



Parks Canada

West Sulphur Fire Guard Timber Assessment & Harvest Planning

Project #: 2202
ENV – Timber & Harvest Plan - 01

Prepared: AA
Revision: 01
Date: 28/08/18
Reviewed: DL
Approved: KB

Edmonton Area Office
17816-118 Ave NW
Edmonton, AB T5S 2W5
P: 780-784-1990

Calgary Area Office
9-214 Grande Blvd W
Cochrane, AB T4C 2G4
P: 403-932-0560

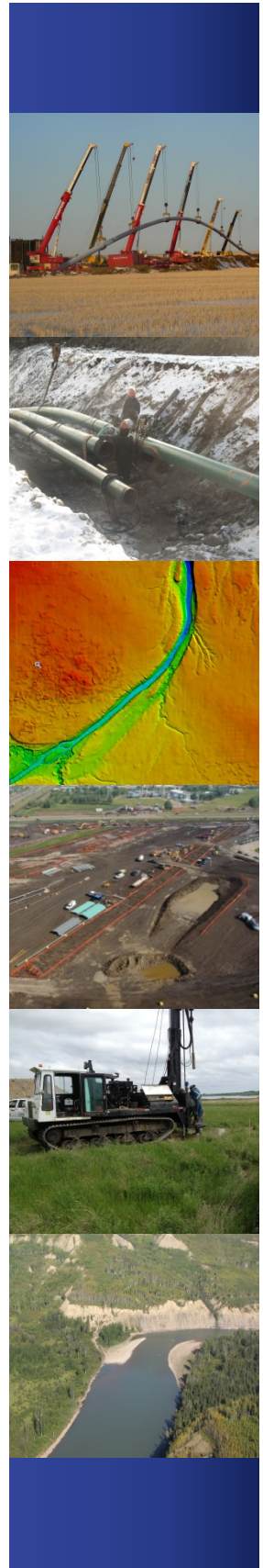


TABLE OF CONTENTS

1	Scope of Work	3
2	Objectives	3
3	Detailed Block Information	4
4	Harvesting Constraints & Techniques	5
5	Timber Types, Transitions & Estimated Volumes	6
6	Visual Impacts To The Landscape.....	6
7	Proposed Retention Patches.....	7
8	Recommendations	7
9	Closure	8
10	Appendices	9
10.1	Overview Map.....	9
10.2	Detailed Block Information Map	10
10.3	Harvesting Constraints & Techniques Map.....	11
10.4	Timber Types, Transitions & Estimated Volumes Map	12
10.5	Visual Impacts To The Landscape Map	13
10.6	Proposed Retention Patches Map.....	14

1 SCOPE OF WORK

Banff National Park is working towards the expansion of Sulphur Mountain fire break through a combination of hand thinning, mechanical thinning and eventually prescribed fire of five units on the west facing slopes of Sulphur Mountain (See Appendix 10.1). CCI was contracted to assess the two mechanical units (See Appendix 10.2). Mechanical Unit # 1 is estimated to be 147 ha in size, while mechanical Unit # 2 is estimated as 74 ha in size. Both assessed areas total approximately 221 ha. CCI will provide a harvest planning summary including:

- Estimated timber volume by species within the mechanical areas
- Timber types with the mechanical areas
- Estimated transitional zones with the mechanical areas
- Any potential amendments to the proposed boundaries of the mechanical area based on operational considerations
- Identify and harvest constraints within the mechanical areas
- Identify any proposed landings and access trails with the mechanical areas (See Appendix 10.3)
- Develop maps showing all timber types (See Appendix 10.4)
- Identify and environmentally sensitive areas (See Appendix 10.4)
- Recommend any harvest techniques with the lowest impacts to the landscape
- Analysis of the visual impact to the landscape or project area (See Appendix 10.5)
- Identify any proposed retention patches to minimize any visual impact to the landscape (See Appendix 10.6)
- Summary of findings and recommendations

2 OBJECTIVES

The objective is for CCI Inc. to complete the field site assessment of both Mechanical Unit 1 & Mechanical Unit 2. A preliminary prescription of the proposed work has already been identified in regards to the details for retention strategy for the project. During the field site assessment, CCI assessed all internal block details within the 2 proposed mechanical units (See Appendix 10.2). Objectives for these areas are:

Mechanical Thin Unit #1

- Identify and Retain all Whitebark pine and Douglas-fir trees
- Retain all healthy deciduous trees and shrubs
- Retain all trees >25 cm in dbh
- Identify environmentally sensitive areas
- Additional requirements for timber removal, timber reduction, debris disposal will be managed during clearing operations as per the prescribed plan

Mechanical Thin Unit #2

- Identify and Retain all Whitebark pine and Douglas-fir trees
- Retain all healthy deciduous trees and shrubs
- Retain all trees >25 cm in dbh
- Identify environmentally sensitive areas
- Additional requirements for timber removal, timber reduction, debris disposal will be managed during clearing operations as per the prescribed plan

The objective for the final work will be to visually emulate natural disturbances such as avalanche paths and fire on the landscape.

3 DETAILED BLOCK INFORMATION

Detailed internal block information was assessed through both Mechanical Units 1 & 2 during a two-day period (Appendix 10.2). Several transects through these proposed areas were completed with the aid of a GPS, geo-referenced maps and with the online ArcGIS collector on our Ipad. This technology gave us the ability to collect and document accurate and detailed information during our field assessment. We were able to collect details, such as:

- Slopes
- Bench
- Rock Outcrops
- Watercourses
- Steep Slopes
- Un-merchantable Area
- Environmentally Sensitive Areas (Douglas Fir Patches)
- Diseases
- Gully
- Blowdown
- Trails
- Etc.

There were no White Pine blister rust or mistletoe identified in the assessed areas. Areas of heavier blowdown consist of a mixture of mature pine and spruce species. The largest pocket of blowdown was located in the south-southeast portion of Mechanical Unit # 2 (See Appendix 10.4 – Area Labelled F on the map). This area is very open with the majority of mature spruce / pine blown down from what looks like a wind event. It is also noted that there is a large number of snags existing in this area with the majority of the current standing timber having broken tops. No nests and very little bird activity were identified over the two days field visit. Some signs of wildlife scat was found throughout the mechanical areas. Two medium sized bears were seen on the last day leaving the area. All details collected in the field provide accurate information for harvest planning to ensure the objectives for these areas are met.

4 HARVESTING CONSTRAINTS & TECHNIQUES

All harvesting constraints (i.e. steep slopes, gullies, rock outcrops, contours, slope breaks, landing etc.) are identified on the maps in Appendix 10.2 & 10.3.

Proposed in-block roads are identified to follow the natural contours of the slope, minimized skidding distances and minimize in block roads. All in block roads should be verified by the logging contractor in the field prior to operations to minimize rutting and soil compaction. The in block roads are identified on the map to access the far south east end of the mechanical Unit #2 and to intersect with the existing main road in the north west end of Mechanical Unit #1. These proposed in block road locations will maintain the 7-8 percent road grade for loaded trucks. All in block roads and landings will be reclaimed back to it's original stage pre-disturbance. Low impact machinery is recommended for clearing and reclamation activities. If operating harvesting equipment (i.e. feller buncher) on steep slopes is resulting in excess soil compaction and damage, operations will be discontinued, assessed and a mitigation plan will be implemented. By working on frozen ground or dry ground conditions will minimize compaction. The existing main access road will need to be upgraded as there are a few 20% grades and 1 steep tight switch back.

Timber should not be processed at the stump. It is recommended all timber be harvested and skidded to designated landings before processing and hauling off site. This technique will allow for minimal slash throughout the proposed areas and to ensure only a few designated landing areas are used. All timber processed at the landing will be decked and hauled to an approved location. The proposed landings are identified on the maps as the best locations throughout the proposed areas. All landings, with the exception of the proposed landing area located in the south east end of mechanical unit #2 have slopes ranging from 0-15%. The proposed landings in the south east end of mechanical unit #2 have steeper side slopes ranging from 15-25%, which will require some additional grading to ensure these landings are operationally feasible. All debris will be piled and burned at the landing sites in several smaller piles. Debris will be burned during favourable conditions only (i.e. snow covered or high dry ground to avoid potential hold over, not in high winds and in favourable weather / forecasts). Piles will be checked after they are extinguished to ensure there is no hold over fires before the fire season. Because the fires will be kept relatively small and are located far from the highway and any local facilities, we do not anticipate there being and safety concerns with smoke generated. As a precaution, signs will be placed in locations approved by Parks Canada advising the public of the potential hazard when burning is underway.

The common harvesting constraints within Mechanical Unit #1 & 2 will be around the gullies, steep +45% in-operable slopes and rock outcrops. The north & northeast boundaries of the proposed boundaries within Unit # 1 & 2 will follow a combination of +45 inoperable slopes, large rock outcrops and the existing road. Amendments to the proposed boundaries locations have been located on the maps (See Appendix 10.2) due to operational constraints for mechanical equipment. Boundaries will have to be adjusted to ensure the slopes maintained are less than 45% slopes. There are several small inoperable sections located within the proposed boundaries of mechanical unit# 1, which will need attention during clearing operations to ensure the safety of the field personnel. These small in-operable sections are only 50-60 meters in length which can be managed through communication and clear planning. Several gullies are identifying in both Mechanical Unit #1 & 2. These gullies are steep with side slopes ranging from 30-40%, have minimal blowdown and are all considered dry draws with no sign of seasonal drainage. All rock outcrops have been identified on the maps and are located

throughout both mechanical units. Caution must be taken when working around these large rock outcrops.

5 TIMBER TYPES, TRANSITIONS & ESTIMATED VOLUMES

All the timber types, timber transition zones and estimated volumes have been identified on the maps in Appendix 10.4.

Lodgepole Pine (*Pinus contorta*), a C3 FBP fuel type is the predominant fuel type accounting for majority of the timber within Mechanical Unit 1 & 2. The remaining fuel types (mostly with Mechanical Unit #2 consist of White Spruce (*Picea glauca*), a C2 Fuel Type. Additional timber in this area is made up of scattered Trembling Aspen, Black Spruce and very large Douglas Fir. The large patches of Douglas Fir have been identified on the maps (Appendix 10.2) as Environmentally Sensitive Areas. All Douglas Fir within mechanical units 1 & 2 will be retained as per the harvest plan. Timber types and transitional lines have been identified (See Appendix 10.4) to show the proposed changes in timber species, heights and species composition.

There were no Whitebark Pine or Limber Pine identified during our field assessment of Mechanical Unit #1 or Mechanical Unit #2. One small un-merchantable Pine area was identified as a retention patch on the map.

The estimated volumes in Mechanical Unit 1 & 2 were determined by identifying the leading timber types (See Appendix 10.4). These timber types are identified under Area's A, B, C, D, E & F. Each timber type has associated volumes per hectare, volumes per species and estimated hectares. These are estimated volume based on timber salvage merchantability specifications of 11-inch top and 15-inch bottom. The estimated total of all merchantable timber in both units is 43,700 m³. The estimated volume break down is 37217 m³ of Pine and 6482 m³ of Spruce. The total merchantable timber is based on all timber greater than merchantable standards. It is estimated that 60 - 70% of the standing timber within Mechanical Units 1 & 2 have dbh above 25 cm. Therefore, it is estimated that 30-40 % of the timber volume will be removed based on prescription requirements (Approximately 12000 m³ Pine & 2000 m³ of spruce).

6 VISUAL IMPACTS TO THE LANDSCAPE

CCI completed a visual impact assessment on the proposed area with the assistance of View Shed, a software application in ArcGIS (See Appendix 10.5). In order to run the analysis, 3 viewpoints were selected based on conversations with Parks Canada. Viewpoint A is the off ramp of HWY 1 and Sunshine RD, viewpoint B is large pull-out along HWY 1 next to the Bow River and viewpoint C is the off ramp of Hwy 1 and Hwy 1A. From all three viewpoints, the hand thin units will be highly visible due to the orientation and elevation of the hillside. The majority of Mechanical Unit #1 will be visible, while approximately half of the area within Mechanical Unit #2 will be visible from these locations. In order to minimize the visual impacts to these areas, strategic retention patches, all deciduous, Douglas Fir and under sized timber should be maintained. There are minimal patches of deciduous timber throughout Mechanical Area 1 & 2. Majority of the deciduous species are scattered throughout the proposed thinning areas. Retention patches will be developed to with stand any potential wind events.

7 PROPOSED RETENTION PATCHES

In order to minimize the visual impacts to the proposed areas, strategic retention patches will be required throughout all hand thin & mechanical thin areas (See Appendix 10.6). Some existing retention patches have been identified throughout the mechanical areas and are identified on the map. These proposed retention patches consist of un-merchantable timbered areas, large patches of Douglas Fir species, large rock outcrops and healthy patches of deciduous trees. The proposed retention patches within Mechanical Units 1 & 2 have been addressed on the proposed retention patches map (See Appendix 10.6) and will be flagged in the field. In conjunction with the retention patches already identified, the proposed fuel modification prescriptions for both mechanical unit 1 & 2 has identified other requirements to reduce, remove and retain standing timber. These thinning requirements will be addressed in the field during operations to ensure strategic retention areas are maintained to minimize the visual impacts to the landscape.

8 RECOMMENDATIONS

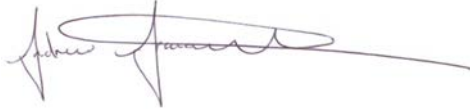
The following are recommendations during the planning and operational phases of the project:

- Minimal traffic and machinery to enter the operational site.
- Public consultation is key as people walking, running, hiking, biking and horse-back riding heavily use this area.
- CCI to assist Parks Canada during the operational phase of this project. CCI can manage all aspects of the thinning requirements, access, hauling, processing, decking, skidding, strategic retention patch selection and burning.
- Recommend a pre-commencement meeting with the clearing contractor before field operations start. This will include in the office review of all requirements and logistics for the project. Additional site visit should be completed with all clearing contractors to walk the proposed area to review ground conditions, harvesting constraints, landing locations, proposed in block roads and environmentally sensitive areas.
- Adequate signage will be used during thinning and burning operations.
- All Permits will be in place prior to any field operations.
- Contractors will have their Emergency Response Plan & Site Specific Safety Plan in place prior to any field operations.
- All boundaries to be flagged as per the proposed locations, with the exception of the north east boundary which will need to be amended in several places based on the operational considerations (Steep slopes above 45+ and large rock outcrops).
- A large portion of the southwest boundary follows an existing heavily used hiking trail. Equipment should not use this trail for access. Equipment should only use the main existing road and proposed in block roads for access.

9 CLOSURE

CCI has prepared this report for the exclusive use of Parks Canada for the West Sulphur Fire Guard Project. Please do not hesitate to contact Andrew Arsenault directly at (403) 840-0015 if you have any further questions.

On behalf of CCI Inc.
RPF Permit No. 663

A handwritten signature in blue ink, appearing to read "Andrew Arsenault", with a long horizontal flourish extending to the right.

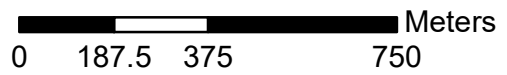
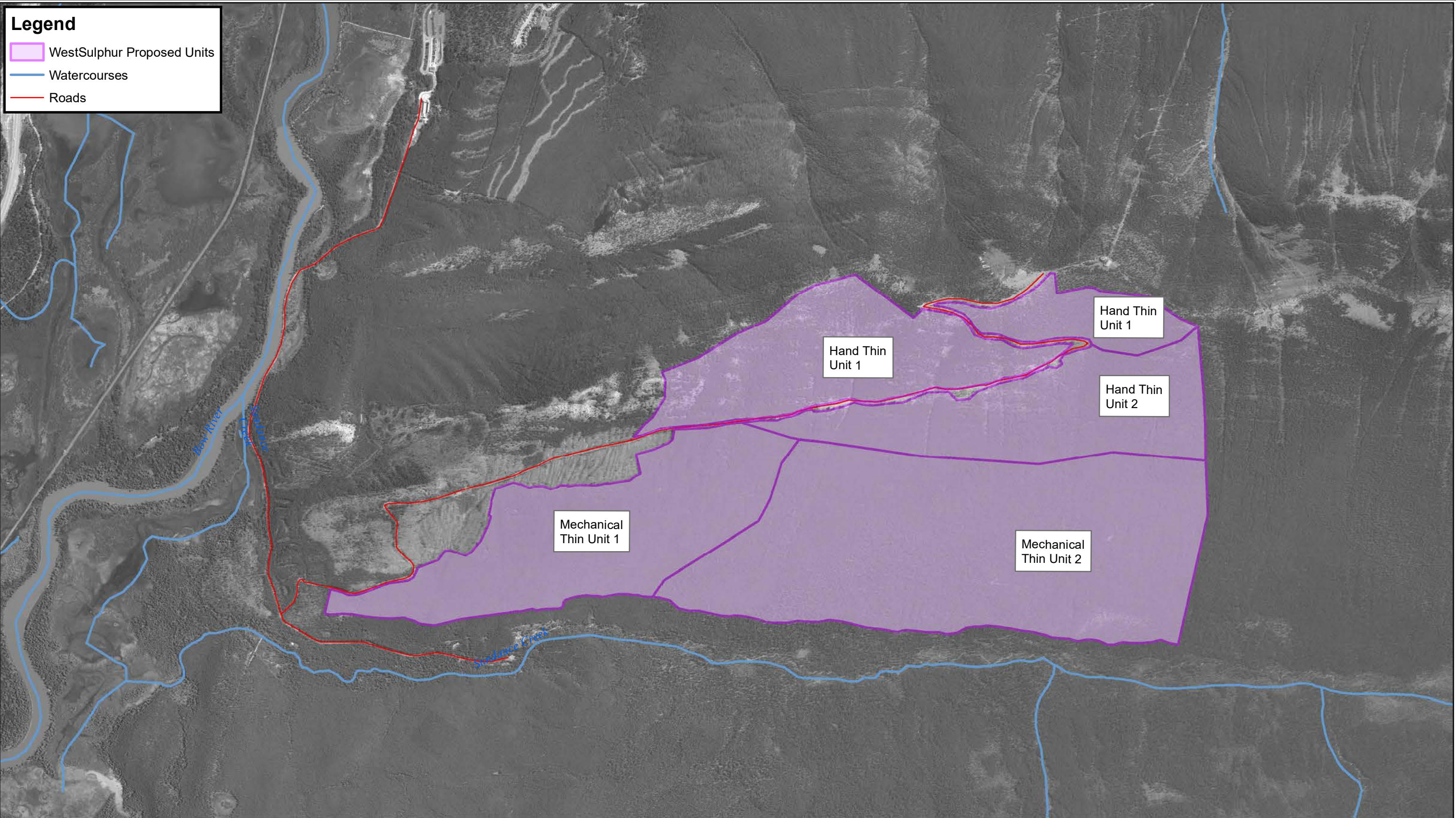
Andrew Arsenault, RPF
Environmental Operations Manager

10 APPENDICES

10.1 Overview Map

Legend

- WestSulphur Proposed Units
- Watercourses
- Roads



SCALE: 1:15,000

**Parks Canada
West Sulphur Fire Guard
Overview Map**

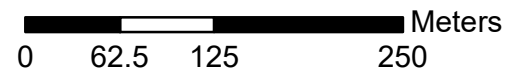
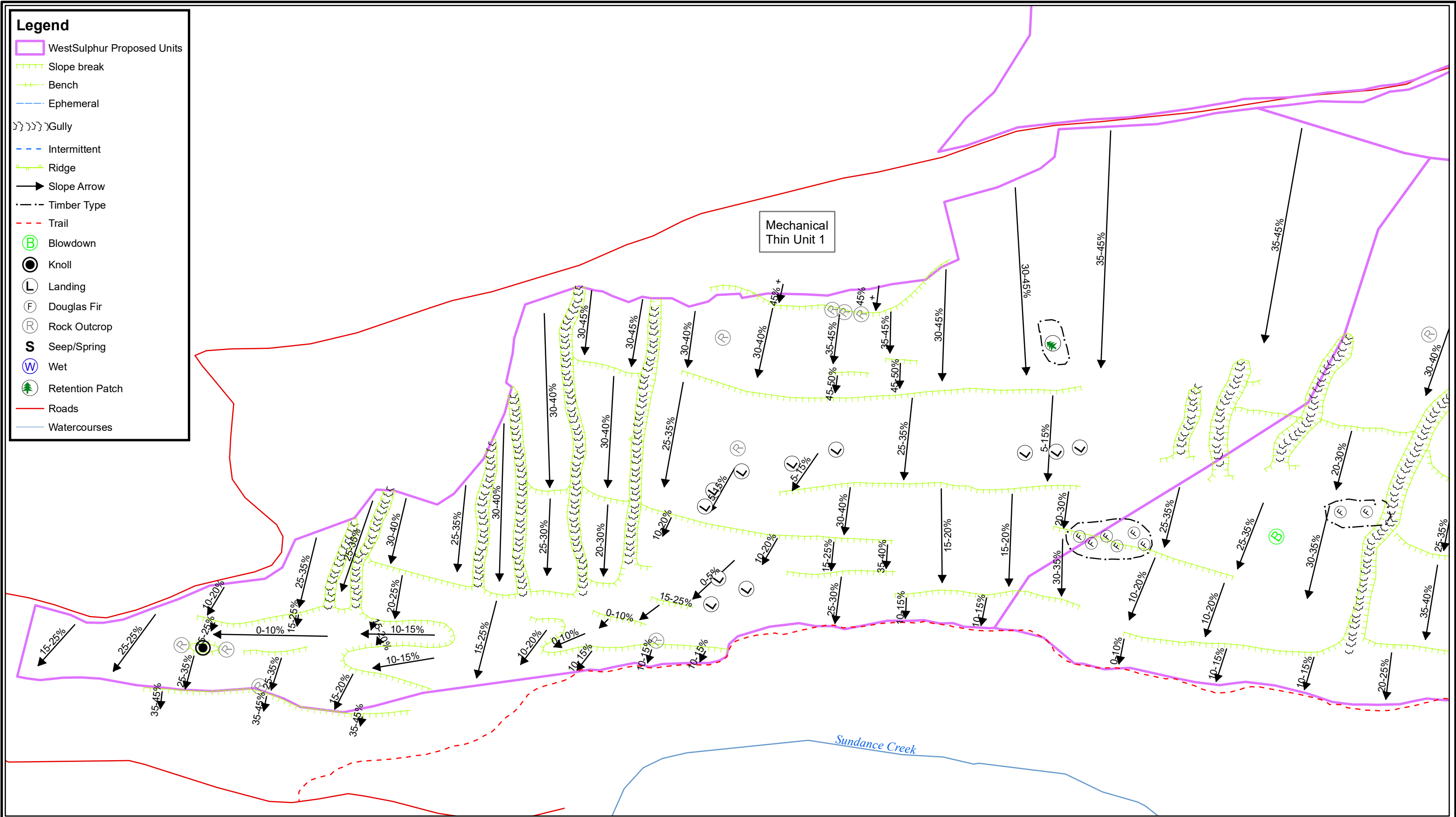


Parks Canada - Timber Assessment
West Sulphur Fire Guard
NAD 1983 UTM Zone 11N
CCI PROJECT #2202
June 28, 2018



10.2 Detailed Block Information Map

- Legend**
- WestSulphur Proposed Units
 - Slope break
 - Bench
 - Ephemeral
 - Gully
 - Intermittent
 - Ridge
 - Slope Arrow
 - Timber Type
 - Trail
 - Blowdown
 - Knoll
 - Landing
 - Douglas Fir
 - Rock Outcrop
 - Seep/Spring
 - Wet
 - Retention Patch
 - Roads
 - Watercourses



SCALE: 1:5,000

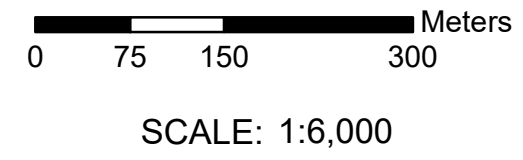
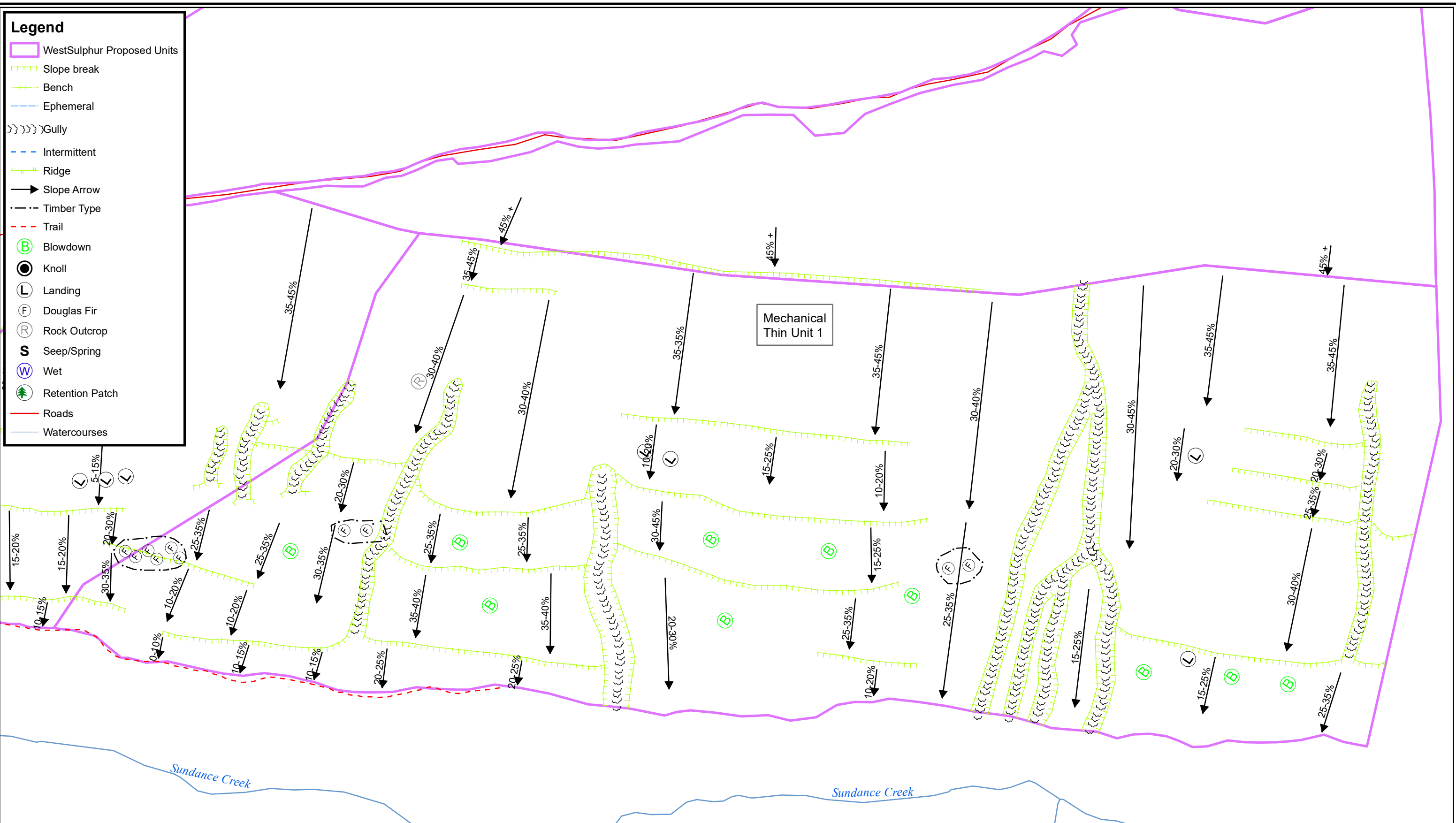
**Parks Canada
West Sulphur Fire Guard
Detailed Block Information
Map 1**



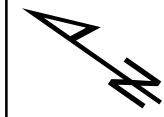
**Parks Canada - Timber Assessment
West Sulphur Fire Guard
NAD 1983 UTM Zone 11N
CCI PROJECT #2202
June 28, 2018**



- Legend**
- WestSulphur Proposed Units
 - Slope break
 - Bench
 - Ephemeral
 - Gully
 - Intermittent
 - Ridge
 - Slope Arrow
 - Timber Type
 - Trail
 - Blowdown
 - Knoll
 - Landing
 - Douglas Fir
 - Rock Outcrop
 - Seep/Spring
 - Wet
 - Retention Patch
 - Roads
 - Watercourses



**Parks Canada
West Sulphur Fire Guard
Detailed Block Information
Map 2**









**Parks Canada - Timber Assessment
West Sulphur Fire Guard
NAD 1983 UTM Zone 11N
CCI PROJECT #2202
June 28, 2018**





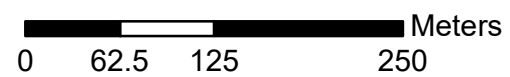
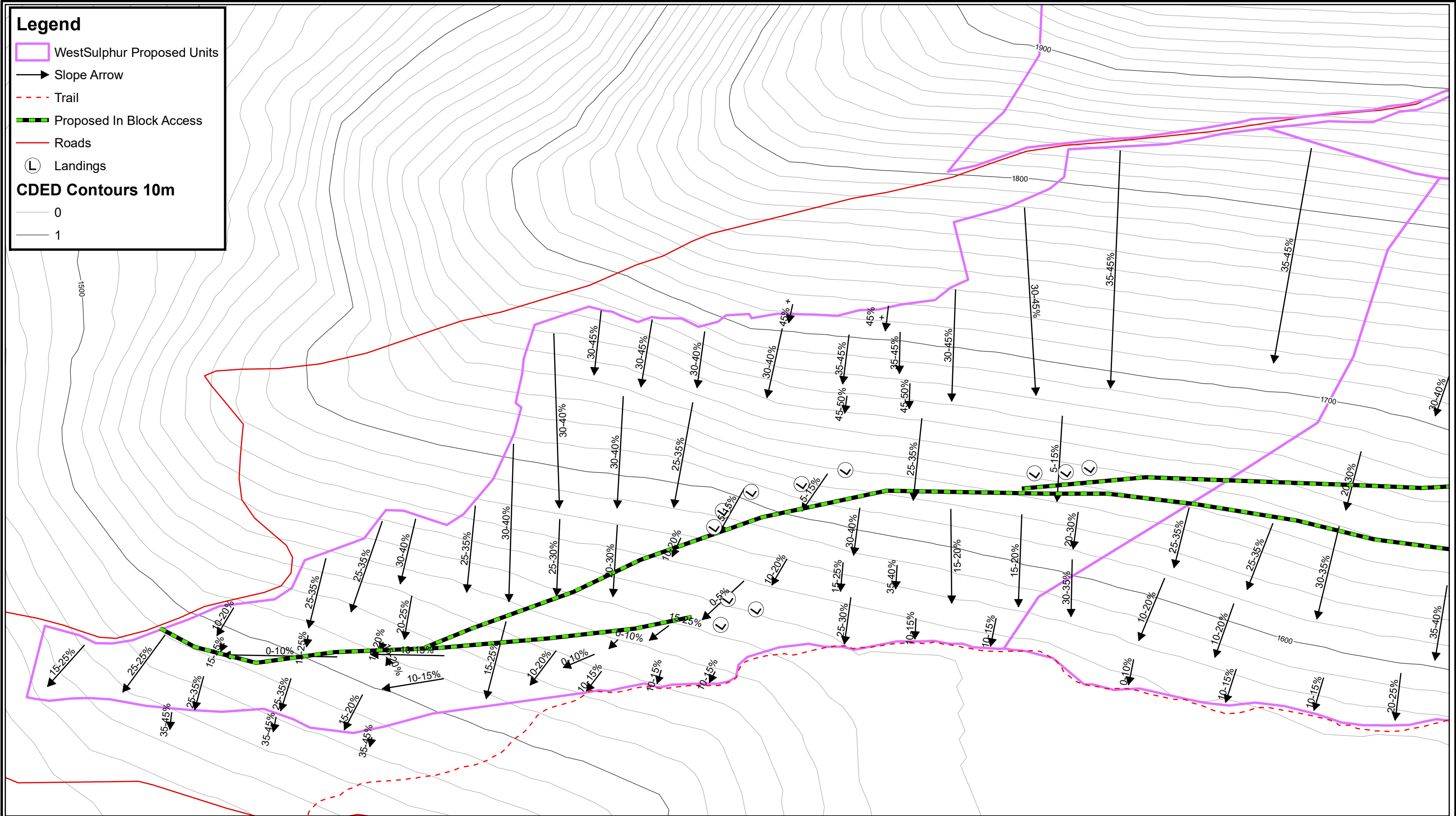
10.3 Harvesting Constraints & Techniques Map

Legend

-  WestSulphur Proposed Units
-  Slope Arrow
-  Trail
-  Proposed In Block Access
-  Roads
-  Landings

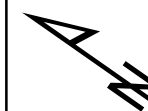
CDED Contours 10m

-  0
-  1



SCALE: 1:5,000

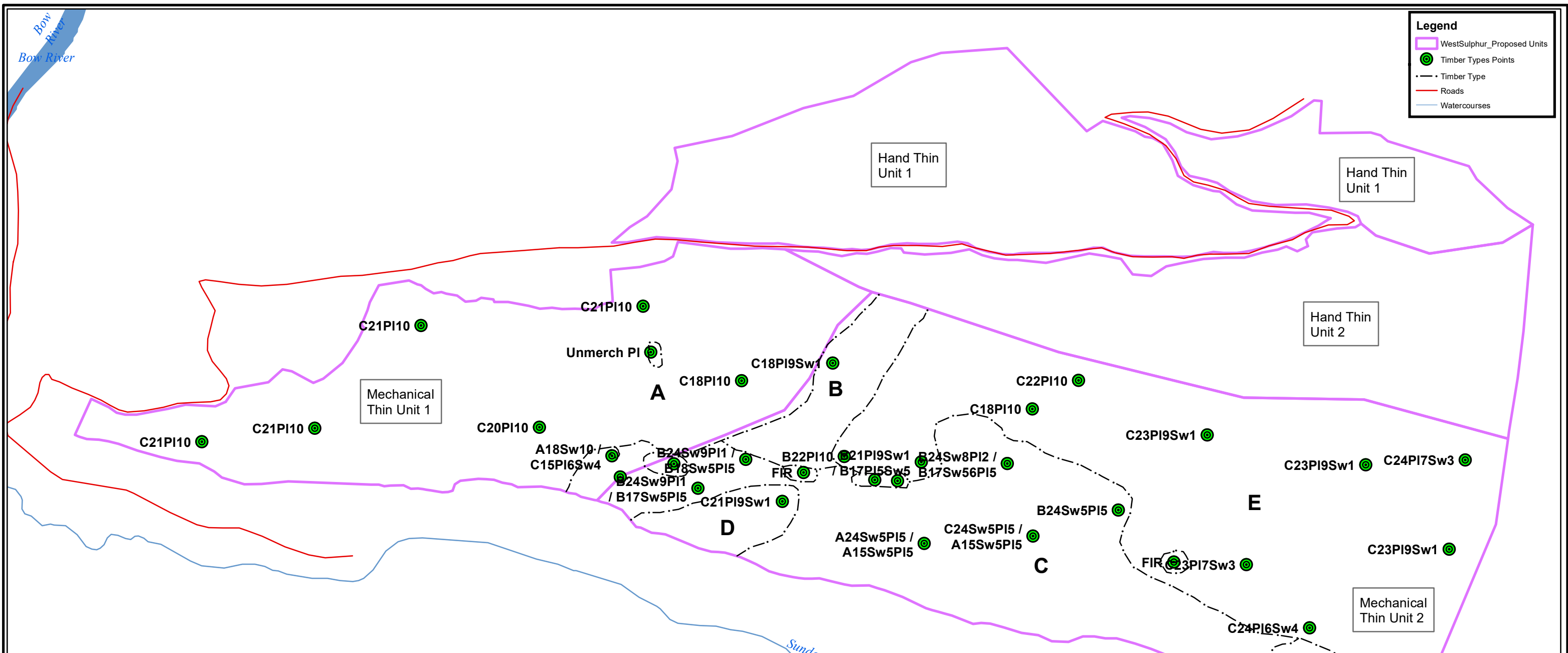
Parks Canada
West Sulphur Fire Guard
Harvesting Constraints & Techniques
(Contours, Slopes, Access)
Map 1



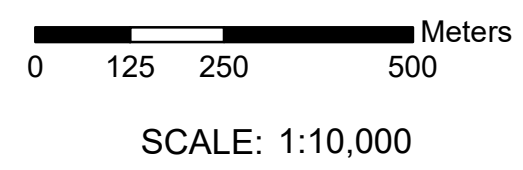
Parks Canada - Timber Assessment
 West Sulphur Fire Guard
 NAD 1983 UTM Zone 11N
 CCI PROJECT #2202
 June 28, 2018



10.4 Timber Types, Transitions & Estimated Volumes Map



Parks Canada - West Sulphur Fire Guard										
Timber Types - Timber Transitions - Estimated Timber Volumes									Volume Per Species	
Label	Type	Ha	ConVol	DecVol	TotConVol	TotDecVol	AREA	# Loads	PL	SW
Mechanical Thin Unit 1	C21PI10	74.00	200	0	14800.00	0	A	424.19	14800.00	0.00
Mechanical Thin Unit 2	C18PI9Sw1	8.70	175	0	1523.24	0	B	43.52	1370.92	152.32
Mechanical Thin Unit 2	B24Sw5PI5	52.12	170	0	8860.16	0	C	258.00	4430.08	4430.08
Mechanical Thin Unit 2	C21PI9Sw1	4.91	200	0	982.32	0	D	28.07	884.09	98.23
Mechanical Thin Unit 2	C23PI9Sw1	79.15	220	0	17412.32	0	E	503.78	15671.08	1741.23
Mechanical Thin Unit 2	A24Sw5PI5	2.44	50	0	122.19	0	F	3.49	61.09	61.09
TOTALS:		221			43700.22			1261.06	37217.26	6482.96



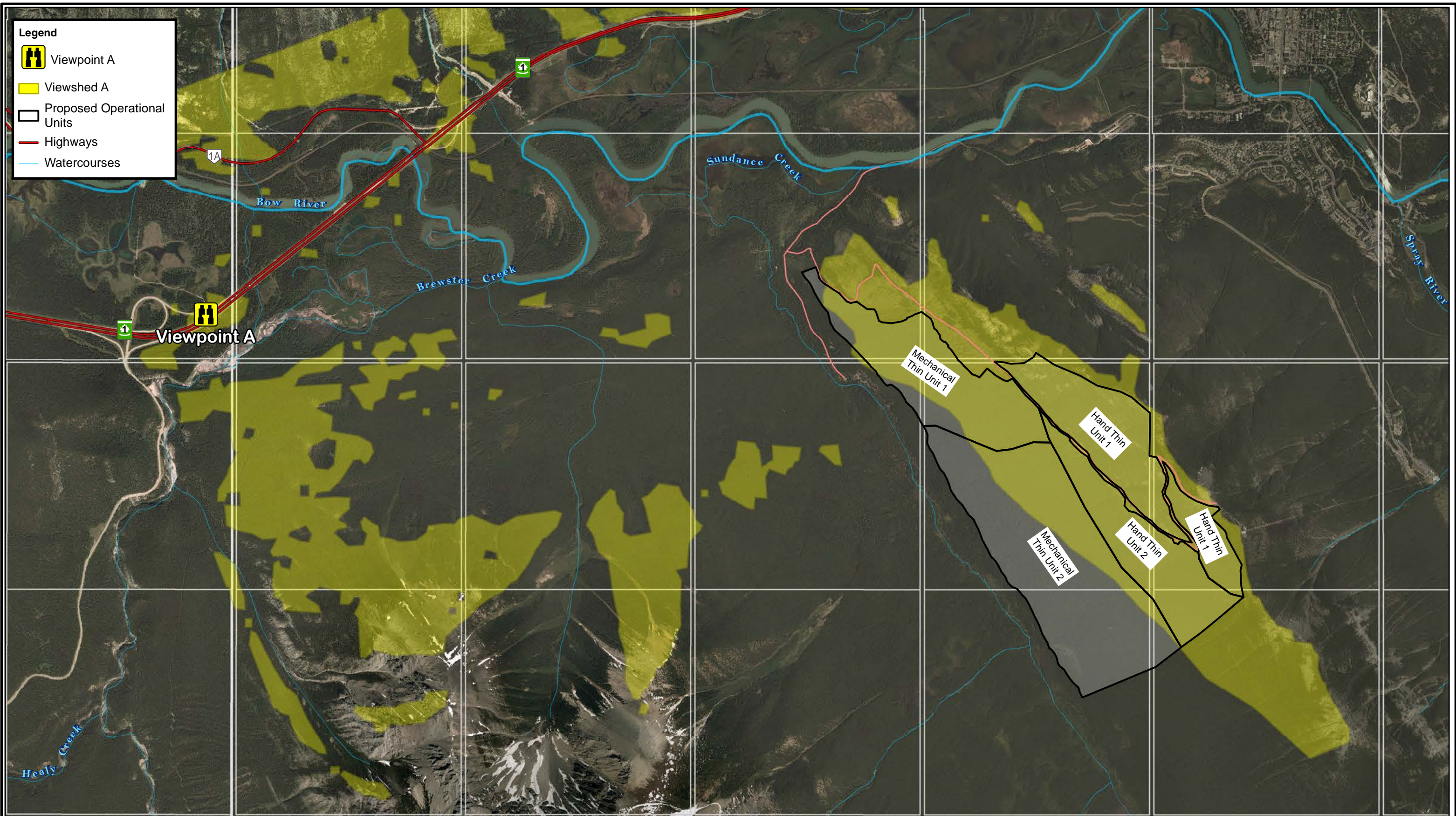
**Parks Canada
West Sulphur Fire Guard
Timber Types & Transitions
& Estimated Volumes**








Parks Canada - Timber Assessment
West Sulphur Fire Guard
NAD 1983 UTM Zone 11N
CCI PROJECT #2202
June 28, 2018

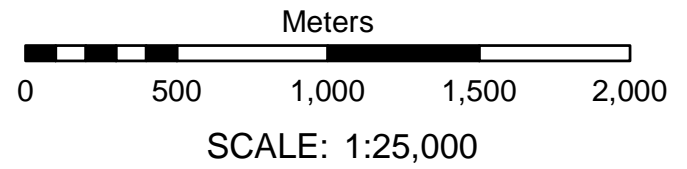


10.5 Visual Impacts to The Landscape Map



Legend

-  Viewpoint A
-  Viewshed A
-  Proposed Operational Units
-  Highways
-  Watercourses

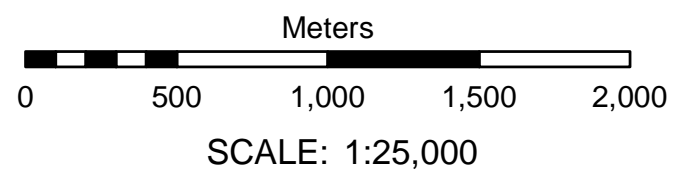
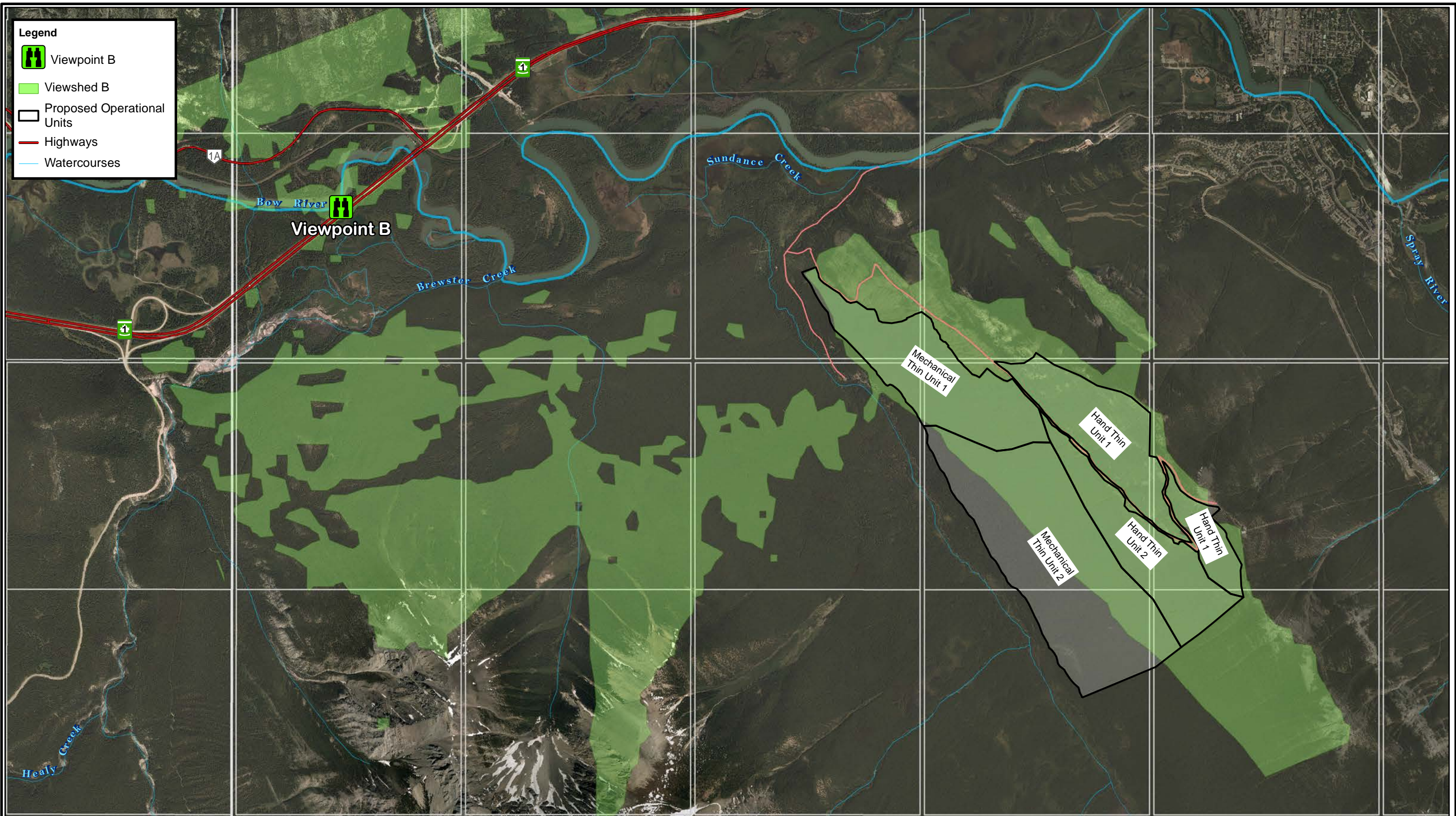


**Parks Canada
West Sulphur Fire Guard
Visual Impact to Landscape
Viewpoint A**



Parks Canada - Timber Assessment
West Sulphur Fire Guard
NAD 1983 UTM Zone 11N
CCI PROJECT #2202
June 28, 2018



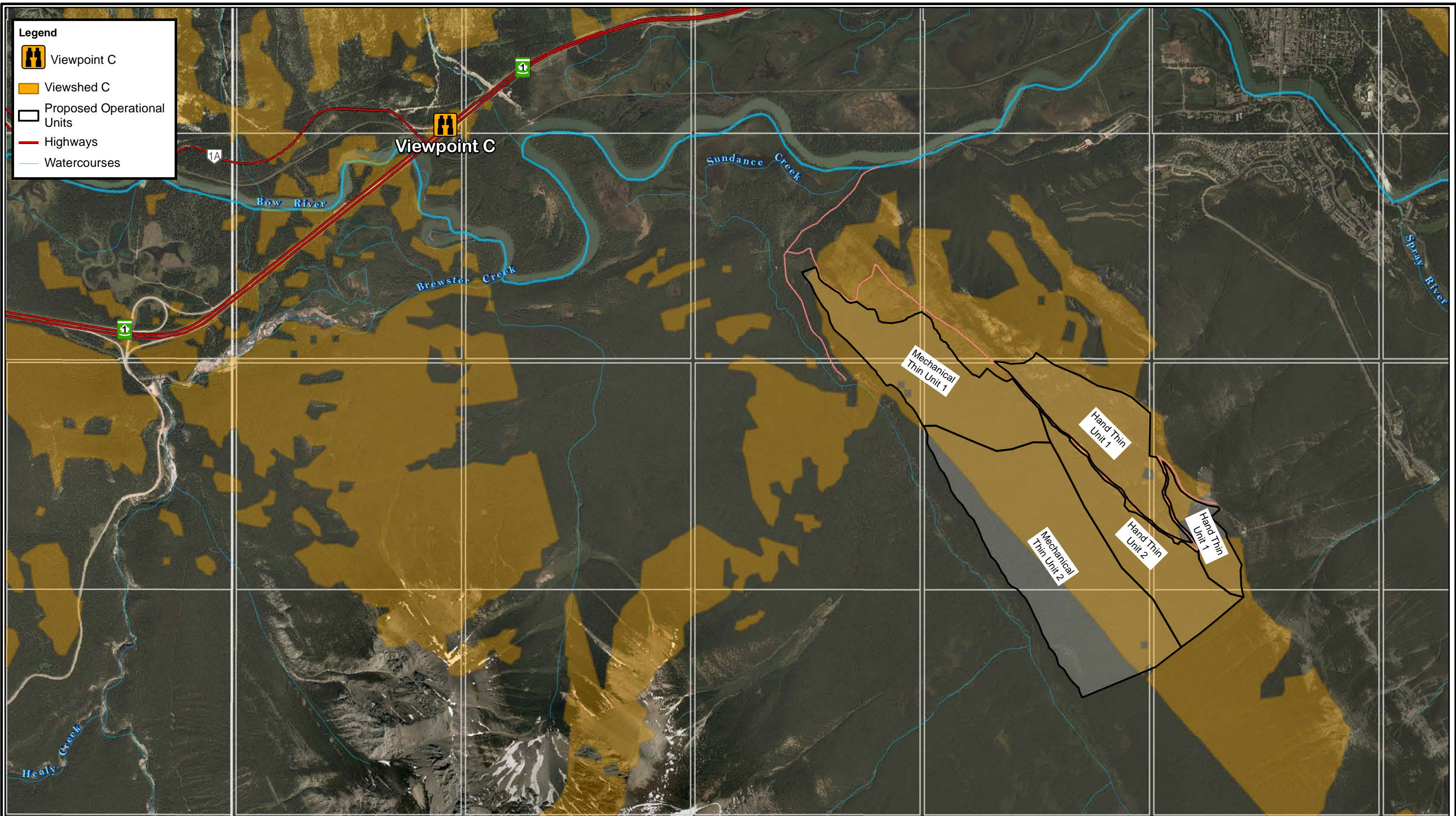


**Parks Canada
West Sulphur Fire Guard
Visual Impact to Landscape
Viewpoint B**








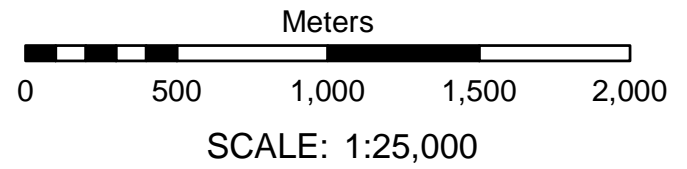
Parks Canada - Timber Assessment
West Sulphur Fire Guard
NAD 1983 UTM Zone 11N
CCI PROJECT #2202
June 28, 2018





Legend

-  Viewpoint C
-  Viewshed C
-  Proposed Operational Units
-  Highways
-  Watercourses



**Parks Canada
West Sulphur Fire Guard
Visual Impact to Landscape
Viewpoint C**











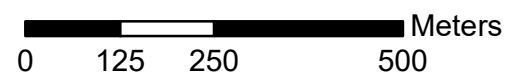
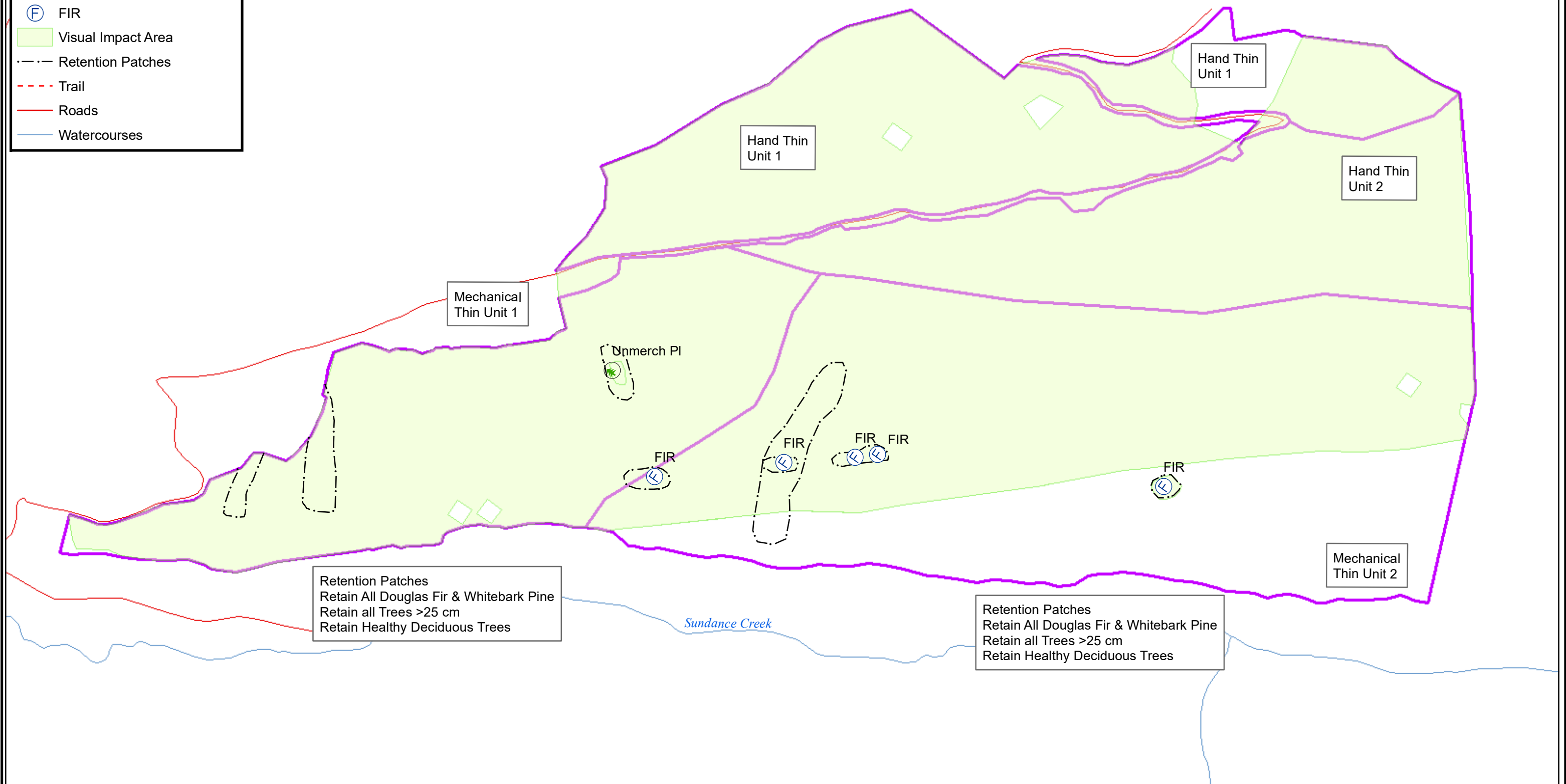
Parks Canada - Timber Assessment
West Sulphur Fire Guard
NAD 1983 UTM Zone 11N
CCI PROJECT #2202
June 28, 2018



10.6 Proposed Retention Patches Map

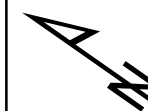
Legend

-  WestSulphur Proposed Units
-  Unmerch
-  FIR
-  Visual Impact Area
-  Retention Patches
-  Trail
-  Roads
-  Watercourses



SCALE: 1:10,000

**Parks Canada
West Sulphur Fire Guard
Proposed Retention Patches**



Parks Canada - Timber Assessment
West Sulphur Fire Guard
NAD 1983 UTM Zone 11N
CCI PROJECT #2202
June 28, 2018

