Lakes TSA – Type 4 Silviculture Strategy

Tactical Plan

Version 1.0

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BRITISH COLUMBIA

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List of Acronyms

ATV	All-Terrain Vehicle
PCT	Pre-Commercial Thinning
SBS	Sub-Boreal Spruce Biogeoclimatic zone
ITSL	Innovative timber Sale Licence
BEC	Biogeoclimatic Ecosystem Classification
MFLNRO	Ministry of Forests, Lands and Natural Resource Operations
MPB	Mountain Pine Beetle
SI	Site Index
sph	Stems per hectare
TSA	Timber Supply Area
WB	Watershed Basin
WMB	Wildfire Management Branch
FFT	Forests For Tomorrow

1 Introduction

In 2012, the British Columbia Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) initiated a Type 4 Silviculture Strategy for the Lakes Timber Supply Area (TSA) to help government and licensees better understand the current and future timber and habitat supply situation in the Lakes TSA, and what can be done to improve it.

1.1 Project Objectives

In support of government objectives to mitigate impacts from past mountain pine beetle (MPB) and wildfires on mid-term timber supply, the project aims to:

1) Provide a realistic, forward-looking assessment of timber and habitat supply under a range of scenarios that will produce a preferred silviculture strategy supported locally and provincially. This strategy will clearly identify the activities that will provide the best return on investment to government.
2) Provide products that will support operational implementation of the strategy (e.g., a tactical plan).
3) Inform licensees and government on the alternative outcomes that could be achieved through different approaches to basic (mandatory) silviculture in the TSA.
4) Provide context information or indicators that would be useful to support future management decisions in the TSA.
5) Where appropriate, illustrate how the recommended treatments link with other landscape-level strategies while considering treatment risk.

1.2 Context

This is the fifth of five documents that make up the Lakes TSA Type 4 Silviculture Strategy:

- Situational Analysis[1] – describes in general terms the current situation for the unit.
- Data Package[2] – describes the information that is material to the analysis including the model used, data inputs and assumptions.
- Modelling and Analysis Report[3] – describes modelling outputs.
- Silviculture Strategy[4] – provides a rationale for choosing a preferred scenario and describes treatment options, associated targets, timeframes and benefits.
- **Tactical Plan** – provides guidance to silviculture practitioners in developing operational plans that identify specific stands for treatment

In the context of this project, the tactical plan describes the steps required to achieve Provincial Timber Management Goals and Objectives (under development) and targets defined in the Silviculture Strategy. It is comprised of this report plus associated maps and georeferenced data that identify spatially-explicit target and candidate treatment areas for specific treatments at a given funding level. In

1 Forsite Consultants Ltd. 2012. *Lakes TSA - Type 4 Silviculture Strategy, Situational Analysis*. Version 1.1. Technical Report. 25p.

2 Forsite Consultants Ltd. 2013. *Lakes TSA - Type 4 Silviculture Strategy, Working Data Package*. Version 3.0. Technical Report. 36p.

3 Forsite Consultants Ltd. 2013. *Lakes TSA - Type 4 Silviculture Strategy, Modelling and Analysis Report*. Version 1.1. Technical Report. 41p.

4 Forsite Consultants Ltd. 2013. *Lakes TSA - Type 4 Silviculture Strategy, Silviculture Strategy*. Version 1.0. Technical Report. 40p.

this case, the more realistic funding level of $3M/year was applied to highlight sufficient opportunities for any funding level.

2 Approach

This section describes the steps taken to gather and prepare the data, describes the targets applied for each treatment type and summarizes the assumptions used to prepare the tactical plan maps and summaries.

2.1 Data Gathering and Preparation

Data and assumptions for this project were derived from addendum 1[5] of the modelling output for the Type 4 Silviculture Strategy analysis – specifically, a modified preferred strategy with composite treatments at a $3M/yr funding rate. Results were queried and linked to generate spatial data for first 4 periods (20 years grouped into 5-year periods). The spatial data included eligible stands for each treatment, as well as, the full extent of blocks scheduled in the model for treatment.

Eligible stands were then prioritized based on the defined operational criteria (section 2.4) while scheduled treatments were symbolized based on treatment period.

2.2 Treatment Targets

A revised silviculture strategy[5] – different from the original LT4 analysis – was applied for this project. The revised assumptions generally involved increasing the area eligible for fertilization and assuming less green volume can be recovered through rehabilitation. Not surprisingly, the composite mix of strategies shifted from a focus on rehabilitation, as in the original strategy, to a focus on fertilization. These revised assumptions aligned better with the Nadina district staff's expectations.

The major silviculture strategies intended to improve timber volume flow over time reflect the target silviculture program described below. These treatment priorities and target silviculture programs are organized into two general planning periods: during and after the salvage period.

Years 2011-2020 (during the salvage period)

- Rehabilitate eligible stands that will not likely be salvaged (e.g., younger stands without merchantable volume, including fire-damaged areas).
- Focus fertilization on stands closest to harvest eligibility; prioritize by Sx then Pl; apply multiple treatments on Sx where possible.
- Pre-commercial thin and fertilize eligible stands where possible (low priority).

Table 1 Target silviculture program – Years 2011-2020

Priority	Treatment	Target Area (ha/yr)	Unit Cost ($/ha)	Target Funding ($M/yr)
1	Rehab	1,570	1,250	1.963
2	Fertilize	1,930	500	0.965
3	PCT	90	800	0.072

[5] Forsite Consultants Ltd. 2014. Lakes TSA – Type 4 Silviculture Strategy, Addendum 1 – Modelling and Analysis Report. Unpublished report prepared for the BC Ministry of Forests, Lands and Natural Resource Operations, Nadina Forest District. March 2014. 20 p.

Years 2021-2030 (after the salvage period)

- Continue rehabilitation levels but shift priority onto stands that optimize various aspects including: merchantable volume, site productivity, haul distance, road access and fire risk.
- Increase fertilization levels on stands closest to harvest eligibility; prioritize by Sx then Pl; apply multiple treatments on Sx where possible.
- Eligible stands for pre-commercial thinning (PCT) and fertilization are expected to be exhausted.

Table 2 Target silviculture program – Years 2021-2030

Priority	Treatment	Target Area (ha/yr)	Unit Cost ($/ha)	Target Funding ($M/yr)
1	Rehab	480	1,250	0.600
2	Fertilize	4,710	500	2.355
3	PCT + Fert	0	800	0

2.3 Planning Considerations

The following sections summarize elements considered for modelling and subsequent mapping of treatment opportunities and priorities. For easier reference to make this a stand-alone document, information from the data package was sometimes copied directly.

2.3.1 Rehabilitation

During the salvage period, rehabilitation is the primary activity to the overall strategy and warrants the majority of available funding. It focuses on ameliorating poorly performing stands severely impacted by MPB to provide more harvest opportunities during the forecasted timber supply shortage (mid-term) while increasing the effective landbase in the long-term.

Following the salvage period, conditions exist where MPB-killed stands will not recover to pre-attack conditions or minimum merchantability criteria (140 m^3/ha) within the planning horizon. Effectively, these stands cease to contribute to the working forest. Within this profile, a continuum of stands exists ranging from uneconomic to marginally economic:

- Uneconomic stands: younger, small-diameter trees, higher percent dead and long haul distances.
- Marginally economic stands: some green volume and larger piece sizes to produce lumber, pulp chips and potentially bio-fuel feed stocks (similar for stands treated under the ITSL[6] program).

Rehabilitation typically involves the removal of standing and fallen trees, site preparation and reforestation of productive stands of suitable tree species. In this analysis rehabilitation of only marginally-economic stands was assumed to utilize trees considered merchantable (e.g., green) and deliver them to a mill for processing. These logs would not have otherwise contributed to the annual harvest.

Objectives

Key objectives of rehabilitation activities include:

- Accelerate the recovery of stands into productive forests that will be available for harvest sooner (e.g., younger stands without merchantable volume, including fire-damaged areas).

6 ITSL – Innovative Timber Sales License – Means to market mountain pine beetle-attacked, pulp and other timber

- Recover some merchantable (green) volume from unsalvaged stands that would not otherwise be harvested – particularly in the mid-term.
- Abate fire hazards associated with standing dead trees and damage to understory trees as the dead material falls.

Eligible Stands

For this analysis, stands considered eligible for rehabilitation included unlogged MPB-impacted stands (identified from the LT4 Base Case scenario) with at least 40% dead and greater than 40 yrs old at time of attack.

In this analysis, a significant change was applied where the live volume from only marginal stands was considered recoverable. (i.e., no harvest from stands with live volumes less than 110 m³/ha).

Responses

Responses for these treatments were modelled by transitioning stands onto future managed stands from the treatment date. Accordingly, these responses take advantage of improved OAFs, lower regeneration delay and select seed to produce higher yields that achieve minimum harvest volumes much sooner. These stand regeneration improvements will contribute to the long-term and potentially the final mid-term periods of the harvest flow.

Costs

Depending on specific site characteristics, treatments and costs associated with the rehabilitation strategy can vary considerably. These costs were applied according to the amount of recoverable sawlog volume in the stand and distance cost criteria were added based on haul cycle times (see Table 3).

Table 3 Treatments and costs for rehabilitating damaged stands

Treatment	Marginal Sawlog Recovery Class (110 to <140 m³/ha)
Knockdown and site prep	$0/ha
Planting and brushing	$1000/ha
Total Cost (1)	$1000/ha

(1) Add distance costs: <5 hrs @ $0/ha, ≥5 & <7 hrs @ $50/ha, ≥7 hrs @ $250/ha

Challenges

The success of this activity depends, in part, on the proponents developing opportunities to improve utilization of merchantable material, improve markets for low quality fibre and/or sequestering carbon credits.

The challenge with this strategy involves identifying stands in the field that would not otherwise regenerate to merchantable conditions on their own; thus maximizing the return on investment. Moreover, the analysis data does not include some spatially-explicit, stand-level criteria required to distinguish the viability of some treatments. With no direct stand-level data to draw from, assumptions for this strategy were designed from opinions of local forest professionals.

2.3.2 Fertilization

Despite the limited number of stands currently available to treat, fertilization continues to play an important role in the overall strategy. There is no immediate incentive to fertilize since there is still plenty of time to treat the eligible stands before they are harvested at end of the mid-term.

Objective

Key objectives of fertilization activities include:

- Accelerate the rate of stand development;
- Increase merchantable yield and value of stands harvested within the mid-term.

Eligible Stands

Eligible stands for this strategy were identified using the criteria provided in Table 4. This differs from the original LT4 analysis by including pine-leading stands on medium sites.

Table 4 Criteria for the multiple fertilization strategy

BEC Zones	Species Groups	Site Index (SI) Range	Existing Density Range (sph)
SBSdk, SBSmc	Pl leading	≥15 & <25	≥1,000 & <4,500
SBSdk, SBSmc	Sx leading	≥15 & <24	≥1,000 & <4,500

Note: includes pine-leading stands on medium (SI 15-19) sites.

Responses

Responses followed the same progression regardless of the stand age when the first fertilization was applied. As well, minimum harvest ages for applicable analysis units were reduced by 2 years for each application.

Cumulative responses to multiple fertilization treatments are shown in Table 5 and Table 6. The response from multi-fertilization of Pl was based on simple multiples of a single treatment response applied every 10 years.

Table 5 Cumulative incremental responses from multiple fertilization treatments (Pl)

Number of Applications	Stand Age Window (yrs)	Pine Cumulative Response (m^3/ha; 10 yrs after treat)	Efficiency
1	30 – 80	12	100%
2	30 – 70	24	100%
3	30 – 60	36	100%
4	30 – 50	48	100%

Pl responses are simply multiples of the single treatment response.

The response from multi-fertilization of Sx is based on initial research findings and ongoing monitoring of repeat applications would be needed to ensure the full response is being achieved (per com. Rob Brockley). These responses were based on a stand with SI 18 (SI 20 and 22 had even higher gains) where N, S and B are applied every 5 years.

Table 6 Cumulative incremental responses from multiple fertilization treatments (Sx)

Number of Applications	Stand Age Window (yrs)	Spruce Cumulative Response (m^3/ha; 5 yrs after treat)	Efficiency
1	30 – 80	15	100%
2	25 – 75	49	100%
3	25 – 65	89	100%
4	25 – 55	132	100%
5	25 – 45	155	100%
6	25 – 35	176	100%

Sx response derived from information provided by the MFLNRO in the document "Intensive fertilization graphs.xlsx" (Rob Brockley email May 17, 2012, Mel Scott/Ralph Winter email June15, July 28, 2012).

Due to the methodology for developing analysis units, some inappropriate stands were identified for treated (i.e., Sx leading analysis units include the leading species: B, Ba, Bl, S, Sb, Se, Ss, Sw, and Sx).

Costs

Application cost for each fertilization application is $500/ha for both pine and spruce. This includes the delivered cost of blended fertilizer for spruce to ensure an appropriate mix of micro-nutrients.

Challenges

Because of the limited number of eligible stands identified for this treatment in the short-term, plus the relatively narrow eligibility window, fertilization treatments are more sensitive to time. Treatment layers for the first 10 years were separated into two 5-year periods. Each fertilization regime (number of fertilizer applications) is also attributed in these layers.

In developing operational plans, access to treatment areas is a prime consideration for transporting fertilizer. While large tractors with B-Train trailers are typically utilized for these projects, other means are also employed – at a much higher cost – to reach areas with difficult access.

2.3.3 Pre-Commercial Thinning and Fertilization

This is considered a much lower priority than the previous treatments. According to the current forest inventory, there are limited opportunities for this treatment and volume gains are marginal. However, more opportunities may actually exist in the field plus this treatment may be regarded as a cleaning treatment that prepares stands for other treatments, including fertilization (i.e., volume gains over fewer stems), or improving wildlife habitat.

This activity aims to PCT dense Pl stands between the ages of 10-20 years old (typically 5,000-20,000 sph), to a target density of ~3,500 sph. At the same time, damaged and diseased stems can be removed from the stand. With the PCT, these stands are now eligible for fertilization according to the approach described in section 2.3.2.

Objective

The purpose of the treatment was to improve stand quality/health/resilience through leave tree selection, increase stand volumes through fertilization and advance operability in these stands.

Eligible Stands

Eligible stands for this strategy were identified using the criteria provided in Table 7. Again, as we are only looking to develop a strategy for the next 20 years, this treatment was only applied to existing managed stands.

Table 7 Eligibility criteria for PCT and fertilization of dense pine

BEC Zones	Species Groups	SI Range	Existing Density Range (sph)
SBSdk, SBSmc	Pl leading	≥15	≥4,500

Responses

The following treatment responses were assumed to apply:

- Merchantable volumes are not expected to improve from PCT but the average diameter of the prime 250 trees is expected to increase thereby providing more valuable trees with higher lumber recovery /ha. This was recognized by reducing minimum harvest ages by 3 years after treatment.
- In addition, volume responses from the fertilization were applied according to the regimes for pine stands shown in Table 5.

Costs

The model was configured to ensure that stands with PCT were also fertilized. Treatment costs for PCT were applied at $800/ha since fewer trees are cut for this cleaning treatment compared to the density control standard ($1100 per hectare from FFT Cost Benchmarks 2012). Treatment costs for fertilization were applied according to those discussed in section 2.3.2.

Challenges

The current inventory was not designed to incorporate stand-level attributes that to accurately identify young stands eligible for this treatment. The available information was applied to identify potential opportunities, but it is likely that many selected stands will not meet the treatment criteria and others will be overlooked.

2.4 Mapping

Two spatially explicit layers were prepared and used to produce tactical plan maps for this project:

- Eligible Stands - For each planning period and treatment type, candidate stands meeting the defined eligibility criteria were generated from the model. Based on the operational criteria discussed below eligible stands were then ranked to assign relative priorities (High, Medium, Low, Nil) for treatment.
- Treatment Blocks - For each planning period and treatment type, scheduled treatment blocks were generated from the model. No operational criteria were applied to this set of stands.

These layers were produced from modelling results for the preferred silviculture strategy and assessed further based on the operational criteria discussed below. They were also loaded onto the Resource Practices Branch's web mapping platform for viewing and organized into a standard spatial package for easy delivery.

Where available, the tactical plan included past incremental silviculture treatments. Unfortunately, spatial and attribute data for these treatments is not always readily available and must be captured or derived through a combination of methods.

2.5 Operational Criteria

Defining operational criteria is a critical component in developing a tactical plan. This step further refines the eligible stands to reflect specific operational aspects used to rank and prioritize stands for treating. Through this process, the prioritized stands provide more realistic options for planners to consider for field verification.

Based on perceived operational realities, limits or thresholds were designated for each treatment criteria to assign a relative ranking of stand types. Criteria with nil rankings identify stands where treatment is not practicable in the near future. These rankings were then grouped to assign operational priorities (high, medium, low and nil) to each eligible stand. Ideally, once these data are verified in the field, the improved operational criteria, thresholds, ranking and priorities can be re-introduced with future tactical plans or silviculture strategies (out of scope for this project).

Generally speaking, wildfire management seeks ways to reduce significant losses from fire. While spatial information is still under development, available wildfire management layers were used to identify how treatment blocks should be considered.

2.5.1 General

Access

Treating some stands can be limited by costs required to access each treatment block. Depending on the treatment, any incremental costs can make the treatment unfeasible. The access criteria shown above reflect extraordinary costs associated with distances (e.g., travel, haul, flight), road construction/reconstruction and barging or other barriers to mobilizing materials and equipment.

Application of this constraint is relies heavily on the accuracy and completeness of road system data. Ideally, this exercise requires a complete road network classified according to the type of traffic is currently capable of carrying (i.e., distinguish between ATV and B-Train) and whether it is actively maintained or requires some level of work for safe and effective travel. Unfortunately, a road network with these features is currently not available for the Lakes TSA. For this project, the best available information was adapted without local knowledge so may not be appropriate for some areas.

Project Size

Overall treatment costs typically decrease where blocks are less dispersed or fragmented. Planners can reduce project costs by grouping nearby treatment blocks. The criteria shown above reflect desired block and project sizes for each treatment type.

Timing

Some treatment strategies can change depending on timing. For example, rehabilitation aims to target different stand types during and after the salvage period. The planning periods for this project align with the harvest flow from the Type 4 analysis – periods 1-2 in the short-term (1-10 yrs) and periods 3-4 in the mid-term (11-110 yrs). The criteria shown above reflect desired stand types targeted for treatment relative to the 5-year planning periods examined.

Wildfire Management

Landscape-level wildfire management seeks to identify wildfire risks and potential losses to timber supply and silviculture investments. The objective of integrating wildfire management into this tactical plan is to mitigate losses to communities and natural resource values.

The BC Wildfire Management Branch (WMB)[7] provides much more information than is captured here. While there are many silviculture treatments that can influence wildfire risk, the scope of this very brief discussion is limited to the three silviculture treatments explored in the Type 4 silviculture strategy.

The WMB is developing spatial information to evaluate wildfire susceptibility over large fire-prone landscapes. WMB is currently developing burn probability models that can be used to evaluate wildfire susceptibility over large fire-prone landscapes. When it becomes available this information, along with local fire management specialist expertise, can be integrated into future Type 4 analyses and tactical plans.

For this analysis, WMB provided a Wildland-Urban Interface layer that can be used to identify blocks scheduled for treatments that should be carefully considered for wildfire management. General approaches for each of the three treatments identified in this tactical plan are described in Table 3.

Table 8 Wildfire management criteria for each treatment

Treatment	Approaches to Reduce Wildfire Risk
Rehabilitation	○ Greatly reduces surface fuels by removing or ameliorating the accumulating dead material. ○ Provides opportunities to reduce future fire risk where managing for deciduous stands is practical. ○ Promote within areas identified with higher fire risk (i.e., treat within WUI, high burn probability, high spotting potential).
Fertilization	○ Increases crown bulk density and surface fuel loading. ○ Avoid within areas identified with elevated fire risk (i.e., treat outside from WUI, high burn probability, high spotting potential). ○ Where possible, group treatments into units that can be easily identified as a priority value for suppression.
Pre-Commercial Thinning	○ In this strategy, PCT exclusively targets dense pine stands to make them eligible for future fertilization. ○ Apply the same approach as fertilization.

2.5.2 Rehabilitation

Modelling criteria used to identify eligible stands for rehabilitation are described in section 2.3.1. The criteria described in Table 9 were used to rank and prioritize eligible stands for rehabilitation.

Table 9 Operational criteria for rehabilitation

Criteria	Rank #1	Rank #2	Rank #3	Nil
Location	Two trips or One trip North	n/a	[2] Within UWR	S. of Ootsa Lk and Landscape Corridors and Connectors
Block size (ha)	≥5	n/a	<5	n/a
Access (km - distance from existing road)	<2	≥2 and <5	≥5	n/a
Inventory Site Index (m_{50})	≥17	≥15 to 17	<15	n/a
[1] Stand percentage dead	≥76	≥62 and <76	<62	n/a
[2] Remaining live volume	≥130 & <140	≥120 & <130	≥110 & <120	n/a

Priority for each stand assigned based on the lowest shade category (green=High; yellow=Medium; orange=Low).
*[1] - During salvage period (1-10 years) only on [TREAT_REHA] like R1*** or like R*2***
*[2] - After salvage period (11-20 years) only on [TREAT_REHA] like R**3* or like R***4*

[7] http://bcwildfire.ca/

Unfortunately, reliable spatial data is not readily available for some rehabilitation criteria. While they were not assessed directly in this tactical plan, the following criteria should be considered at the operational planning and field verification stages:

- Stand components with adequate secondary structure likely developing into operable stands.
- Potential benefits to non-timber values.
- Proximity to appropriate seed sources.

2.5.3 Fertilization

Modelling criteria used to identify eligible stands for fertilization are described in Table 4. The criteria described in Table 10 were used to rank and prioritize eligible stands for fertilization.

Table 10 Operational criteria for fertilization

Criteria	Rank #1	Rank #2	Rank #3	Nil
Location	n/a	n/a	n/a	S. of Ootsa Lk
Leading Species Type	Sx/Sw-Leading	Pl-Leading	Others	n/a
Stand Age (yrs)	≥60 yrs	≥30 & <60	<30	n/a
Inventory Site Index (m_{50})	≥17 & <21 m	≥21 m	<17	n/a
Previously fertilized	1 or 2 treat prior to 2008 or No treat	1 or 2 treat since 2008	n/a	n/a

** Priority for each stand assigned based on the lowest shade category (green=High; yellow=Medium; orange=Low).*

Unfortunately, reliable spatial data is not readily available for some fertilization criteria. While they were not assessed directly in this tactical plan, the following criteria should be considered at the operational planning and field verification stages:

- Identify fully stocked and healthy stands.
- Avoid stands with moderate or severe forest health damage.
- Apply multiple treatments every 5+ years on spruce stands where possible.
- Treat stands progressively closest to harvesting to minimize risk of loss and maximize the net present value.
- Delay harvesting for 5 to 10 years following the final fertilizer application.
- ROI ≥ 2%

2.5.4 Pre-Commercial Thinning and Fertilization

Modelling criteria used to identify eligible stands for PCT and fertilization are described in Table 7. The operational criteria described in Table 11 were used to rank and prioritize eligible stands for PCT and Fertilization.

Table 11 Operational criteria for PCT and fertilization of dense pine

Criteria	Rank #1	Rank #2	Rank #3	Nil
Location	n/a	n/a	n/a	S. of Ootsa Lk.
Stand Age (yrs)	n/a	n/a	n/a	≥25
Pine Distribution (%)	≥90%	<90 & ≥75	<75	
Inventory Site Index (m_{50})	≥17	≥15 & <17	<15	

** Priority for each stand assigned based on the lowest shade category (green=High; yellow=Medium; orange=Low).*

Unfortunately, reliable spatial data is not readily available for some PCT criteria. While they were not assessed directly in this tactical plan, the following criteria should be considered at the operational planning and field verification stages:

- Ensure secondary structure within stands is adequate to achieve the treatment objectives set in section 2.3.3.
- ROI ≥ 2%

3 Results

Table 12 provides links to further information on how to access documents for the overall project and the spatial layers for this project.

Table 12 Sources for information on treatment layers

Source	Link
Lakes Silviculture Strategy Documents	for.gov.bc.ca/hfp/silstrat/Lakes/Lakes%20index.htm
Spatial Treatment Layers (Tactical Plan)	forsite.ca:7070/analysis/419/LakesTSA/LT4.html

Note: Forsite is only hosting the tactical plan temporarily; it will eventually be migrated to a MFLNRO server.

The main products generated from this project are the spatial layers and the various attributes used to rank and prioritize candidate stands for the various treatment types. Because these data can be summarized in a multitude of ways, it is preferable to provide results in as tools for planners to access. The spatial data can also be provided for more detailed summaries, maps and reports.

The mapping application for this tactical plan provides users with a tool to explore the various treatment options at different locations and scales throughout the TSA (Figure 1). Besides the navigational aids, pre-formatted layers can be turned off or on and clicking on polygons produces a pop-up window with the underlying attributes.

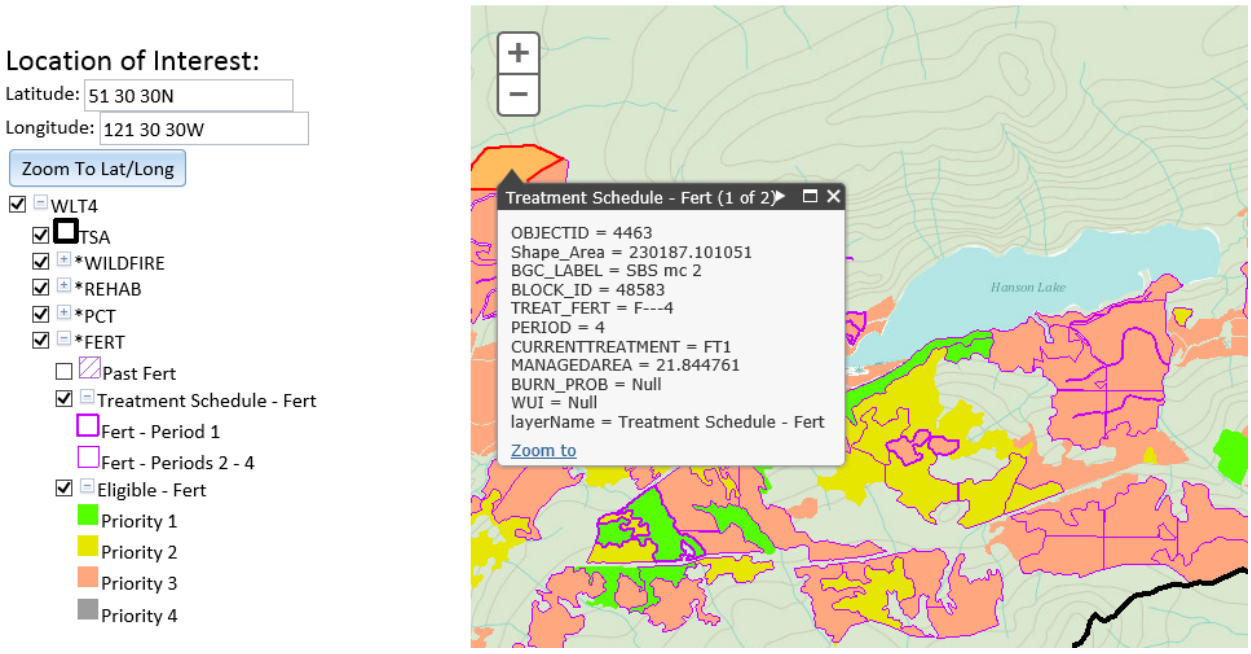

Figure 1 Tactical plan mapping application – example near Hanson Lake

In this example, key reference information is also included to show where past treatments have occurred and where wildfire risk should be considered.

Table 13 summarizes the total area of candidate stands over the first 4 periods after the operational criteria and priorities were applied to each treatment type. Areas are summarized further to identify where special considerations are required to address wildfire risk, as described in section 2.5.1.

Due to various operational criteria, significant components of eligible stands were rejected (Priority 4) in each treatment type (approximately 30% for rehabilitation and 15% for fertilization and PCT).

Table 13 Area of eligible stands by priority

Treatment Type	Considerations	Eligible Area (ha) by Priority			
		1	2	3	4
Rehabilitation (During Salvage)	Normal	2,693	16,420	47,140	42,319
	Wildfire	1,268	3,795	9,519	3,355
Rehabilitation (After Salvage)	Normal	862	2,832	13,989	7,435
	Wildfire	171	336	4,569	811
Fertilization	Normal	1,112	4,091	38,974	10,278
	Wildfire	722	1,825	14,822	539
PCT	Normal	2,814	4,498	4,925	2,725
	Wildfire	407	1,814	1,564	12

Table 14 summarizes the total area of treatments scheduled by the model for each 5-year period. Again, areas are summarized further to identify where special considerations are required to address wildfire risk, as described in section 2.5.1.

The scheduled treatment areas are intended to provide general guidance for developing operational plans but they are likely be revised as more site-specific criteria are considered, as discussed in section 4 below.

Table 14 Area of scheduled treatments by period

Treatment Type	Considerations	Area Scheduled (ha) by Period			
		1-5 yrs	6-10 yrs	11-15 yrs	16-20 yrs
Rehabilitation	Normal	11,319	6,275	3,435	1,384
	Wildfire	1,132	732	490	364
Fertilization	Normal	3,321	10,573	9,745	11,203
	Wildfire	1,200	3,573	3,156	3,096
PCT	Normal	425	277	39	
	Wildfire	96	119		6

4 Application

With an aim to increase harvest levels throughout the mid-term, this tactical plan provides a schedule of activities, at ideal and constrained funding levels. It is intended as a guide for silviculture practitioners to consider in developing operational plans that identify specific stands for treatment.

While the tactical plan is primarily focused on the scheduled blocks generated from the model, eligible stands are also included to provide alternative locations for consideration during field assessments. Points presented in following sections should be considered when using the tactical plan to prepare operation plans.

4.1 Translate budget to area

- Prioritize and schedule treatments by considering the annual budget against the recommended treatment targets in section 2.2.
- Calculate annual target areas based on the relative unit costs for each treatment. Cost assumptions used to develop this tactical plan are provided section 2.3.

4.2 Consider treatment risk

- Assess the financial risk associated with the proposed suite of activities by considering the time these treatments are exposed to natural disturbance events before becoming eligible for harvesting.
- Review local wildfire management plans to identify areas and priorities for specific treatments. This should include visiting the wildfire management website and working with local Wildfire management specialists to assess the proposed operational plan against existing wildfire management strategies.

4.3 Consider related plans and strategies

- Check how the proposed treatments align with related plans and strategies – particularly for forest health, wildfire management, ecosystem restoration, and watersheds (see Silviculture

Strategy document). Identify locations or conditions that might protect or improve timber and non-timber values.

- Periodically update information on related strategies to ensure they are current.
- Identify locations or conditions that might be explored to help inform future treatments and strategies.

4.4 Verify data

- Determine whether new or better information is available for key spatial layers such as: ownership, old growth management areas, wildlife habitat areas, ungulate winter ranges, and visual landscape polygons.
- Check silviculture history records to identify stands where similar treatment activities have occurred in the past and assess efficacy of those treatments (Note: this may be included on the silviculture strategy mapping website).

4.5 Identify candidate treatment blocks

While the best available forest-level data were used to develop the silviculture strategy and tactical plan, these data are not considered to be accurate at a stand level. Consequently, candidate treatment blocks must be assessed in the field before treatments are prescribed. The tactical plan should be used to identify candidate treatment blocks that will be assessed in the field.

- Blocks that do not conform to the operational criteria defined (section 2.5) are unlikely to be practical on their own.
    - Consider scheduled blocks for the specific treatment
    - Include other eligible stands – particularly those close to priority blocks – to guide field survey crews in developing logical treatment programs.
    - Add other stands that meet the treatment eligibility criteria but were not considered based on deficient or inaccurate forest inventory data.

4.6 Assess candidate treatment blocks

- Consider timing issues that must be incorporated (e.g., linkages to related activities, road access, restoration requirements and rehabilitation treatments).
- Assess candidate treatment blocks in the field. Survey crews should also consider eligible stands close by.
- Track all assessments to explore trends with the data and record outcomes for areas already assessed.
- Develop a mechanism to identify and track miscellaneous stands that are not already represented spatially.

5 Discussion

This tactical plan provides guidance to silviculture practitioners in developing operational plans that identify specific stands for treatment. It was developed by using modelling outputs from a revised silviculture strategy (see section 2.2) and was further refined by incorporating operational criteria (section 2.5) to rank and prioritize potential stands for treating.

It must be stressed that the spatial data used to develop this silviculture strategy were typically forest-level inventories that are not accurate at large-scale applications. While these data are limited for stand-level planning, they are appropriate for guiding planners to areas where more detailed fieldwork can be done to assess potential treatment opportunities.

The exercise of incorporating operational criteria highlighted new constraints that could be incorporated into developing future silviculture strategies. An example of this would eliminate treating stands located south of Ootsa Lake. Documenting the assumed operational criteria now and tracking how these are actually implemented over the next few years will assist in improving future modelling exercises that explore ways to improve timber and habitat supply in the Lakes TSA.