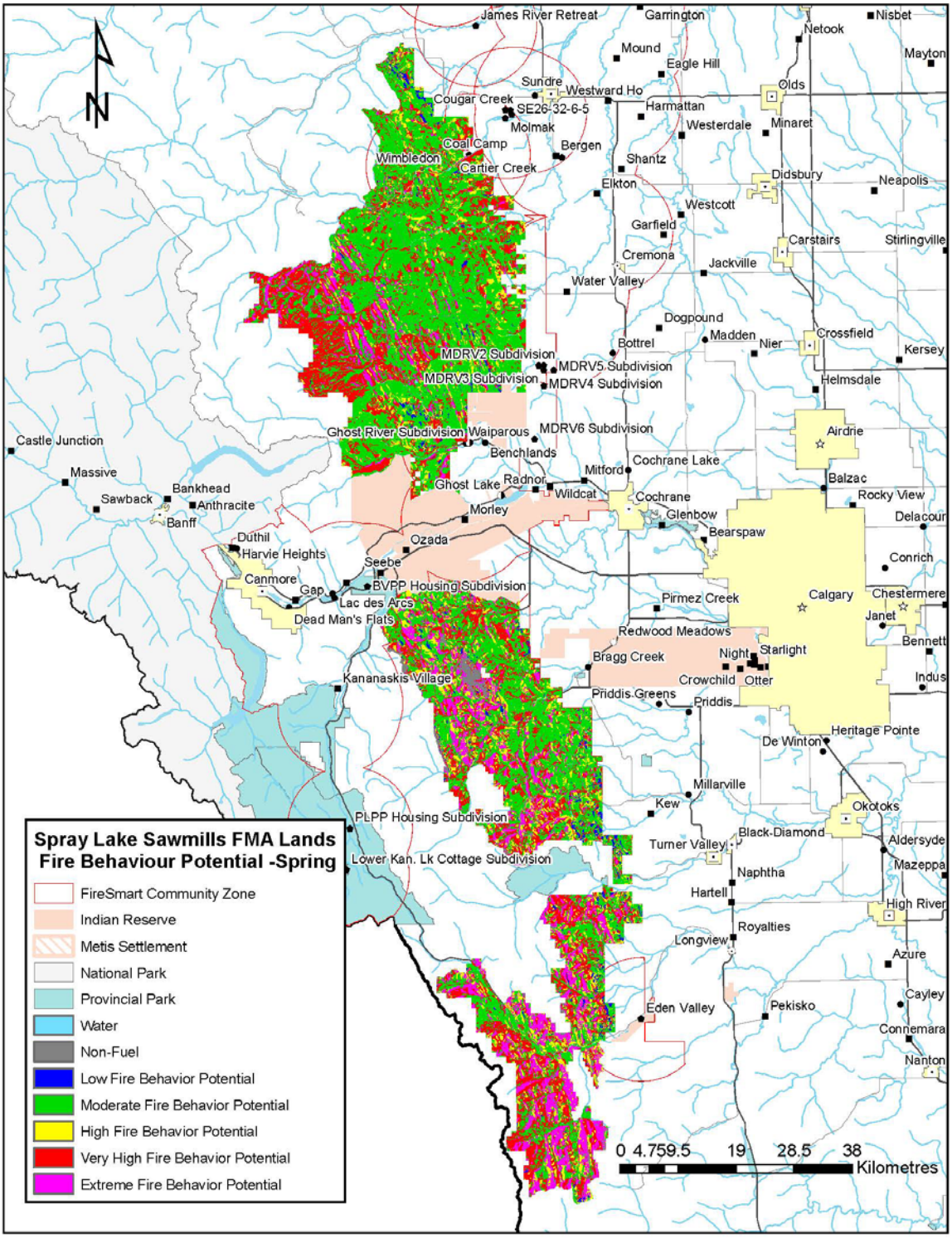
Fire Behaviour Potential

Fire behaviour potential is how fuel ignites, flame develops, and fire spreads and exhibits other related phenomena. Fuels, topography, and fire weather and climate are the primary influences on the fire behaviour potential of a given location. Various planning and operational activities rely on fire behaviour prediction, including the development of daily action plans during wildfire events, developing prescriptions for prescribed burns, and developing landscape-level fire management strategies.

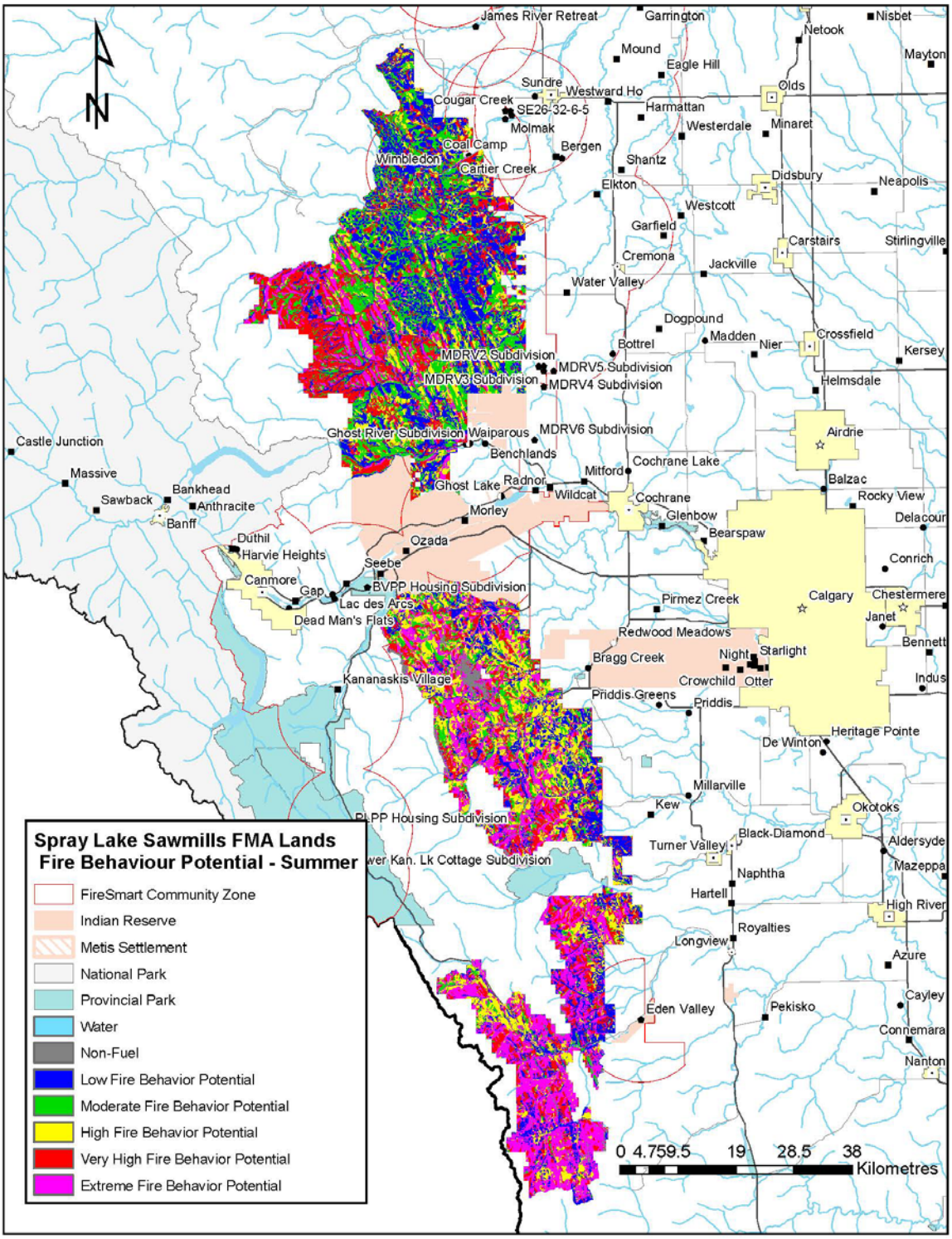
Using the Canadian Forest Fire Weather Index (FWI) System, the effect of fuel moisture is calculated daily to generate FWI values. The Wildfire Threat Assessment model uses the FWI values at the 90th percentile (very dry) based on historical weather, fuels, and topography to calculate the ratings (low to extreme) of the average of Crown Fraction Burn (CFB) and Head Fire Intensity (HFI), two secondary output of the Canadian Fire Canada Information System. Current fire behaviour potential classes in B12 FMU have been analyzed for spring (Map 2), summer (Map 3), and fall (Map 4) periods (Table 1).

The 90th percentile FWI indices are used in the model to show the possible hazard to resource managers over the landscape based on historical weather and current vegetation. Wildfires that occur under these conditions are challenging to manage and pose the greatest threat to resources and assets.

Map 2. Spring Fire Behaviour Potential within the B12 FMU.



Map 3. Summer Fire Behaviour Potential within the B12 FMU.



Map 4. Fall Fire Behaviour Potential within the B12 FMU.

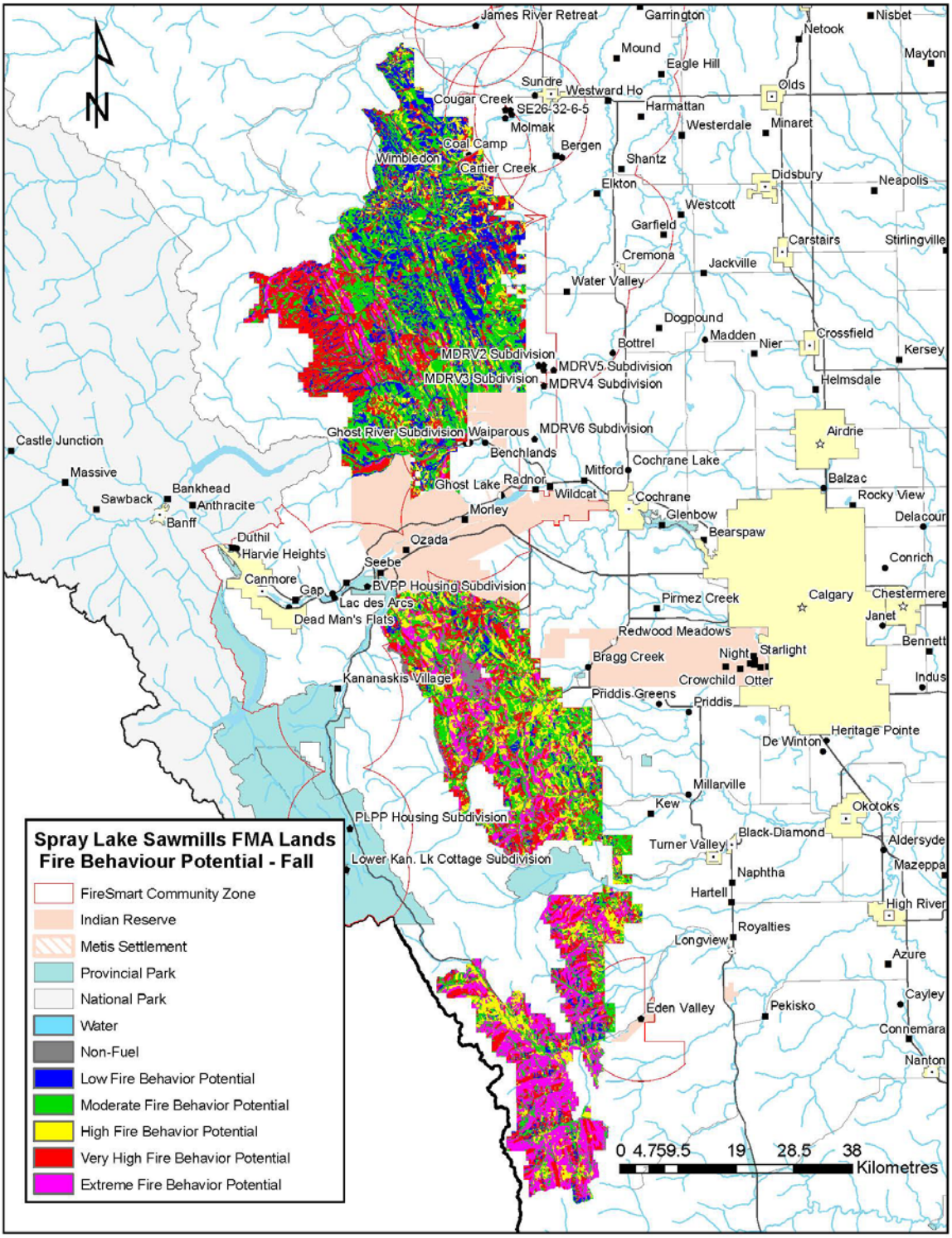


Table 1. Percentage of the B12 FMU with a given fire behaviour potential rating each fire season period.

Rating	Spring	Summer	Fall
Low	5.5%	25.2 %	0.5 %
Moderate	75.0 %	21.6 %	28.8 %
High	1.8 %	34.4 %	51.5 %
Very High	15.3 %	4.6 %	6.6 %
Extreme	2.4 %	14.2 %	12.6 %

There have been large wildfires during the winter season as a result of chinook weather conditions; however, they are more the exception. The 3 season FBP maps change due to the fuel moisture content of the forest fuels throughout the seasons, which is primarily driven by weather conditions. Multiple consecutive dry years stress vegetation and increase the potential for more and larger fires over the landscape. The lower the fuel moisture content, the greater the potential of fuel available for consumption and increased fire intensity potential.

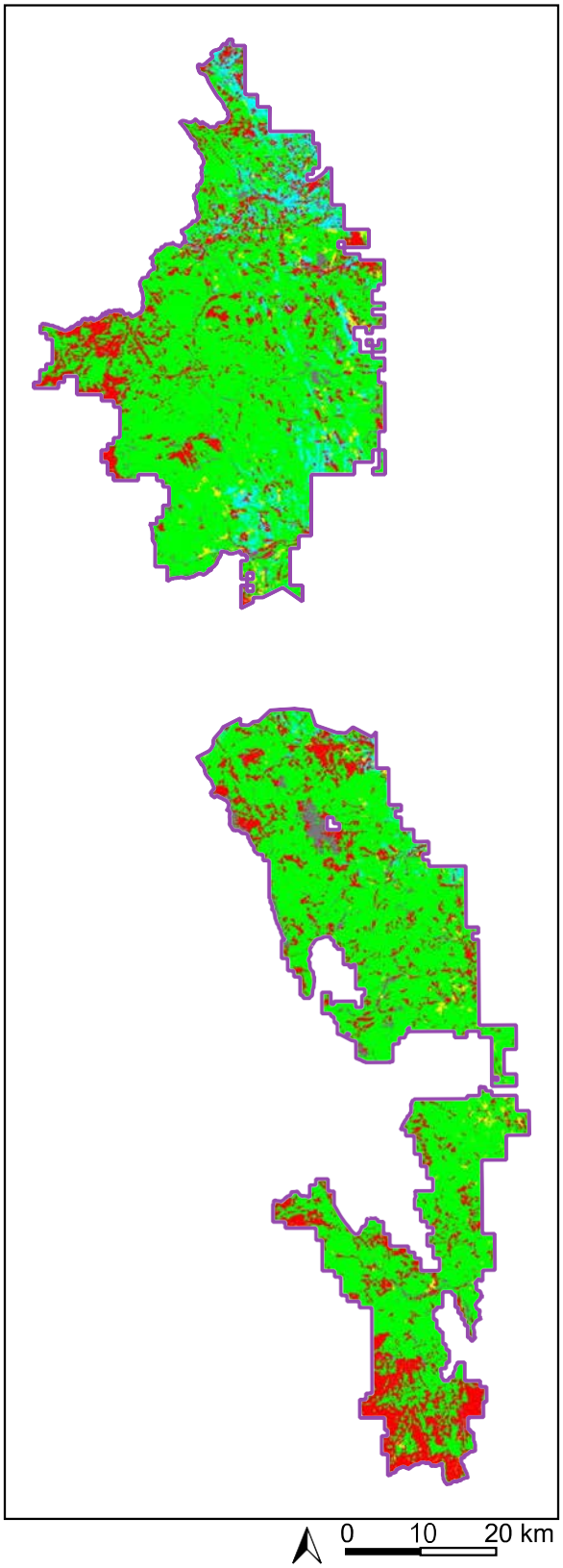
Head Fire Intensity

Head Fire Intensity (HFI) is the predicted intensity, or energy output, of the fire at the front or head of the fire and is a function of the Fine Fuel Moisture Code (FFMC), Build-Up Index (BUI), and Initial Spread Index (ISI). Primarily driven by fuels, HFI indicates the type of fire behaviour to expect, and thus it is one of the principal methods by which fire managers estimate the difficulty of controlling a fire. Areas with high fuel buildup will be susceptible to high-intensity, difficult-to- control fires under the appropriate weather conditions. Fire suppression activities within B12 over the past several decades have produced an older forest age class structure containing a fuel buildup in many areas and, thus, the prevalence of high HFI classes for spring (Map 5), summer (Map 6), and fall (Map 7) periods. High and extreme Head Fire Intensity classes can have an adverse impact on water and soils if entire watersheds burn under these conditions.

Map 5. 90th Percentile Head Fire Intensity for Spring within the B12 FMU.

90th Percentile Head Fire Intensity-Spring (2018)

- Non-Fuel
- Intensity Class 1
- Intensity Class 2
- Intensity Class 3
- Intensity Class 4
- Intensity Class 5
- Intensity Class 6
- B12 FMU Border



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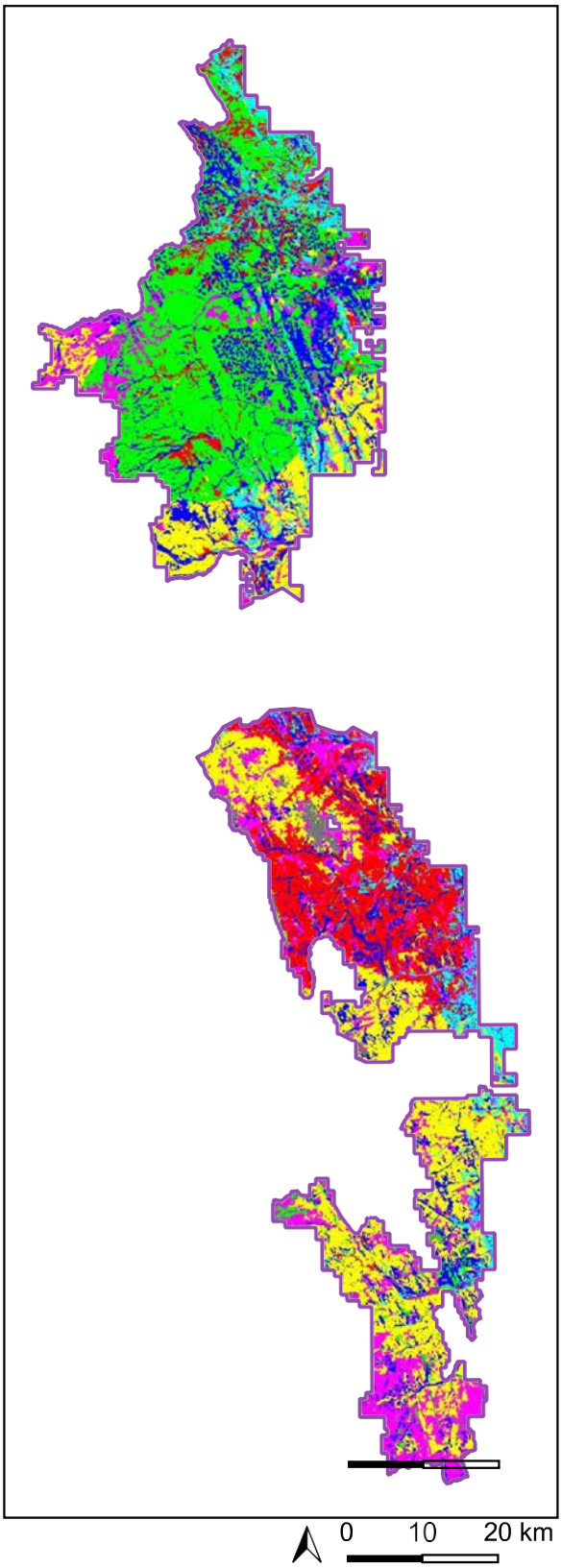
Map 6. 90th Percentile Head Fire Intensity for Summer within the B12 FMU.

90th Percentile Head Fire Intensity-Summer (2018)

- Non-Fuel
- Intensity Class 1
- Intensity Class 2
- Intensity Class 3
- Intensity Class 4
- Intensity Class 5
- Intensity Class 6
- B12 FMU Border



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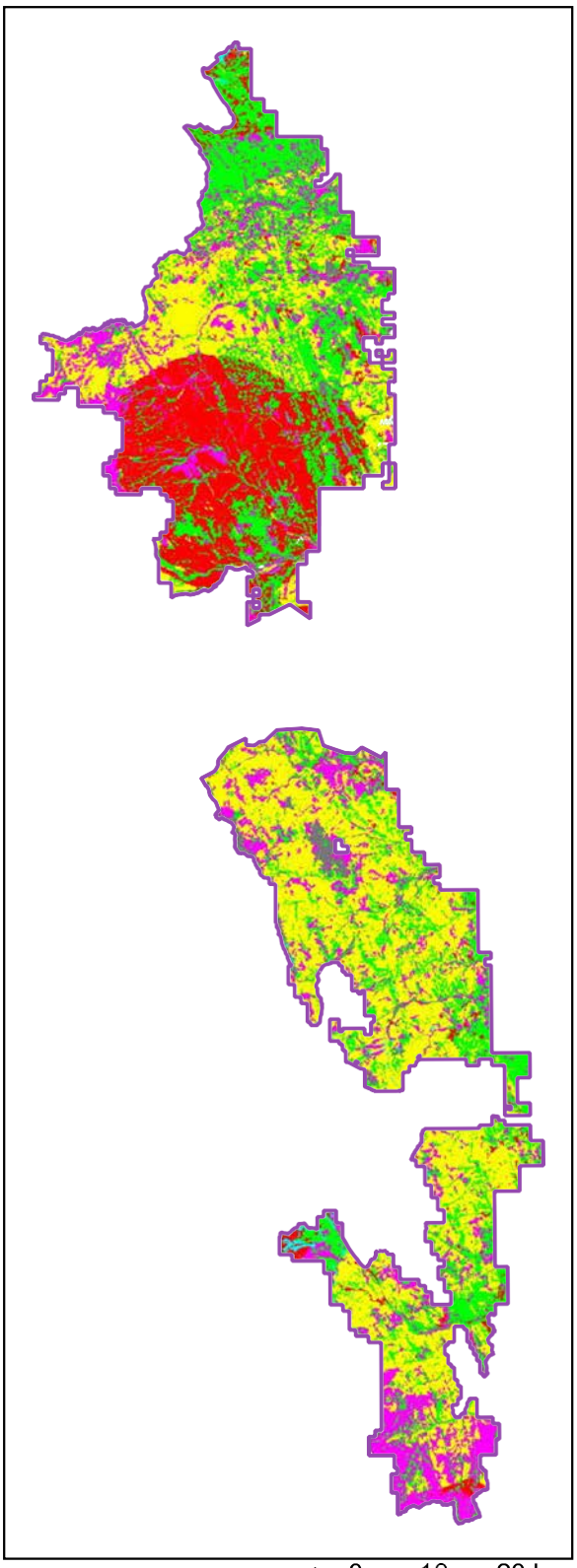
Map 7. 90th Percentile Head Fire Intensity for Fall within the B12 FMU.

90th Percentile Head Fire Intensity-Fall (2018)

- Non-Fuel
- Intensity Class 1
- Intensity Class 2
- Intensity Class 3
- Intensity Class 4
- Intensity Class 5
- Intensity Class 6
- B12 FMU Border



0 10 20 km

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Fuel Types

As fuels can influence the ignition, rate of spread, buildup, intensity, and thus overall behaviour of a fire, they are considered in both fire weather indices and fire behaviour models. Qualitative descriptions of fuel types include stand structure and composition, surface and ladder fuels, and forest floor cover and an organic layer, with each fuel type displaying characteristic fire behaviour under defined burning conditions. The most ubiquitous classification of fuel types used by Fire Managers is the Canadian Forest Fire Behaviour Prediction (FBP) system classification. Under this system, the B12 FMU is represented primarily by C-2: Boreal Spruce and D-1: Leafless Aspen, with limited areas of C-1: Spruce-Lichen Woodland, C-3: Mature Jack or Lodgepole Pine, M-1/M-2: Boreal Mixedwood, and O-1: Grass (Map 8, Table 2).

The majority of the province's FBP fuel types are calculated based on Alberta Vegetation Inventory (AVI) for each vegetation polygon – B12 FMU updated by Spray Lakes Sawmills Ltd. in 2018 (Alberta Sustainable Resource Development, 2002). Modification and exception have been created within the AVI to FBP (AVI2FBP) calculation model to ensure stands represent the characteristics of the fuel type.

Map 8. Fuel Types within the B12 FMU.

FBP Fuel Type (2019)

- C-1 (Spruce - Lichen Woodland)
- C-2 (Boreal Spruce)
- C-3 (Mature Jack or Lodgepole Pine)
- C-4 (Immature Jack or Lodgepole
- Pine) C-5 (Red and White Pine)
- C-6 (Conifer Plantation)
- C-7 (Ponderosa Pine - Douglas-Fir)
- D-1/D-2 (Aspen)
- S-1 (Jack or Lodgepole Pine Slash)
- S-2 (White Spruce - Balsam Slash)
- S-3 (Douglas-Fir Slash)
- O-1 (Grass) Non-Fuel Water
- Vegetated Non-Fuel
- M-1/M-2 (Boreal Mixedwood - 10% Conifer)
- M-1/M-2 (Boreal Mixedwood - 15% Conifer)
- M-1/M-2 (Boreal Mixedwood - 20% Conifer)
- M-1/M-2 (Boreal Mixedwood - 25% Conifer)
- M-1/M-2 (Boreal Mixedwood - 30% Conifer)
- M-1/M-2 (Boreal Mixedwood - 35% Conifer)
- M-1/M-2 (Boreal Mixedwood - 40% Conifer)
- M-1/M-2 (Boreal Mixedwood - 45% Conifer)
- M-1/M-2 (Boreal Mixedwood - 50% Conifer)
- M-1/M-2 (Boreal Mixedwood - 55% Conifer)
- M-1/M-2 (Boreal Mixedwood - 60% Conifer)
- M-1/M-2 (Boreal Mixedwood - 65% Conifer)
- M-1/M-2 (Boreal Mixedwood - 70% Conifer)
- M-1/M-2 (Boreal Mixedwood - 75% Conifer)
- M-1/M-2 (Boreal Mixedwood - 80% Conifer)
- M-1/M-2 (Boreal Mixedwood - 85% Conifer)
- M-1/M-2 (Boreal Mixedwood - 90% Conifer)
- B12 FMU Border

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0 10 20 km

Table 2. Fuel Type percentages in the B12 FMU.

Fuel Type	Percentage of Area
C-1 (Spruce - Lichen Woodland)	4.81%
C-2 (Boreal Spruce)	13.89%
C-3 (Mature Jack or Lodgepole Pine)	4.56%
C-4 (Immature Jack or Lodgepole Pine)	2.15%
C-5 (Red and White Pine)	0.22%
C-7 (Ponderosa Pine - Douglas-Fir)	0.34%
D-1/D-2 (Aspen)	12.09%
M-1/M-2 (Boreal Mixedwood <50%)	3.27%
M-1/M-2 (Boreal Mixedwood =>50%)	7.02%
S-1 (Jack or Lodgepole Pine Slash)	0.03%
S-2 (White Spruce - Balsam Slash)	0.03%
O-1 (Grass)	28.97%
Non-Fuel	4.9%
Water	3.86%
Vegetated Non-Fuel	13.86%
Total	100%

Characteristics of the two dominant fuel types and their fire behaviour are described below based on the FPB system as well as (Graham, et al., 2006).

Fire Weather Index

In addition to fuels and topography, the weather is a primary influencing factor in fire behaviour. The Canadian Forest Fire Weather Index (FWI) System has been used for the past 40+ years to estimate the effects of fuel moisture and wind on fire behaviour. Based on consecutive daily observations of temperature, relative humidity, wind speed, and 24-hour precipitation, the FWI system calculates three fuel moisture codes, which are then used to develop three fire behaviour indices. These codes are also used in the calculation of the Fire Behaviour Potential and Head Fire Intensity in Alberta's Wildfire Threat Assessment Rating Model.

The three fuel moisture codes are as follows:

- Fine Fuel Moisture Code (FFMC) – the moisture content of surface litter and other cured fine fuels, which indicate the relative ease of ignition and flammability of fine fuels.
- Duff Moisture Code (DMC) – the average moisture content of loosely compacted, moderately deep organic layers, which indicates fuel consumption in moderate duff layers and medium-size woody material.
- Drought Code (DC) – the average moisture content of deep, compact organic layers, which indicates seasonal drought effects and the amount of shouldering in deep duff layers and large logs.

The three fire behaviour indices developed from these fuel moisture codes include the following:

- Initial Spread Index (ISI) – the expected rate of fire spread based on the wind and FFMC.
- Build-up Index (BUI) – the total amount of fuel available for combustion, based on the DMC and the DC.
- Fire Weather Index (FWI) – the predicted fire intensity based on the ISI and BUI that is used as a general index of fire danger.

Several automatic and manned weather stations located within the B12 FMU (Table 3), providing extensive databases from which both historical and current fire weather indices can be determined. Additional temporary weather stations are frequently installed in or near prescribed burn units to identify prevailing winds and diurnal weather trends in advance of planned ignition.

Table 3. Weather stations located in the B12 FMU.

Station Name	Type	Elevation
North Ghost (B8)	Automatic	1477
Mockingbird (MH)	Lookout Tower	1906
Elbow (B7)	Automatic	1413
Junction Mountain (JM)	Lookout Tower	2240
Highwood (B1)	Automatic	1576
Raspberry Ridge (RR)	Lookout Tower	2360

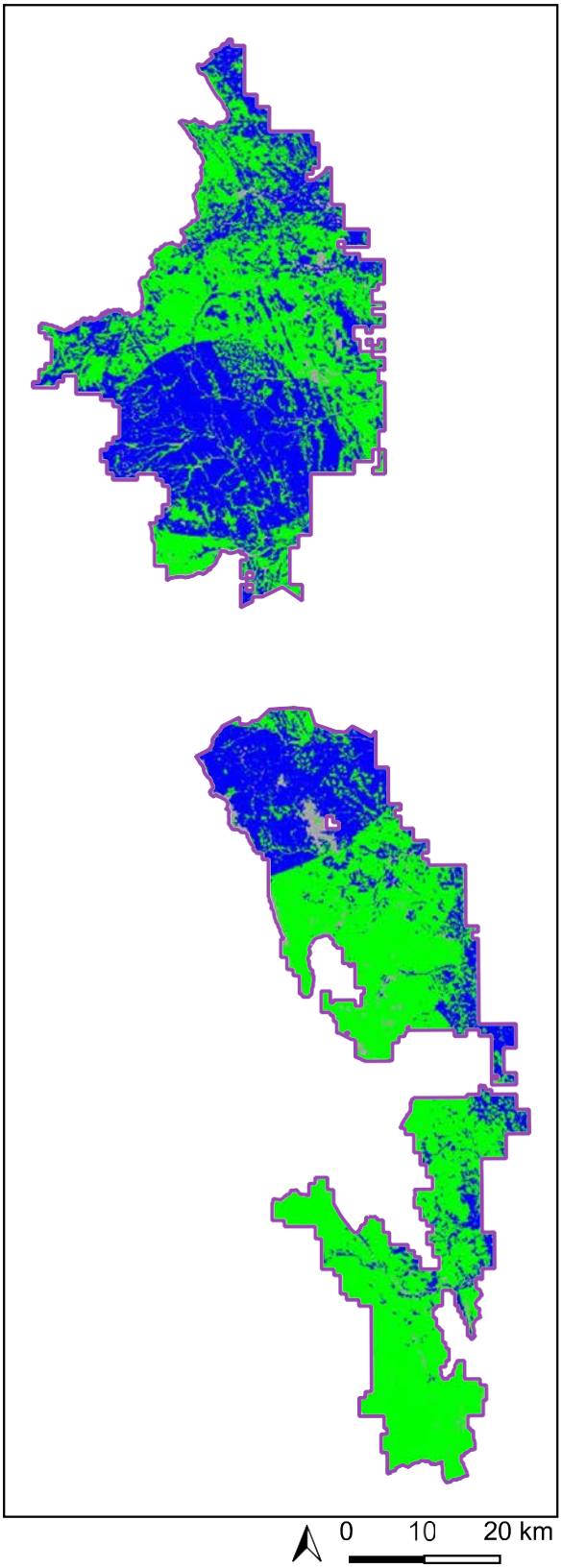
Fire Occurrence Risk

Fire occurrence risk is the relative probability or chance of a fire starting as determined by the presence of causative agents (i.e., the potential number of ignitions). An assessment of fire probability incorporates factors such as weather and fuel moisture, soil types and moisture, green-up stages, climate projections, and potential ignition sources. The fire occurrence risk in B12 FMU is highest in the spring (Map 9) and summer (Map 10) seasons. The fall (Map 11) season is relatively short as the first primary frost starts the season, and the region can have several snowfalls resulting in lowing the risk of a fire occurring.

Map 9. Spring Historical Fire Occurrence Risk within the B12 FMU.

Highest Fire Occurrence Risk - Spring (2018)

- Non - Fuel
- Lowest Fire Occurrence Risk
- Moderate Fire Occurrence
- Risk High Fire Occurrence
- Risk Highest Fire Occurrence
- Risk B12 FMU Border



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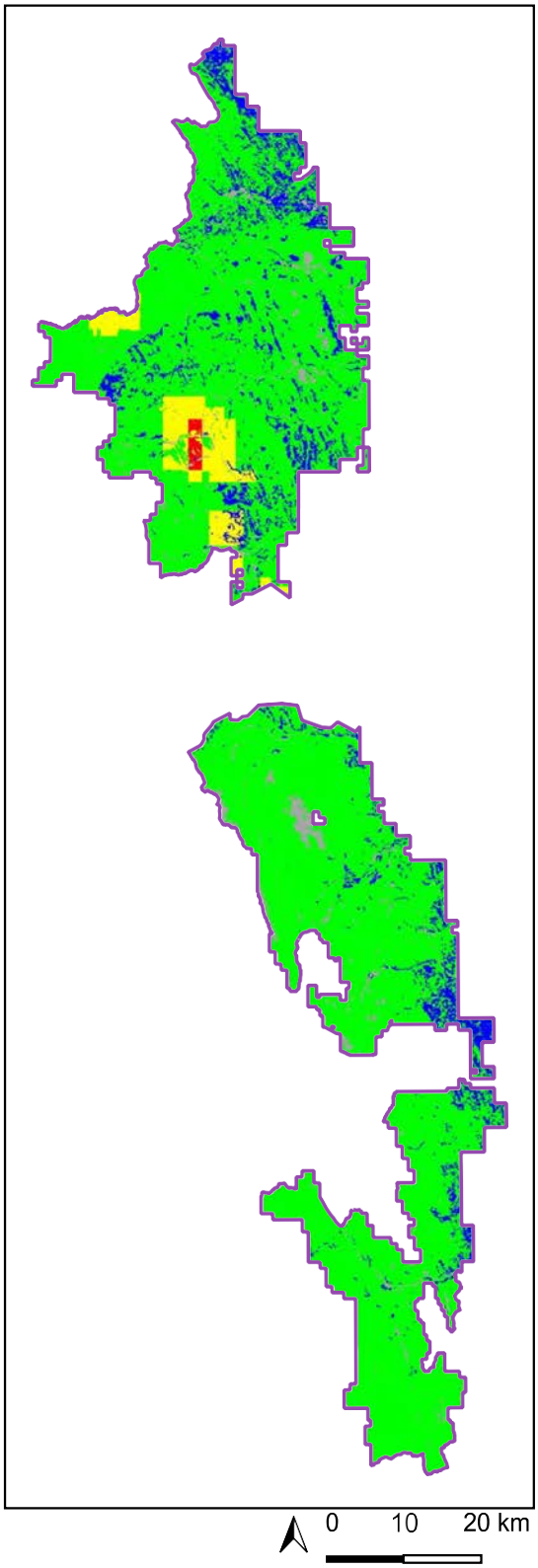
Map 10. Summer Historical Fire Occurrence Risk within the B12 FMU.

Highest Fire Occurrence Risk - Summer (2018)

- Non - Fuel
- Lowest Fire Occurrence Risk
- Moderate Fire Occurrence
- Risk High Fire Occurrence
- Risk Highest Fire Occurrence
- Risk B12 FMU Border



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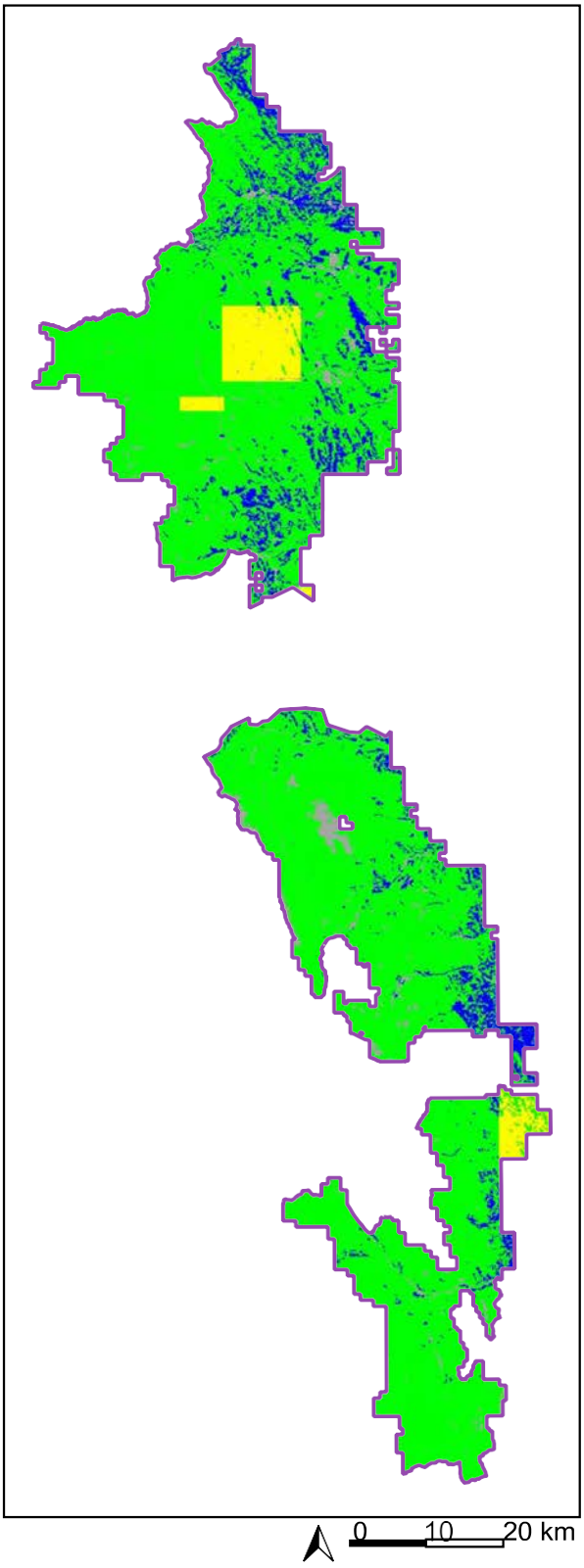
Map 11. Fall Historical Fire Occurrence Risk within the B12 FMU.

Highest Fire Occurrence Risk - Fall (2018)

- Non - Fuel
- Lowest Fire Occurrence Risk
- Moderate Fire Occurrence
- Risk High Fire Occurrence
- Risk Highest Fire Occurrence
- Risk B12 FMU Border



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Values at Risk

Values at risk are primarily human-made improvements and developments that have measurable or intrinsic worth, and which could potentially be impacted by the fire. Human life and communities receive the highest priority with regards to provincial fire suppression efforts, followed by the values encompassed by watersheds/soils, natural resources (i.e., timber, Protected Areas, fish and wildlife habitat, threatened/endangered species), and infrastructure. The eastern portion of B12, have the highest rankings for values at risk (Map 12). Most of the remaining high rankings are attributable to infrastructure development, including residential construction, commercial accommodations, industrial sites, and campgrounds.

Suppression Capability

Suppression capability includes the factors and limitations that are related to the ability to contain a wildfire upon detection to protect values at risk. Landscape elements that can influence suppression capability include steepness of terrain/slope, water availability, existing barriers to fire spread such as deciduous stands and linear disturbances, and ecological factors such as riparian habitats and insect- or disease-affected stands. Human limitations are also capable of affecting suppression elements. Examples of these constraints include but are not limited to detection capability, initial attack response times and success, available access, and proximity to firebases.

Suppression capability in the southern portion of B12 FMU ranking as relatively weak (Map 13). Landscape elements such as steep topography, homogeneous conifer cover, and lack of lakes capable of supporting air tankers, limit the suppression capabilities within B12.

Recommendations

The focus of this plan is to reduce the regional risk of catastrophic wildfires and use as an input into strategic landscape planning. This is focused on areas with the highest potential risk to human life, communities, natural resources, and critical infrastructure. Those fire suppression policies implemented have been beneficial is containing wildfire size and spread, it has also affected forest stand age class. This has shifted the majority of naturally occurring wildfires (lightning caused) into Class A (very small fires).

The importance of the role wildfire in ecosystem productivity and forest health cannot be measured; however, a changing landscape of human development increases the need for wildfire reduction. With an increase in the number of human caused fires (power line, industrial, resident, and arson), wildfires are becoming more frequent at a time of year where catastrophic wildfires events are more likely. These human caused wildfires affect the historical wildfire regime where forest stands have adapted to burn during higher lightning activity in summer months. Current land use policies and management decisions will have a direct impact on the outcomes of such disturbances.

The following recommendations can provide direction as to measures to be taken to reduce catastrophic wildfire and its consequences to provincial priorities.

Clear-cut and partial harvesting of highly flammable stands are two of the treatments which best emulate historical disturbance. The considerations to incorporate into this strategy are:

- Harvesting of mature coniferous stands to produce younger stands reduces flammability and intensity of wildfire, providing better opportunity for success with wildfire control, and

- Following harvesting, one FireSmart strategy is the conversion of forest to less flammable forest types such as converting pure spruce to deciduous mixed-woods or pure deciduous stand types.

From the perspective of Forest Management Planning, post-harvest conversion has several implications that must be addressed:

- Ensure all recommendations can be incorporated into current Forest Management Plans and do not affect yield and timber supply analysis,

- Determine the percentage area within current Spatial Harvest Sequence that can be converted and balanced within the total Defined Forest Area,

- Incorporate proposed area into the silviculture matrix and within the context of GOA's strata balancing directive,

- Reflect proposed area in the timber supply strata conversion and spatial harvest sequence,

- Assess current boundaries of community zones then prioritize areas and individual blocks of concern for harvest, and

- Fit within the GOA's objectives for maintenance of cover types.

From the perspective of Wildfire Prevention, there are a number of strategies incorporated:

- Wildfire management plans that incorporate burn units in undeveloped and remote areas for moderate fires to occur on the landscape. This will reduce fuel loading, create fuel breaks, and allow for natural ecological fire cycle to occur,

- The implementation of prescribed fire and hazard reduction burns to reduce fuel loading and create fuel breaks around developed areas,

- The thinning or removal of stands through timber harvesting, selective harvesting, and FireSmart vegetation management treatments. This will reduce fuel loading and increase fire suppression capabilities, and

- The identification and removal of debris piles as per the timber harvest ground rule debris disposal policy.

References

Alberta Sustainable Resource Development. 2002. *Whitecourt Landscape Fire Assessment Pilot Project - Wildfire Threat Assessment User Guide.* Alberta Sustainable Resource Development. Whitecourt : Alberta Sustainable Resource Development, 2002. p. 59. Version 1.0.

Graham, L and Quintilio, K. 2006. *Willmore Wilderness Park Fire Management Plan.* Edmonton, AB : Alberta Community Development; Alberta Sustainable Resource Development, 2006. p. 102.

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