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ENHANCEMENT PLAN:
ROCKY MOUNTAIN BIGHORN SHEEP HABITAT
MAUSE CREEK-PREMIER LAKE

For

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December 15,2006

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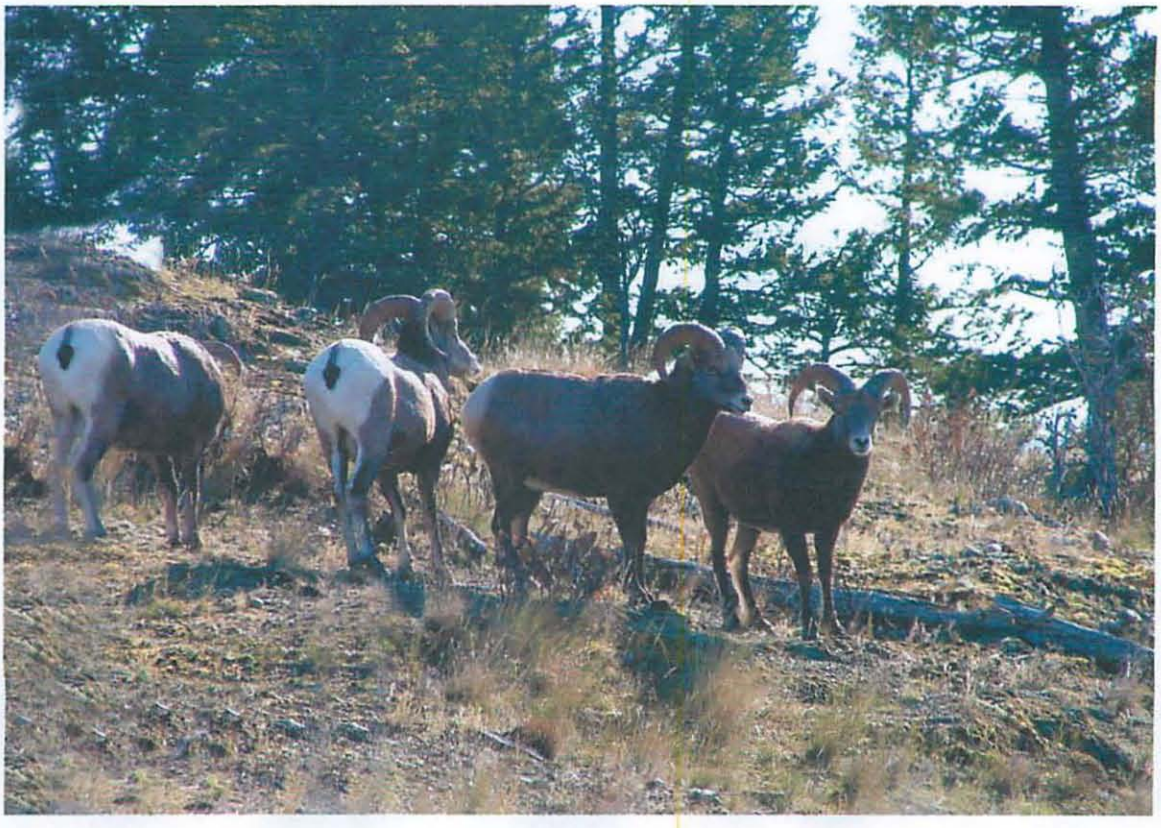

Executive Summary

A dramatic decline in open range and open forest habitat used by bighorns spring, fall and winter range has occurred in the past 60 years due to effective fire suppression activity by the Ministry of Forests. Historically, frequent low intensity burns had occurred in the Interior Douglas fir biogeoclimatic zone of the East Kootenay Trench and the adjacent Montane spruce zone on the western edge of the Rocky Mountains. Most wild fires have been controlled by the Ministry of Forests, since creation of a Fire Protection Branch in 1946.

Ministry of Environment staff recognized that forest encroachment and in-growth were reducing suitability of bighorn sheep winter range in the East Kootenays and initiated prescribed burning on Wigwam Flats in 1978. Restoration of bighorn sheep winter range was expanded in the 1980's through a Rocky Mountain Bighorn sheep restoration program funded by the Habitat Conservation Fund (now Habitat Conservation Trust Fund, Davidson 1994). Prescribed burns, logging, slashing and seeding were used to improve the suitability of bighorn sheep winter ranges while translocations, anti-parasite and trace mineral treatment were used to stimulate population growth.

Between 1990 and 1996, habitat restoration efforts on bighorn sheep range were limited and forest in-growth was rapidly reducing suitable open range and open corridors between seasonal ranges. The Ministry of Forests initiated Ecosystem Restoration Plans for the entire East Kootenay Trench in 1997. The Provincial Government established the Rocky Mountain Trench Ecosystem Restoration Steering Committee in 1998 with the responsibility for planning and delivering a strategic restoration plan for fire maintained ecosystems in the Rocky Mountain Forest District (Blueprint for Action 2006). Committee members were selected from government ministries, timber licencees, stakeholder organizations and program funding agencies (Blueprint for Action 2006). A sub-committee of the Steering Committee called the Operations Committee was formed to deliver site-specific restoration activities. Habitat restoration priorities for bighorn sheep were evaluated against all other restoration priorities in the Rocky Mountain Forest District.

With the designation of Rocky Mountain bighorn sheep as a blue listed or vulnerable species in1999, (Identified Wildlife Strategy of the Forest Practice Code), both the Ministry of Environment and the Columbia Basin Fish and Wildlife Compensation Program have placed a renewed emphasis on habitat management for bighorn sheep.

The Columbia Basin Fish and Wildlife Compensation Program issued a contract in September 2006, to enhance Rocky Mountain bighorn sheep range located between Mause Creek and the mouth of Diorite Basin east of Premier Lake. This plan identifies

the location of proposed habitat restoration activities, proposed habitat enhancement techniques to be used, priority areas for proposed work and factors which may influence desired outcomes to improved range suitability. Stand management prescriptions were completed on three winter range areas recently used by bighorn sheep so that restoration work could commence in 2007 and 2008.

Rocky Mountain bighorn sheep populations wintering between Mause Creek and Premier Lake have declined from an estimated population of 260 in 1991 to 70 in 2005. A transplant of 25 Rocky Mountain bighorns was done form Stoddart Creek to the Premier ridge herd in February 2005 in order to reduce the dramatic decline in population. Proposed habitat enhancement activities will help to ensure that this population will increase in number and have suitable range to support future population growth

Acknowledgements

I would like to thank Larry Ingham of the Columibia Basin Fish and Wildlife Compensation Program and Irene Teske of the Ministry of Environment for their helpful comments and information support. Dennis Petryshen (Resource Officer for Silviculture, Ministry of Forests, Cranbrook) has always provided information on request and gone out of his way to be helpful. I would like to thank Jim Beare, for his support in providing field information when I could not be there. Oliver Thomae of Arbourtech Consulting has been extremely helpful in providing GIS (Geographical Information System) support for this project. And finally I would like to thank bighorn sheep for being in the East Kootenay Region.

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1.0. Introduction

1.1 Objectives

The objectives of this project were to:
1. Identify potential sites for habitat enhancement on bighorn sheep winter range located between Mause Creek and the mouth of Diorite Basin;
2. Identify types of enhancement required and desired habitat after enhancement ;
3. Prioritize areas and years of treatment of habitat;
4. Develop detailed enhancement plans (Two Stand Management Prescriptions) on several areas so that habitat enhancement activities can proceed in 2007 and 2008.

1.2. Background Information

1.2.1. Population Trend and Probable Cause

Rocky Mountain bighorn sheep numbers have declined from an estimated population of 270 animals in 1991 to less than 70 at present in the Wildhorse, Estella and Premier Ridge herds. (Teske 2005-Table 1, Appendix 0; Figure 1: Overview Map of Area of Interest-Insert). The rapid decline in bighorn numbers are postulated to be the result of loss of open range, particularly fall, winter and spring range. The loss of open range is directly related to forest encroachment and in-growth which has steadily occurred since major fires of the 1920's and 1930's in the East Kootenays. The Wildhorse, Estella Mountain and Premier Ridge herds winter at lower elevation on the western side of the Rocky Mountains where reduced snowfall, chinook winds and higher solar radiation tend to keep snowfall depth low. Stand maintaining fires in the East Kootenay Trench Ecosection and stand replacement fires in the adjacent Montane spruce biogeoclimactic zone on the western edge of the Rockies have been suppressed by the Ministry of Forests for about 60 years. The resultant buildup of forest cover has had several negative impacts on bighorn sheep range. One of the direct impacts is a loss of productive bunch grass when canopy closure exceeds about 25% (Ross pers com). Dense forest in-growth dramatically reduces sight lines for bighorns making them totally vulnerable to predators. Steep, rocky terrain is sought for escape terrain from predators. Bighorn sheep have high visual acuity and can spot predators from distances of over a mile in open country. Effective sight lines are reduced to several meters in closed canopies, resulting in increased predator effectiveness. The change in forest cover and increased predator effectiveness has also been coupled with high predator populations in this area. Deer and elk numbers have steadily increased on winter ranges used by bighorn sheep during the past 10 years (since the deep snow winter of 1995-1996), due to mild winter conditions and a conservative hunting season. It is understandable that predator populations would increase in response to an increasing prey base.

Viable populations of bighorn sheep in the area of interest (Figure 1) now only exist in the Premier Ridge/Wasa Mountain areas where suitable escape terrain is readily accessible. According to Pete Lum (pers. com.) bighorn sheep did not winter on Premier

Ridge until the 1940's. Most potential winter range south of Herbert Creek and north of the Steeples range is no longer used by bighorns.

2.0 Description of the Area of Interest

2.1 Wildhorse Area

Populations of bighorn sheep have varied from over 70 animals prior to a die-off in1964 (R. Demarchi pers com) to about 35 in the early 1980's and 70 in the late 1980's due to transplant augmentation. Since then, the population has declined to less than 15 animals. The Wildhorse sheep herd traditionally wintered on lower Sunken Creek, Lone Peak, Lower Lakit Mountain and Brewery Ridge (Appendix 1, Figure1).

Lone Peak

Lone Peak is a steep rocky cone shaped peak located between Mause Creek and the Wildhorse River (Appendix II, Figure 1). This peak ranges in elevation from 960 meters at the base to 1800 meters at the peak. Coarse boulder outcrops occur down to about 1300m elevation on the southern aspect and to 1150 m on the west aspect. A band of colluvium about 100m wide in occurs below the boulder outcrops. Soils of Lone Peak are eutric brunisols of the Bigfish Soil Series (Lacelle 1975).

The steep boulder terrain above 1300 m provides good escape terrain for bighorn sheep on Lone Peak. The Lower Sunken Creek winter range located south of Lone peak and north of the Steeples range has little escape terrain but historically was the central part of winter range for bighorn sheep in the Wildhorse area.

Ungulate Biophysical Mapping (D. Demarchi 1975), rated the west side of Lone Peak as having moderate winter range capability to support bighorn sheep. Bighorn sheep also winter on the lower south side of Lone Mountain.

The lower southeast part of Lone Peak was selectively logged in 1996 while the toe of the western side of Lone Peak was logged (patch cut), in 1992 (Appendix 1, Figure 1,TU1A). The reconnaissance level range survey done by Tim Ross (1999) indicates that the lower western slopes of Lone Peak is dominated by Douglas fir with minor amounts of Ponderosa pine and western larch depending on the aspect. The dominant grass is pinegrass,(Calamgrostis rubescens) in moderate to heavy forest cover while Richardson's needlegeass, (Stipa richarsdonii) and rough fescue (Festuca scabrella) are the dominant grass in logged areas (Ross 1999). A Stand Management Prescription done for the lower west side of Lone Peak (Davidson 2005) , requests that the rest of the area be logged and slashed to create open forest habitat which will promote desirable forage species for bighorn sheep. The south side of Lone Peak below 1200 meters elevations and the western side below 1060 meters has potential for habitat enhancement because the slope is less than 50% and can be logged with conventional systems. Lone Peak is part of Wildhorse pasture in the Peckham's Lake range unit.

Brewery Ridge

Brewery Ridge is a low-lying (860-1080 meters elevation), gently sloped north-south running ridge commencing 4 km east of Fort Steele and extending north 8 km to Lakit Lake. Interior Douglas fir (80-100 years old), covered Brewery Ridge until 1985 when a wild fire in August, burned the southern half of Brewery Ridge and the Lower southwest slope of Lakit Mountain (Appendix II, Figure 2). The southern half of Brewery is classified as open forest in the Ecosystem Restoration Plan (2001) for the Wildhorse Lewis Range Unit Plan but should be classified as open range or lightly stocked open forest to maintain forage values for bighorn sheep, elk and mule deer.

Recommended treatments for the south end of Brewery Ridge were to space conifers, then conduct a prescribed burn, then slash, residual small diameter stems (Wildhorse/Lewis Range Unit Ecosystem Restoration Plan, Feb. 28, 2001).

Winter range in the burned area of Brewery Ridge was ranked as having a high to very high capability to support bighorn sheep (D. Demarchi, 1975, Appendix II Figure 1). This ranking is probably not realistic due to the lack of escape terrain except in the Wildhorse river canyon. Brewery Ridge is part of Brewery pasture in the Wildhorse/Lewis Range Unit.

Lower Lakit Mountain

The lower southwestern part of Lakit Mountain had been logged in 1982, but a wildfire during the summer of 1985 destroyed all leave trees. The wild fire did stimulate the release of snowbrush (Ceanothus velutinus) on Lakit Mountain, now one of the most extensive patches in the East Kootenays (Figures 2 and 3 below). The fringes adjacent to mature Douglas fir stands are now re-growing with Interior Douglas fir (Figure 3). The recommended treatment for this area in the Wildhorse/Lewis Range Unit Restoration Plan (MOF 2001) was to slash regenerating trees and then prescribe burn the area. A Stand Management Prescription was completed for the burned area of Lakit Mountain (Sean Beswick April 2003). The enhancement prescribed burning proposed in the Stand Management Prescription has not been completed.

Figure 2: Lakit Mountain burn area with snowbrush (Ceanothus velutinus) in foreground and encroaching Douglas fir in the background

Figure 3: Lakit Mountain burn area in 2006, 21 years after a wild fire: now a snowbrush and bluebunch wheatgrass community

The western face of Lakit Mountain is dominated by 80-100 year old Interior Douglas fir of about 10-12 meters in height (Figure 4). There are some patches of Douglas fir which are older than 140 years, but these may be providing critical habitat for flammulated owls. The Wildhorse/Lewis Range Unit Ecosystem Restoration plan recommends that the Montane spruce zone (>above 1200m) be managed for managed forest while the lower slopes be managed for open forest through harvest, then spacing and maintenance burning. All but the toe of the western face of Lakit Mountain is steep (70-100%) and would require cable logging. Tembec Industries Inc. intend to use conventional logging to harvest some of the lower west-facing slopes of Lakit Mountain adjacent to Brewery Creek (E. Pighin pers com, Forest Harvest Planner, Tembec, Industries Inc, Cranbrook)

The western slopes of Lakit Mountain were mapped (D. Demarchi 1975) as having a moderate biophysical capability to support bighorn sheep (Appendix II, Figure 1). There are virtually no boulder outcrops or scree slopes on the western edge of Lakit Mountain which could be used as escape terrain by bighorns (Figure 4). All the area which could be logged using conventional systems between the western face of Lakit Mountain and Tracy Creek (Estella Mountain) was logged for pulpwood by Tembec Forest Industries in 2003 (Appendix 1, Figure 2 A). Lower Lakit Mountain is part of Lower Brewery Pasture in the Wildhorse/Lewis Range Unit.

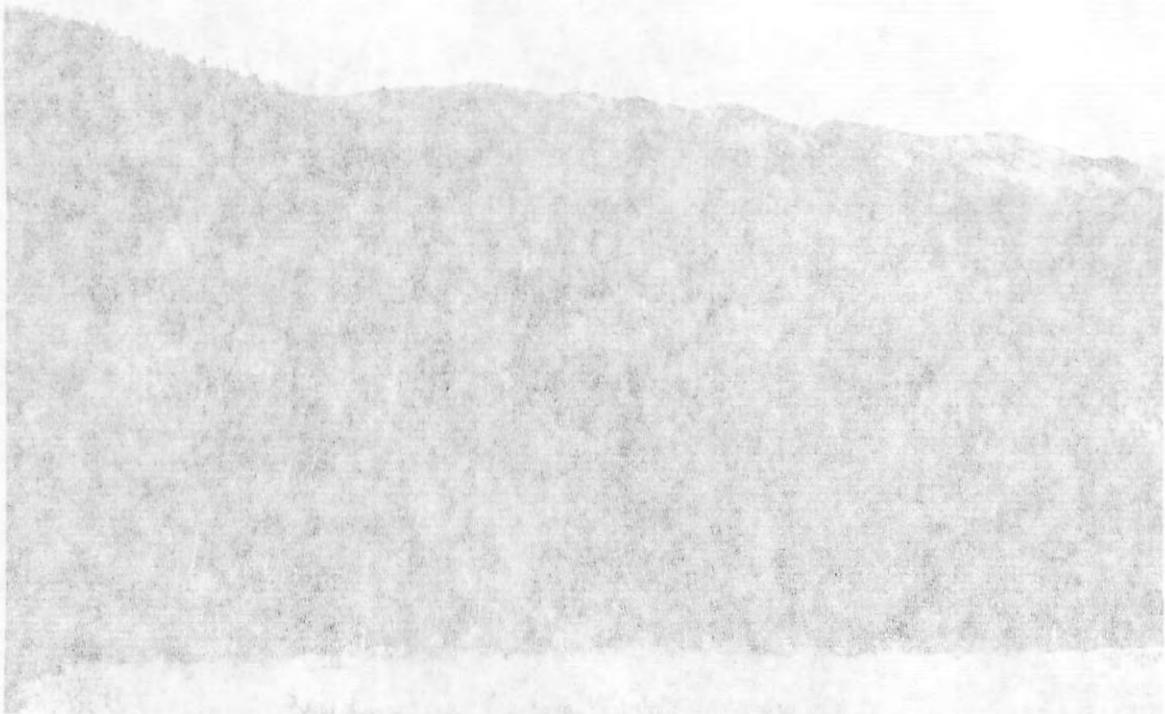
Figure 4: Western slopes of Lakit Mountain covered with mature Douglas fir

2.2 Estella Area

Estella Mountain Area

The Estella Mountain bighorns historically (1970's -1980's) wintered on the open grasslands of Estella Mountain (Appendix 1,Figure 3) and moved down to range near Lewis Creek when snow got too deep (TU 9, Appendix 1, Figure 4). At present some resident sheep have been observed on the face of Herbert Creek (Figure 1, TU 5) and in the Lewis Creek badlands during winter months (Figure 5.

Most of the Estella Mountain area was classified (D. Demarchi, 1975) as Class 1 and Class 2 bighorn sheep winter range having a high to very high capability support bighorn sheep during winter months (Appendix II Figure 2). The open grasslands on the moderately steep west –facing slope support rough fescue grasslands from 1240 meters to over 2040 meters elevation. Both the Montane spruce and Engelmann spruce biogeoclimatic (BEC) zones occur on this range (Figures1 and 5)). The grasslands would be classified as MSdk/02 and ESSFdk/02 site series in both BEC zones, while the aspen shrublands below the road in the southern part of the area would be classified as a 03 site



series. A prescribed burn was conducted on Estella Mountain in May, 1988 but this was fairly unsuccessful in killing regenerating lodgepole pine (Davidson 1994). Some of the lodgepole pine below the road was slashed in the early 1990's (G. Tipper pers com) and a prescribed burn was conducted over the area by Bob Forbs in the spring of 1995. Lodgepole pine continues to invade treatment units 9 and 10 in the Estella range but are well above the operability line for timber harvest. The pine beetle epidemic under way in the Rocky Mountain Forest District is killing much of the lodgepole pine at lower elevations and may affect these stands as low elevation pine dies. There is evidence that lodgepole pine is being killed by beetle at similar elevations in the Wolf Creek Basin several kilometers north of here. Estella Mountain is not grazed by livestock.

Lewis Creek Badlands

Bighorn use of winter range in the Lewis Creek badlands was not recognized by D. Demarchi in his ungulate biophysical capability mapping in 1975. During the 1980's the Lewis Creek badlands (Figure 1, Appendix 1. Figure 4) were used extensively as late winter and spring (lambing) range. The badlands probably rate as having moderate capability to support bighorn sheep due to shallow soils and numerous rocky outcrops. This area is located in the IDFdm2 biogeoclimatic zone and ranges in elevation from 880 meters to 960m. The ridge above the Lewis Creek and west of the Lewis Creek gorge has grown in with a moderate to dense stand of Douglas fir of all structural stages. Habitat enhancement opportunities in this area are limited by private land to the south and north and an active Christmas tree permit to the northwest (Appendix I, Figure 4, yellow outlines). The western side of Lewis Creek is located in CTP pasture of the Lewis/Wolf Creek Range Unit.
The eastern side of Lewis Creek in the badland area is largely covered with 140 + year old Douglas fir with some larch near the toe of the slope(Figure 5). There are patches of 60-100 year old Douglas fir in some of the driest parts of the west-facing slopes. Tembec Industries Inc. does not intend to log these mature stands in the near future (Pighin pers comm). This area is part of Grundy Pasture in the Wildhorse/Lewis Range Unit.

Herbert Creek

Both resident and translocated bighorns have been observed on the lower face of Lakit Mountain between Herbert Creek and Tracy Creek (TU5 Appendix 1, Figure 2A) This area is steep with a sparse mature Douglas fir over-story; mock orange (Philadelpia lewisii) and Juniper (J, communis and J. scopulorum) , Douglas maple (Acer douglasii) in the shrub layer and bluebunch wheatgrass in the grass layer. This area is part of Rocks pasture in the Wildhorse/Lewis Range Unit.

Figure 5: Estella Mountain grasslands in foreground, Lewis Creek badlands in mid-ground and Wasa Lake in background

Figure 6: Mature and old Douglas fir forest on the eastern side of Lewis Creek

2.3 Premier Ridge Area

During the late 1980's about 150 bighorn sheep wintered on the Premier ridge area. The west and southwestern facing slopes of Premier Ridge provided winter range for about 70 bighorns, and many mule deer and elk (Appendix I, Figure 7B) The small rock bluffs on the west side of Premier Ridge (SW corner of Figure 7B) were used as escape terrain for this herd. The western edge of Premier Ridge (TU20, Appendix 1, Figure 7A) was ranked as having very high capability to support bighorn sheep by D. Demarchi (1975, Appendix II, Figure 2). This ranking was probably inaccurate due to the lack of suitable escape terrain. This area is part of Sheep Pasture in the Premier Ridge Range Unit

About 55 bighorns grazed the open forest grasslands above Quartz (Rockbluff) lake and used the steep slopes on the western side of Quartz Lake for escape terrain. The ram herd wintered on the steep western slopes of Wasa Mountain located about 2.5 km southeast of Premier Ridge. This area is part of Quartz pasture in the Premier Ridge Range Unit. The open forest area west of Quartz Lake and the lower slopes of Wasa Mountain were rated as having a high capability to support bighorn sheep during winter months (Appendix II, Figure 2).

The open, south facing slopes of Wolf Creek Basin and the upper west and south-facing slopes of Wasa Mountain were rated (Appendix II, D. Demarchi 1975) as having a moderate capability of supporting bighorn sheep. These badlands and Wolf Creek drainage are not grazed by livestock.

Use of Premier Ridge as winter range by bighorns declined rapidly through the 1990's as total herd numbers declined. The present population is estimated to be 50 to 70 bighorns including transplants. During the past few years, bighorn sheep only use Premier Ridge infrequently. Resident and translocated bighorn sheep have been observed on the traditional ram winter range located on Wasa Mountain. It is interesting to note that present winter range use reflects historic winter range use. According to Pete Lum (pers com), bighorn sheep wintered on Wasa Mountain and Wolf Creek basin until the early 1940's when some began using Premier Ridge. The 25 bighorn sheep translocated (February 2005) to winter range immediately south of Wasa Creek still return to this range. Global positioning collars and VHF collars placed on 14 of the ewes translocated to Wasa Mountain (2005), indicate that this herd returns to the release site during winter months. Both the translocated herd and native bighorns also use winter range on the steep western slopes of Wasa Mountain, the upper south facing basin of Wasa mountain, Lewis Creek badlands, Herbert face, the west side of Quartz Lake and the steep slopes of the east side of Premier Lake. Occasionally, some of the herd will foray onto Premier Ridge for several days.

Forest encroachment on Premier Ridge has reduced open range to less than 20% of open range found on the Ridge in 1951. (Compare Figures 7A and 7 B of Appendix 1). Premier Ridge ranges in elevation from 880m to 1320 m. The dominant forest cover on the east and north-facing slopes of Premier Ridge is Interior Douglas fir with some larch on the lower southeastern slopes and some lodgepole pine on the northeastern and lower western slopes. Part of this area was logged in the 1960's. The unlogged stand is 60-120 years of age and 15-18 meters in height. Most of the traditional bighorn sheep winter range on the Ridge (Appendix I, TU 21, Figure7B), is in the IDFdm2 BEC unit and in the driest site series 02. Antelope brush is the dominant shrub while the dominant grass is bluebunch wheatgrass grass. On winter range located west of Quartz Lake, bluebunch wheatgrass and rough fescue are co-dominant in the open forest habitat of TU 19 (Appendix 1, Figure 7B). In the more dense stand of TU 20 west of Quartz Lake (Appendix 1, Figure 7B)) a pinegrass under-story indicates the site series is 01 dry in the IDFdm2 BEC unit. M. Jalkotzy (2003 Unpublished report) found five basic communities on Premier Ridge. I do not have the location of these plant communities because the report has not yet been published.

The habitat on the lower (<1200m elevation) slopes of Wasa Mountain are in the IDFdm2 BEC unit and the dominant site series is 01 dry. An open forest of 80-100 year old Douglas fir and in-growth of all age classes of Douglas fir is found from Wasa Creek north for 1.5 km. The dominant grasses were rough fescue and bluebunch wheatgrass in open forest areas and pinegrass under dense Douglas fir canopies. North of here, lodgepole pine is dominant for 2 km followed by Douglas fir for about 0.5 km to Wolf Creek. Wasa mountain also contains many aspen stands which fade into lodgepole pine

stands on the northern aspect of Wasa Mountain (Figure 7). Much of the lodgepole pine on the lower western edge and the mid-north-facing slopes of Wasa Mountain is dying due to mountain pine beetle attack.

The southern and western slopes of Wolf Creek Basin are open bluebunch wheatgrass/rough fescue grasslands which are rapidly being lost due to lodgepole pine encroachment (Figure8). Lodgepole pine is rapidly succumbing to pine beetle from the valley in the lower Montane spruce (MSdk) zone to the lower Engelman spruce zone (ESSF Figure 8).

Translocated bighorns have moved along the east side of Quartz and Premier Lake to the steep slopes of Diorite Basin. There is little opportunity for habitat enhancement due to private land, steep slopes and lack of road access to this area (Figure 1).

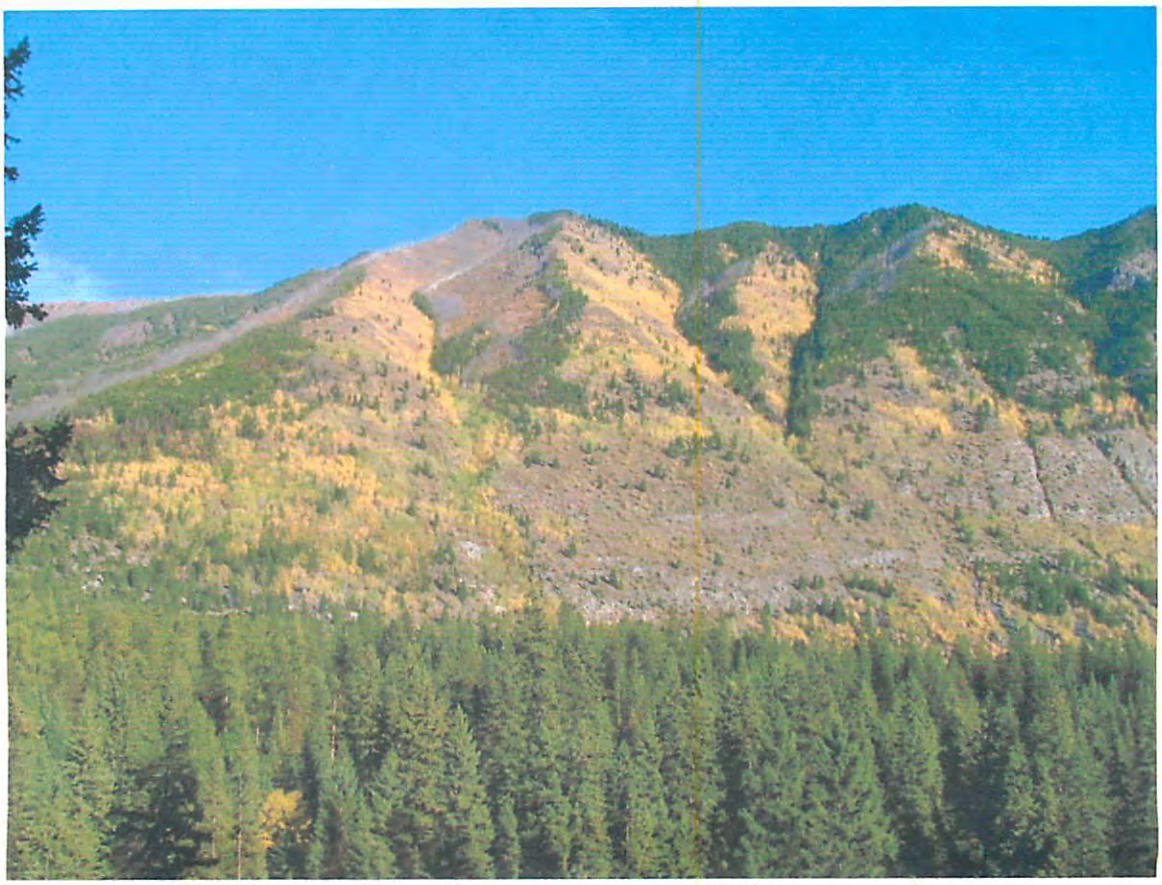


Figure 7: Wasa Mountain: yellow trees are trembling aspen, brown trees on upper left are beetle killed lodgepole pine

Figure 8: Wolf Creek Basin: Brown trees are beetle killed lodgepole pine

Several range enhancements have been conducted on Premier Ridge bighorn winter range during the past 25 years. They include:

1: A spring burn on Sheep and Quartz pastures in 1983;
2: A September burn of Wolf Creek Basin in 1984;
3. A spring burn of Sheep and Quartz pastures in 1998;
4. Slashing of TU 19 (Appendix 1, Figures 6 and 7B) in the winter of 2004/2005(CBFCP-Columbia Basin Fish and Wildlife Compensation Program)
5. Slashing of the Lower part of TU 18, Wolf Creek Basin in the winter of 2004/2005 (Appendix 1 Figures 6 and 7A, CBFWCP).

3.0 Methods

3.1 Site Selection

Sites were selected for habitat enhancement based upon the following criteria:

a. Present and historic distribution of bighorns
b. Ungulate biophysical capability mapping
c. Distance to escape terrain
d. Movement corridors and seasonal range
e. Cost effectiveness of proposed treatments
f. Consistency with Higher Level Plans
g. Risks to other values
h. Air photo analysis and field review

3.1.1. Present and Historic Distribution of Bighorns

Most of the historic winter range of bighorn sheep between Mause Creek and the mouth of Diorite Basin is not being used due to low numbers of sheep. Population numbers in the Wildhorse and Estella herds must increase significantly in order to re-establish traditional range use (Table 1). The Premier Ridge herd is the only viable population (> 30 animals) of sheep left in the study area. Habitat enhancement projects will be most effective on winter ranges which are still used by resident and translocated bighorn sheep in this area.

3.1.2 Ungulate Biophysical Capability Mapping

Ungulate biophysical capability mapping provides some idea of the perceived winter range potential using expert opinion in 1975. Ungulate biophysical mapping was usually done by a team of specialists, which included a soil specialist, a wildlife specialist and a habitat specialist. There are minor adjustments to this mapping which need to be made due to more recent information about bighorn sheep distribution on winter ranges.

3.1.3. Distance to Escape Terrain

A major consideration for suitability of bighorn sheep winter range is the distance to escape terrain. Bighorn sheep require steep, rocky terrain within several hundred meters of forage areas in order to escape from predators such as coyotes, cougar, wolves, lynx, and wolverine. Cougar can stalk bighorns in virtually any terrain but cannot out run bighorns on steep, rocky terrain (Personal observation). Few bighorn sheep are found in areas such as Brewery Ridge, Lower Lakit Mountain, Estella Mountain and the western side of Lewis Creek (Lewis Ridge), in-spite of the fact that these areas are rated as having a high capability to support bighorn sheep (Appendix II, Figures 1 and 2). It is strongly suspected that the rapid decline in bighorn sheep populations in the study area was due to high predator populations, poor sight lines due to in-growth and lack of escape terrain.

3.1.4. Seasonal Range and Movement Corridors

Bighorn sheep wintering on the lower western slopes of the Rocky Mountains complete seasonal migrations to capitalize on forage quality (Hebert 1973). They migrate up-slope as green-up moves up-slope. . Deep snow during fall months forces bighorn sheep to move down slope to grassland areas where chinook winds, higher sun radiation and lower snowfall permit easy winter grazing. With the in-growth of trees, fall range in the MSdk zone may become winter range. Fall range is generally located up slope and adjacent to winter range Tree growth on lambing range may lead to vulnerability to predation. Bighorn sheep lambing range is generally located on steep, rocky ground interspersed with small grassy benches near a stream. The result of forest encroachment and in-growth is that bighorn sheep leave winter range two weeks later in spring and return to winter range two to three weeks earlier in the fall (Davidson, 1994), thus placing greater grazing pressure on winter range.

Range enhancement activities which focus on fall and spring range will increase the suitability of these ranges by increasing sight lines, and increasing forage production while reducing grazing pressure on winter range.

Bighorn sheep may be most vulnerable to predation when travelling between seasonal ranges or within winter range areas. The single main objective for enhancement habitat activities may be to increase sight lines for bighorn sheep and reduce vulnerability to predation on movement corridors. Logging, slashing, spacing, prescribed burning and tree girdling are some of the enhancement techniques which can be used to open tree canopies and provide better sight lines for bighorns.

Creation of a functional connective corridor was considered feasible for bighorn sheep located in the Wildhorse area between Lone Peak and Brewery Ridge (Figure 1). A connective corridor was considered between lower Lakit Mountain and Estella Mountain (a traditional winter range for bighorns 15 km north (Figure 1, Appendix I Figure 2 TU4c, Figure 2A TU5). This corridor was not considered economically feasible due to the fact that the majority of wood on the western edge of Lakit Mountain is 80-100 year old Douglas fir, 10-13m in height and on slopes greater than 60%. These slopes require cable logging and the timber license holder (Tembec Industries Inc) cannot economically harvest these slopes or this type of timber under present market conditions. In addition, there is a low priority to create an open corridor between the Lakit Mountain burn and Estella because there is little or no known bighorn use of this area at present.

A connective corridor is considered feasible between winter range on Estella Mountain and winter range in the Lewis Creek badlands (Appendix I, Figure 4).

Proposed habitat enhancement activities between Lazy Lake and Wasa Creek will create help maintain an open connective corridor between winter range on Herbert Face, and Lewis Creek to Wasa Mountain (Figure 1). Proposed habitat enhancement activities on Estella Mountain, Wasa Mountain and Wolf creek will provide more open corridors from winter range to summer range in Diorite Basin..

3.1.5. Cost Effectiveness of Proposed Treatments

Habitat enhancement activities should focus on areas where suitable forage species exist, where soil is well developed and contains adequate nutrients, where slopes are gentle enough to permit a successful vegetative response, where moisture regimes are adequate and within 500m of escape terrain. Under-story vegetation should contain remnants of desirable bunch grass species. Desirable bunchgrass species (M Jalkotzy 2003 unpublished report) are believed to be bluebunch wheatgrass, (Elymus spicatum), rough fescue (Festuca scabrella), Idaho fescue (Festuca idahoensis), sheep fescue (Festuca ovina), and June grass (Koeleria micrantha). Desirable shrub species are saskatoon (Amelanchier alnifolia), chokecherry (Prunus vulgaris), snow brush (Ceanothus velutinus).Douglas maple(Acer douglasii), and willow (Salix spp.). When the research of Martin Jalkotzy is published forage preference of bighorn sheep on Premier Ridge will be clarified.

Some potential bighorn sheep will not be treated in the near future due to the cost of logging, lack of access and other priorities of timber licensee.. The western slopes of Lakit Mountain should be logged slashed and burned to create open forest habitat on range connecting the Wildhorse herd with the Estella herd. This will not be done in the near future because of the high cost of cable logging (slopes > 50%), and the small piece size of trees (B. Dureski, Harvest Planner, Tembec Industries Inc. Cranbrook Division). Tembec Industries will not log mature and old Douglas fir stands on Crown land located east of Premier Lake in the near future because there is no existing access. Private land surrounds the northern and eastern side of the Premier Lake, while Premier Lake Park occurs on the north end of the Lake (Figure 1). Most of the forest area east of the private land is located on steep slopes with shallow soils over bed-rock (Figure 1). No helicopter logging or cable logging is planned in Douglas fir stands due to cost/benefit restraints with this company.

3.1.6. Consistency with Higher Level Plans

Higher level plans which were considered:

1. The Kootenay Boundary Land Use Plan particularly the Implementation Strategy (1997);
2. Ungulate Winter Range Guidelines, Plan Numbers U-4-006 and U-4-008 for the Cranbrook and Invermere Forest Districts;
3. Kootenay-Boundary Higher Level Plan Order, Province of British Columbia, 2000.
4. Range Unit Restoration Plans for Peckhams Lake, Wildhorse/Lewis, Lewis/Wolf and Wolf/ Sheep Creek.

3.1.7. Risks to Other Values

a. Christmas Tree Permits

Some prescriptions for enhancement may have to be modified or dropped in order to accommodate other values on Crown land. Some of these values include Christmas Tree Permits (CTP), endangered wildlife, archeology and cultural values.

Enhancement plans have been avoided all CTP license areas because the desire to produce Christmas trees is usually directly at odds with the desire to maintain open range for bighorn sheep using prescribed fire.

b. Rare and Endangered Species

Enhancement planning has also considered species at risk. There are two known wildlife species at risk in the area of interest including the flammulated owl and the American badger. The flammulated owl is a blue listed species (vulnerable) in British Columbia (CDC 2004) and an Identified Wildlife Species under the BC Forest and Range Practices Act. Flammulated owls prefer mature and old forests in the lower MSdk and upper IDFdm2 biogeoclimatic zones along the western edge of Rockies between Elko and Stoddart Creek as well as in dry forests in the Newgate area. There are several Wildlife Habitat Areas established for protection of flammulated owl in the Mause Creek area and Lazy Lake areas (Appendix IIII, Figures 1 and 2). Management activities outside flammulated owl Wildlife Habitat Areas should consider flammulated owl habitat requirements where possible. Flammulated owls are secondary cavity nesters using holes made by flickers or pileated woodpeckers. Availability of suitable nest cavities is critical habitat feature (Cooper et al 2004). These owls glean insects from vegetation or catch flying insects over grasslands in small forest openings (Ibid 2004). Dense thickets of Douglas fir are used for hiding and roosting cover (Howie and Ritcey 1987; Astrid van Woudenberg 1999 in Cooper et al 2004). These small owls (18 cm tall), are susceptible to predation from most larger owls found in the area, the most common being barred and great horned owls. During the nesting period, the male delivers a single prey item per trip to the nest, therefore foraging areas must be close to the nest site (Linkhart et al. 1998 in Cooper 2004).

Best management practices (Cooper et al 2004) for treatment areas include:

- retention of snags and Class 2 wildlife trees and all old live Ponderosa pine and Douglas fir tree greater than 50 cm dbh (Should also include western larch pers obs)
- Retain all trees with existing cavities
- Retain riparian deciduous forest
- Maintain small natural openings by brushing conifer regen.
- Moderately graze grasslands with domestic livestock to retain insect populations
- Discourage firewood collecting

Selective logging (variable retention) which leaves a heterogenous forest canopy with small openings and retains all snags may be compatible with flammulated owl habitat needs (Cooper 2004).

The "American" badger (Taxidea taxus jeffersonii) is a red listed species in British Columbia (CDC 2004) because populations are small and declining, grassland habitat is fragmented and declining in extent, and overgrazing has reduced quality of grasslands where prey species (Columbian ground squirrels and pocket gophers) are most common (Cooper et al 2004). Badgers are most commonly found in the Ponderosa pine and Interior Douglas fir biogeoclimatic zones of the East Kootenay Trench Ecosection (Cooper et al 2004). Best management practices (Cooper 2004 et al), are to:

- Maintain open grasslands (KBLUP-IS) with sufficient liter and hiding cover
- Maintain a one tree length no machine buffer around burrows to prevent den destruction
- Retain some live and dead trees
- Do not encourage livestock use (salt, water troughs) within a 200m radius from dens
- Locate all road at least 300 m away from dens
- Do not use rodenticides within reserve areas
- Maintain foraging burrows because they can act as shelter
- Follow the Identified Wildlife Management Strategy measures (Adams and Kinley 2004)for natal dens

Other important considerations in the Identified Wildlife Management Strategy (CDC 2004) are to:

- Minimize urbanization and conversion of agricultural to more intense uses;
- Maintain lowest possible road densities
- Continue restoration activities which reduce forest encroachment and in-growth
- Create and maintain a range of successional and structural stages in grasslands and open forest ecosystems to attract ground squirrels and other prey species
- Leave larger, older trees to provide structural stability
- Restrict ATV use in areas of high badger use

Rare plant communities such as Douglas fir snowberry (IDFdm2/03 site series), antelope brush bluebunch wheatgrass (IDFdm2/02) and bluebunch wheatgrass/rough fescue grasslands (CDC 2004) may occur on Premier Ridge Range unit, but slashing of young conifers and maintenance of grasslands through low intensity burns should benefit these communities. Rare plants may also occur in the area of concern but comprehensive surveys have not been completed. A list of species at risk in the BC Timber Sales business area in the East Kootenays is provided in Appendix IV ,Table 1.

c. Archeology Values

Archeology overview assessments were done by Wayne Choquette in the plan area for the Ministry of Forests in 1998 and 2003. In areas having moderate and high archeology potential, detailed archeology surveys should be conducted before any soil is disturbed. Hand slashing and prescribed burning do not disturb soils. Mechanical slashing and

logging can be done on frozen ground to avoid soil disturbance. Slash piles should not be placed on terraces or bench land near wetlands, streams or rivers with archeology potential because the intense heat of slash burning may disturb artifacts. For habitat enhancement work which likely will not disturb soils such as prescribed burning or hand slashing and burning of in-growth, a referral to the Ktunaxa about proposed work might be adequate. For any work which is likely to disturb soils such as mechanical slashing, road building, mechanically constructed fire guards or timber harvesting, a detailed assessment is required where an overview assessment has indicated potential for sites. The Ktunaxa also have other values that may be affected by habitat enhancement tratements such as traditional gathering sites, medicinal plants etc. A referral is neccessary to the Treaty Council of the Ktunaxa for any proposed work.

d. Grazing Rights

Most of the proposed enhancement areas are in licensed livestock grazing areas. Any proposed work which may affect livestock grazing should be referred to the Range Division of the Ministry of Forests well in advance of proposed work. Pastures which are to be treated with prescribed burning may require a season of rest from livestock grazing in order to accumulate fine fuel loads. This may require an adjustment in planned grazing for the Range unit. There are four range units within the areas planned for enhancement including:

1. The Peckhams Lake range unit for land lying between Mause Creek and the Wildhorse River;
2. The Wildhorse/Lewis range unit for land located between the Wildhorse River and Lewis Creek
3. The Lewis/Wolf Creek range unit lying between Lewis Creek south of Lazy Lake and Wolf Creek south of Premier Ridge;
4. The Premier Ridge range unit located between Wolf Creek and Sheep Creek.

e. Mineral Tenures

There are numerous mineral tenures within the study area. It is important not to disturb claim stakes during habitat enhancement activities.

f. Water and Fisheries Values

Several streams in the plan area hold domestic water licenses including Mause Creek, Brewery Creek, Wasa Creek, Lewis Creek and Wolf Creek. All planned enhancement activities should be at least 100m away from water intakes. No enhancement activities above water intakes should be planned within 20m of streams which hold water licenses. Several streams are fish bearing within the plan area including the Wildhorse, Lewis Creek, and Wolf Creek. Enhancement activities should not occur within 20 meters of the latter two streams (S3 Forest Practice Code 1995) and 30 meters of the Wildhorse River (S2).

3.1.8. Air Photo Analysis and Field Review

A field review of most areas was done after outlining potential enhancement areas on 1:15,540 aerial photographs (1994) or 1:20,000 orthophotos (2005). While walking, major over-story, and under-story vegetation was recorded as well as elevation, aspect and basic soil characteristics.

4.0 Treatment Unit Priorities and Recommended Treatments

4.1. Initial Priorities

Two sites were initially selected for a stand management prescription so that work could begin in 2007. These sites were located where resident and transplanted sheep have been observed recently and historically. Both sites have under-story grass and shrub communities which indicate that a desirable would occur with opening of the canopy i.e. bluebunch wheatgrass/rough fescue under an Interior Douglas fir canopy. Enhancement activities would also improve sight lines to escape terrain. These sites include:

A. Lower Wasa Mountain face (TU's 15 and 17a, Figure 1).
B. Herbert face (TU 5, Figure 1).

A. Lower Wasa Mountain

The prescription involve stand tending in two treatment units to increase sight lines to escape terrain on Wasa Mountain, reduce conifer in-growth and encourage palatable forage production. The prescriptions were completed by Mark Hall in October and November 2006 and are included as separate report. Treatment Unit 15 north of Wasa Creek is a 30.6 hectare patch of multi-storied Douglas fir stand with bluebunch wheatgrass, pine grass, mountain juniper and saskatoon in the under-story. Treatment Unit 15 is located from 0.3 km to 1.5 km away from road access at the south end and is located at the foot of steep (>80% slope) of Wasa Mountain. All of Treatment Unit 15 is located within 400m of steep talus slopes of Wasa Mountain. Treatment Unit 17A (Figure 1; Appendix I, M.Hall 2006) is an 8.6 hectare multi-storied open canopy Douglas fir stand with a similar under-story as TU 15 (Mark Hall 2006). It is located just south of Wolf Creek and east of Quartz Lake. Treatment Unit 17A can be accessed from Premier Lake Park via a small road at the south end of Quartz Lake with permission of the Regional Manager B.C. Environment. is about 400m. The unit begins about 400m upslope of the end of this road.

B. Herbert Face

Herbert face or Treatment Unit 5, is accessible from a Branch of the Lakit Lake road. This stand-tending treatment is recommended for 22.2 hectares of old age Douglas fir forest in the IDFdm2 03(60%)/02(40%) site series (Hall 2006). The stand is multi-storied with an under-story of bluebunch wheatgrass, antelope brush and saskatoon. A

combination of girdling or slashing of all trees less than 25 cm dsh is recommended (Hall 2006) to increase sight lines for sheep to escape terrain, and reduce conifer density.

4.2 Other Treatment Unit Priorities

Wasa Mountain and surrounding areas are the focus of enhancement activities because the Premier Ridge herd of 50 to 70 bighorns is still viable while the Estella and Wildhorse herds (about 10 animals each) are not. The order of priority for treatment following those of Lower Wasa Mountain and Herbert face are listed in Table 1.

Table 1: Treatment Unit Priorities, Treatment Technique and Desired End Condition

Treatment Unit	Treat. Priority	Year(s)of Treatment	Method of Treatment	Figure(s)	Desired End Condition
13,12,Lazy L/Wasa	1	2007/2008	Sel. Log,,Slash	Fig.1 App.VI, Fig.5, App. 1	Open Forest(OF)
14, Bradford Connector	1	2007	Slash	Fig.1 App VI, Fig.5,App.1	OF
15, Lower Wasa Mtn	1	2007	Slash	Fig.1 App VI Fig.5,App.1	OF 70% OR 30 %
5, Herbert Face	1	2007	Slash/Girdle	Fig. 2A,App.1	OF
17A, Wolf Cr. badland	1	2007	Slash	Fig 1 App VI, Fig.6.App. I	Open Forest
17A,B,C,D, Wolf Cr.Badland	1	2008	Burn(Spring or Fall)	Fig.2 App. VI, Fig.6 App. 1	OR 60% OF 40%
11,Lazy L. East	2	2009	Slash	Fig.1 App. VI, Fig 5,App.I	OR 60% OF 40%
16A,Wasa Mtn.South	2	2008/2009	Burn (Fall)	Fig 2 App VI, Fig 5 App I	OF50% MF 30%,OR 20%
16B, Wasa Mtn North	2	2008/2009	Burn (Fall)	Fig 2 App. VI, Fig 6 App.1	OR 60% OF 40%
18, Wolf Creek	2	2008/2009	Burn(Fall or Spring)	Fig 5 App. VI, Fig. 6 App. I	80% OR 20% OF
6, Lewis Cr.Badlands	2	2009/2010	Slash in 2009, Burn 2010	Fig. 3,App.VI, Fig. 4 App I	75% OR, 25 % OF
9, Estella Mt.	3	2010	Slash	Fig 4 App VI, Fig.3 App. I	Open Range
9, Estella	3	2011	Burn	Fig 4, App. VI	Open Range
10 a, Estella	3	2011	Burn	Fig 4,App. VI, Fig 3,App.1	OR65%,OF 35%
10b,Estella	3	2011	Burn	Fig 4,App. VI	Short shrubs
3, Brewery Ridge	4	2012	Burn	Fig 5, App. VI, Fig. 2 App. I	OR 70%,OF 30%
4a,4b, Lower Lakit Mtn	4	2012	Slash	Fig 6. App VI, Fig .App. I	Open Range

19, Premier Ridge South	4	2012-2015	Log,Slash then Burn	Fig.7 App. VI. Fig. 7B,App.I	Open Range
Treatment Unit	Priority	Year(s) of Treatment	Method of Treatment	Figures	Desired End Condition
8, Estella Connector	5	2013	Slash and girdle	Fig.3,App.VI, Fig.4,App.1	Open Forest
7. Tracy Creek	6	2013-2015	Log and slash	Fig.3App.VI, Fig.4.ApP.I	OF 70% OR 30%
20.Premier Ridge North	6	2015-2016	Log and slash	Fig.8,App. VI, Fig, 7B,App.I	Open Forest
21. Premier Ridge West	6	2016-2017	Prescribed burn	Fig. 7,App. VI, Fig. 7B,App.I	Open Range
1.Lone Peak South	7	2018	Log and slash	Fig.9,App. VI Fig. 1,App.I	Open Forest
2.Lone Peak Connector	7	2018	Slash	Fig 6,App.VI	Open Forest

4.3 Physical Attributes of Proposed Treatment Units

Table 2 below will describe more of the physical attributes of each proposed treatment unit

ID	TU #	Location	Hectares	BEC ,Site Series	Forest Cover	Archeology Potential
0	TU 1	Lone Peak South	60.0; 14.1 ha logged 1996	IDFdm2-03,MSdk 03/01	140-250 year old DF minor Py and Lw	High, Poly 2985,2003
1	TU 2	Lone Peak Connector	8.52	IDFdm2/01	Open forest, Logged,1993	None
2	TU 3	Brewery Ridge	236.08	IDFdm2/03/01dry	Wild fire 1985	M-H, SW corner,1998
3	TU 4a	Lakit Burn West	57.87	IDFdm2-03	Wild fire 1985	High,1998
4	TU 4b	Lakit Burn East	42.44	IDFdm2-03	Wildfire 1985	Mod
5	TU 5	Herbert Face	18.50	IDFdm2-02/02	250 + Year old DF , minor Lw	None
6	TU 6	Lewis Cr. Badlands	79.73	IDFdm2-02(80%)03(20%)	120 year + DF minor Py at South end; 60-80 year old DF,Py north	Moderate 2003
7	TU 7	Tracy Cr.	87.61	IDFdm2-	120-140 DF with minor Py and Lw	Moderate, 1998
8	TU 8	Estella Connector	28.86	IDFdm2-03 (15%),MSdk – 03/01	140+ year old DF,minor Lw an Py	Moderate, 1998
9	TU 9	Estella Northwest	73.15	MSdk-02,ESSFdk-02	Open range	Moderate 2003

10	TU 10a	Estella North	43.07	ESSFdk-02(40%) ESSFdk-01(60%	Open Range (40%), 60-80 Pl,(60%)l	None
11	TU 10b	Estella South	82.02	MSdk-03 ESSFdk-03	Aspen Shrub land	None
12	TU 11	Lazy Lake East	51.79	IDFdm2-03,MSdk-03	100-120 year old DF,minor Py and Lw	Moderate to High,2003
13	TU 12	Lazy Lake North	31.11	IDFdm2-01(80%)03(20%)	100-120 year old DF,minor Lw,Pl	Moderate, 1998
14	TU 13	Lazy-Wolf Cr. Con.	61.59	IDFdm2-03(40% IDFdm2-01 (60%)	100-120 year old DF,minor Lw and Py	Moderate 1998
15	TU 14	Bradford Connector	9.67	IDFdm2-03	250 year+DF minor Lw	Moderate
16	TU 15	Wasa Mtn. Lower	27.11	IDFdm2-02 (30%) IDFdm-0170%	100-120 year old DF, minor Lw and Pl	Mod.-High
17	TU 16a	Wasa Mtn. South	141.37	MSdk-03 ESSFdk-03	60-80 year old DF(80%),250+ DF(20%)	None
18	TU 16b	Wasa Mtn. North	123.62	MSdk-01,ESSF-01	60-80 year old aspen, DF, /minor Lw	None
19	TU's 17a,d	Wolf Creek South	11.22	IDFdm2-02/03	60-80 year old DF	Mod._high
20	TU 's 17B, C,	Wolf Creek Badlands	43.66,45.5,29.9	IDFdm2-02/03	60-80 year old Pl	Moderate-High
21	18	Wolf Cr. North	157.75	IDFdm2-03; MSdk-02/01; ESSFdk-02/01	Open range; 60 80 year old P;	M-H in IDF
22	TU 19	Premier Ridge South	59.93	IDFdm2-02; OF logging,1992	Open Range 60-100 DF	None
23	TU 20	Premier Ridge North	162.11	IDFdm2-01 Dry	Open Forest;100-250+ years DF	Mod High
24	TU 21	Premier Ridge West	631.47	IDF dm2-03(30%) IDFdm2-02(60% IDFdm2-01dry-10%	Open Range	Mod-.High

4.4 Discussion on the Treatment Unit Priorities

Bradford South, Treatment Units 12 and 13

The focus of initial enhancement activities should be on range used by the Wolf Creek/Wasa Mountain herd. One of the highest priorities for development following the implementation of recommended treatments for Treatment units 5,15 and 17 at the base of Wasa Mountain (Mark Hall, attached SMP's) should be development of Stand Management Prescriptions for selective logging of treatment units 12 and 13 located south of the Wink Bradford property at the toe of Wasa Mountain (Figure 1,App.VI), This area is used by both transplanted and resident bighorn sheep during winter months (September-April). Due to moderate archeology potential ,(Aarcheology Overview

Assessment MOF 2003), an intensive archeology overview should be undertaken prior to any logging. In addition, a survey for flammulated owl should be completed because they have been heard east of the Lazy Lake recreation site (Irene Manley pers com) and may be located in these proposed treatment units. A Stand Management Prescription should be completed for this area in the spring or summer of 2007 so that logging and slashing can begin during the winter of 2007/2008. Creation of open forest habitat will increase sight lines for bighorn sheep and encourage the development of bunchgrasses such as bluebunch wheatgrass and rough fescue. In all cases where selective logging is proposed on bighorn sheep range, all spur roads, skid roads and landings should be deactivated and seeded to a native forage range mix if possible. The desired end point for logging is open forest (Report and Recommendations of the East Kootenay Ungulate Winter Range Committee 2003,Appendix VI). This will require retention of about 30 layer 1 trees (Upper canopy), 50 layer 2 trees and 70 layer 3 trees with no retention of layer 4 stems. Open forest habitat may be maintained by prescribed fire every 15-20 years.

Bradford Connector, Treatment Unit 14

The in-growing Douglas fir located on Crown land located between farm land of Wink Bradford and Wasa Mountain to the east (Figure 1,Appendix VI), should have all Douglas fir less than 25 cm dsh slashed to improve sight lines to talus slopes of Wasa Mountain for transplanted sheep which use cultivated fields as forage areas. This work will help connect open forest habitat south of the Bradford property with winter range habitat on Lower Wasa Mountain. Wink Bradford is amenable to having smaller diameter trees slashed on slopes between his land and slopes on Crown land to the east. A written agreement should be made between the Columbia Basin Fish and Wildlife Compensation Program and Wink Bradford prior to undertaking this work.

Wolf Creek Badlands, Treatment Units 17a,b,c,d,

The badlands of Wolf Creek should be treated with a prescribed burn in the spring of 2008. This area connects bighorn sheep range located above Quartz Lake with sheep habitat on Wasa Mountain. The area has very shallow fluvial glacial soils over bedrock. The dominant tree is lodgepole pine in Treatment units 17 b and c, while Douglas fir is dominant in 17a and d. Much of the lodgepole pine is dead or dying while Douglas fir is encroaching in treatment units 17a and d (Figure 2,Appendix VI). Part of treatment unit 17d is located in Premier Lake Provincial Park. In discussions with Mike Gall, (Ecosystem Officer, Ministry of Environment), he did not object to this treatment but would like to be involved in the plan. Aerial prescribed burning is the only economical option for this area due to the difficulty of foot access and the ruggedness of this course boulder outcrop terrain. Hand slashing of lodgepole pine would be labor intensive and result in little gain of open bunchgrass habitat. The area might burn well due to the amount of dead and dying lodgepole pine. An intensive archeology survey should be conducted in this area which has a moderate to high archeology potential in the archeology overview survey completed in 2003

Lazy Lake East, Treatment Unit 11

Hand slashing of all conifer trees is recommended for Treatment Unit 11 located east of Lazy Lake (Figure 1, Appendix VI) to maintain open forest conditions. This work will help create an open corridor from mineral licks east of Lazy Lake to open forest habitat of Treatment Units 12 and 13 south of the Bradford property. The southern part of this unit is located in a Wildlife Habitat Area for flammulated owl (Appendix III Figures 1 and 2). In this area it is acceptable to slash under-story to create small openings (0.25 ha) but retain thickets next to these openings (Ted Antifeau, Rare and Endangered Species Biologist, Nelson Region). There are many natural mineral licks in this area. Slashing under-story conifers will increase sight lines of bighorns and reduce vulnerability of bighorn sheep to predation. . This area is only accessible by foot travel from block 647 of CP 337 above Lazy Lake (Figure 5, Appendix 1).

Upper South Face of Wasa Mountain, Treatment Unit 16a

A fall burn in 2008 or 2009 is recommended for the upper south-facing slopes of Wasa Mountain (Treatment Unit 16A, Figure 5 Appenndix I) due to the high elevation (1360-1800 m) which would put the burn outside an acceptable time for surrounding forested areas. The fire hazard in adjacent lower elevation forests would likely be high by the time this slope is free of snow. It is only expected that about 20% of this area will burn because of advanced regenerating Douglas fir and shallow soils. Care should be taken to leave a 100m non-burn buffer adjacent to Wasa Creek because this stream is a domestic watershed for the Bradford's at the toe of the slope. This area is used as late winter and spring range by resident and transplanted sheep.

North Face of Wasa Mountain, Treatment Unit 16b

A fall re-burn of the northern side of the Wasa Mountain Ridge, (Treatment Unit 16b) is also recommended in 2008 or 2009 to further open the canopy of dead and dying lodgepole pine and consume blow-down. The area (170 ha) was first burned in October, 2000 to reduce blow-down and provide a movement corridor for sheep on Wasa Mountain (S. Crowley , Range Officer, B. C. Environment, pers com). The proposed burn on the north side of Wasa Mountain could be done at the same time as the south side (Figure 6, Appendix I).

Wolf Creek Basin, Treatment Unit 8

An aerial spring or fall burn is recommended for Wolf Creek Basin (TU 18, Figure 6, Appendix I)) in 2008 or 2009. There is some risk to this burn because the northern side of Wolf Creek Basin is covered with a heavy fuel load of mature lodgepole pine which is dying. A fall burn in 1985 was unsuccessful in killing this lodgepole pine. The Wolf Creek Basin was traditional spring and fall range for bighorn sheep. Wolf Creek Basin is located on a movement corridor between Wasa Mountain and Diorite Basin and between Premier Ridge and summer range in Diorite Basin.

Lewis Creek Badlands, Treatment Unit 6

The proposed treatment of this area is to hand slash encroaching Douglas fir stems less than 25 cm dsh in 2009 followed by a prescribed burn in the spring of 2010 (Treatment Unit 6,Figure 4, Appendix 1). The southern end of this unit has an over-story of 100-120 year old Douglas fir with some Ponderosa pine and an under-story of bluebunch wheatgrass and juniper. The objective for slashing is to create open forest in the southern 1/4 of this unit and open range in the northern ¾. The ungulate winter range target for open range is less than 76 stems per ha with at least 10 stems per hectare being layer 1 (upper canopy layer, Appendix VII, Report and Recommendations of the East Kootenay Ungulate Winter Range Committee, July, 2003). This area was traditional late winter and spring (lambing) range for the Estella Mountain herd. This area was rated as having a moderate potential for archeology sites in 1998 (Archeology Overview Assessment for MOF 1998). An intensive archeology assessment should be completed if any bladed fireguards are to be built. The existing road on the eastern side of Lewis Ridge could be used as a fireguard for most of this unit. In the south end a hand built fireguard would have to be constructed. Flammulated owls have been heard on the northern end of this unit, so a more detailed assessment should be done before slashing begins.

Estella Mountain, Treatment Units 9, 10a and 10b

Hand slashing of encroaching lodgepole pine is recommended for 2010 on the open west-facing slope of Estella Mountain. Treatment Unit 9 (Figure 3, Appendix I) can be accessed by quad from the Estella Mountain mine road. Treatment units 9,10a and 10b (Figure 3,Appendix I) should be burned using aerial ignition in 2011. The live lodgepole pine in Treatment unit 10a may be too mature (60 years old) to be killed by a prescribed burn. Pine beetle attack may kill sufficient lodgepole pine to provide a dead fuel load needed for a successful burn. This area was used as fall and early winter range for about 70 bighorn sheep until the mid 1990's when populations rapidly declined..

Brewery Ridge and Lower Lakit Mountain, Treatment Units 3,4a,4b

The next areas recommended for treatment are Brewery Ridge and Lower Lakit Mountain (Treatment Units 3, 4a and 4b, Figure 2, Appendix 1). There are few sheep left in this area, but core winter range for sheep and mule deer could be lost to encroachment by Douglas fir unless these areas are treated. A prescribed burn is recommended for Brewery Ridge (Treatment Unit 3, Appendix 1) in 2012 but this treatment should possibly be done within the next 3 years to prevent advanced growth of regenerating conifers. Private land and residence are located on the eastern edge of Brewery Ridge so proposed prescribed burns should fire guard this area.. An intensive archeology survey should be done on the south and west sides of Brewery Ridge where an archeology overview assessment has indicated a moderate to high potential for sites (MOF 1998).

Douglas fir regeneration on lower Lakit Mountain is slower than on Brewery Ridge except for the lower southeast corner of Treatment unit 4 B (Figure 2, Appendix I).

Forest encroachment in Treatment units 4 A and 4 B should be hand-slashed, piled and burned where trees are dense. A prescribed burn is not recommended for at least 10 years because the snowbrush/bluebunch wheatgrass plant community is healthy at present and burning in the near future would only set it back. If a prescribed burn is deemed necessary, the eastern side of Treatment Unit 4b would have to be well guarded to prevent spread to Tembec's Timber License and harvest area. An intensive archeology survey should be conducted on Lower Lakit Mountain where a moderate potential for archeology sites was identified (MOF 1998).

Lewis Creek East, Treatment Unit 7

The next treatment priority should be to open the canopy of mature and old Douglas fir on the eastern side of Lewis Creek below Estella Mountain. This will increase sight lines within a movement corridor between Estella Mountain and the Lewis Creek badlands. About half the old Douglas fir can be logged with conventional logging systems in Treatment Unit 7 (Figure 3, Appendix 1), while the rest of the area will have to be cable logged. The old Douglas fir (minor western larch) stands within this unit may be important to retain for old growth in the under-represented Douglas fir BEC zone. If this is true, the under-story in-growth of Douglas fir should be slashed to increase sight lines for bighorn sheep and mule deer which winter in this area. The under-story of encroaching Douglas fir should be slashed to <25cm dsh in 2013/2014.

Estella Connector, Treatment Unit 8

An open movement corridor should be developed between grasslands of Estella Mountain and the Lewis Creek area. Treatment Unit 8 (Figure 3,Appendix VI) is located on very steep,(60-90%), west-facing slopes below the grasslands of Treatment Unit 9 on Estella Mountain. Hand slashing of encroaching Douglas fir and Ponderosa pine is recommended in areas where sawyers can safely operate. Girdling of conifers less than 25 cm dsh is recommended in areas which are too steep for sawyers. This treatment and that of treatment unit 8 below the Lazy Lake road will increase sight lines on a bighorn sheep travel corridor to the Lewis Creek badlands from Estella Mountain All trembling aspen (Populus tremuloides) western larch and Ponderosa pine should be retained. There are some talus and rock outcrops on steep slopes (80%-90%) but also more gentle slopes with a bluebunch wheatgrass under-story

.Quartz Lake West, Treatment Unit 20

A low priority is placed on enhancement of the area west of Quartz Lake on Premier Ridge due to the fact that most of the area lacks good escape terrain except for the steep rocky escarpment surrounding the southern end of Quartz Lake. The southern end of the unit is classified as open range while the northern end is open forest. Some of the lower, eastern side of this treatment unit was selectively logged in 1992. There are numerous deep gullies in the southern half of this treatment unit which will make access to wood difficult. In addition, most of the Douglas fir stand is under culmination age (100 years), so a variance would be needed to log the stand. There is a wide range in age class of

Douglas fir (60-250 years+) in stands within this 161 ha unit. About 1/3 of the area at the northern end of this area is on steep slopes (TU 20,Figure 8, Appendix VI, hatched area)) which will have to be cable logged. Selective logging in 10 to 20 years is recommended for Treatment Unit 20, (Figure 7B,Appendix 1) located west of Quartz Lake on Premier Ridge. Conifers <25 cm dsh should be slashed immediately after logging to achieve desired open forest stem densities. The response the bluebunch wheatgrass/ rough fescue bunchgrass communities is expected to be dramatic providing canopy cover retention is less than 25%. Stand Management Prescription should be done prior to the commencement of logging. Logging should be done during winter months to reduce soil disturbance and the opportunity for quick Douglas fir in-growth. All spur roads, skid roads and landings should be fully reclaimed and seeded with a native forage seed mix.

Premier Ridge, Treatment Unit 21

Treatment Unit 21 is located in Sheep pasture on the upper western side of Premier Ridge. This area contains many archeology sites. An intensive archeology assessment will have to be conducted on polygons having a high archeology potential (Archeology Overview Assessment 1998 MOF) before any work is undertaken. Douglas fir trees should be slashed in about 10-12 years in Sheep Pasture on Premier Ridge (Treatment Unit 21, Figure 7 Appendix 1) to prevent conifer encroachment on traditional open winter range for sheep.

Lone Peak, Treatment Unit 1

The lowest priorities for habitat enhancement are the logging on the south side of Lone Peak and the slashing of a connective corridor from Lone Peak to Brewery Ridge (Figures 1 and 2,Appendix I). The work proposed is a low priority due to the limited use of the area by bighorn sheep (<10 sheep) and the distance of this small population from core populations at Bull River and Wasa Mountain. The eastern 1/3 of the block is a mixture of mature and old Douglas fir and western larch, while the area west of the old access road is largely a mixture of Douglas fir and Ponderosa pine with some pockets of lodgepole pine. The eastern part of this Treatment unit and the logged area could legitimately be treated as managed forest, based upon site series (IDFdm2-01 wet) but the western part is a drier IDFdm2-03 site series which should be managed for open forest. . Part (14.1 ha) of the proposed 60 hectare cut-block on the southeastern side of Lone Peak was logged in 1996. Any access created to log this proposed block should be completely de-built and reclaimed when harvest is done to protect sheep, elk and mule deer from harassment while on winter range. An intensive archeology review is required prior to any soil disturbance because the area has been identified as having a moderate potential for archeological sites. (MOF 1998). Slashing of the Lone Peak connector has been discussed previously.

Lone Peak Connector Treatment Unit 2

Under-story slashing of Douglas fir less than 25 cm dsh is planned on a movement corridor between Lone Peak and Brewery Ridge (Treatment Unit 2,Figure 1, Appendix I, Figure 2). This will increase sight lines and should reduce vulnerability to predator attack. Most of this corridor would normally be classified as 01 wet in the IDFdm2 BEC zone, but I propose a variance to manage the area as open forest. Part of the planned corridor is located on steep slopes(>60%)having shallow soils over bedrock within 100m of Wildhorse Creek. These areas may require girdling of trees. All snags with evidence of wildlife use should be retained in this corridor because it is immediately adjacent to a wildlife habitat area for flammulated owls (Appendix II, Figure 1). There is a moderate priority to create more open habitat between Lone Peak because there are still are a few bighorn (about 10) using this area.

5. Summary

Proposed enhancement treatments have focused on winter and spring range for bighorn sheep in the Premier Ridge and Wasa Mountain area. This herd is viable, providing extensive habitat enhancement work occurs The East Kootenays may never regain the wide expanse of open range created through wild fires of the 1920's and 1930' through massive stand replacing fires. Habitat enhancement efforts for bighorn sheep will have to be strategic and focus on historic traditional spring and winter range. Habitat enhancement treatments will not only increase palatable bunchgrass forage on traditional winter range, they will also reduce vulnerability to predation by increasing sight lines The population of sheep (<70 animals) located between Mause Creek and Premier Ridge is in a precarious position of being extirpated. My hope is that a continuous and sustained effort at habitat enhancement for bighorn sheep in this area will stimulate a population expansion so that all traditional range is used again.

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Appendix 0: Population Estimates of Rocky Mountain Bighorn Sheep/Kootenay Region-2005

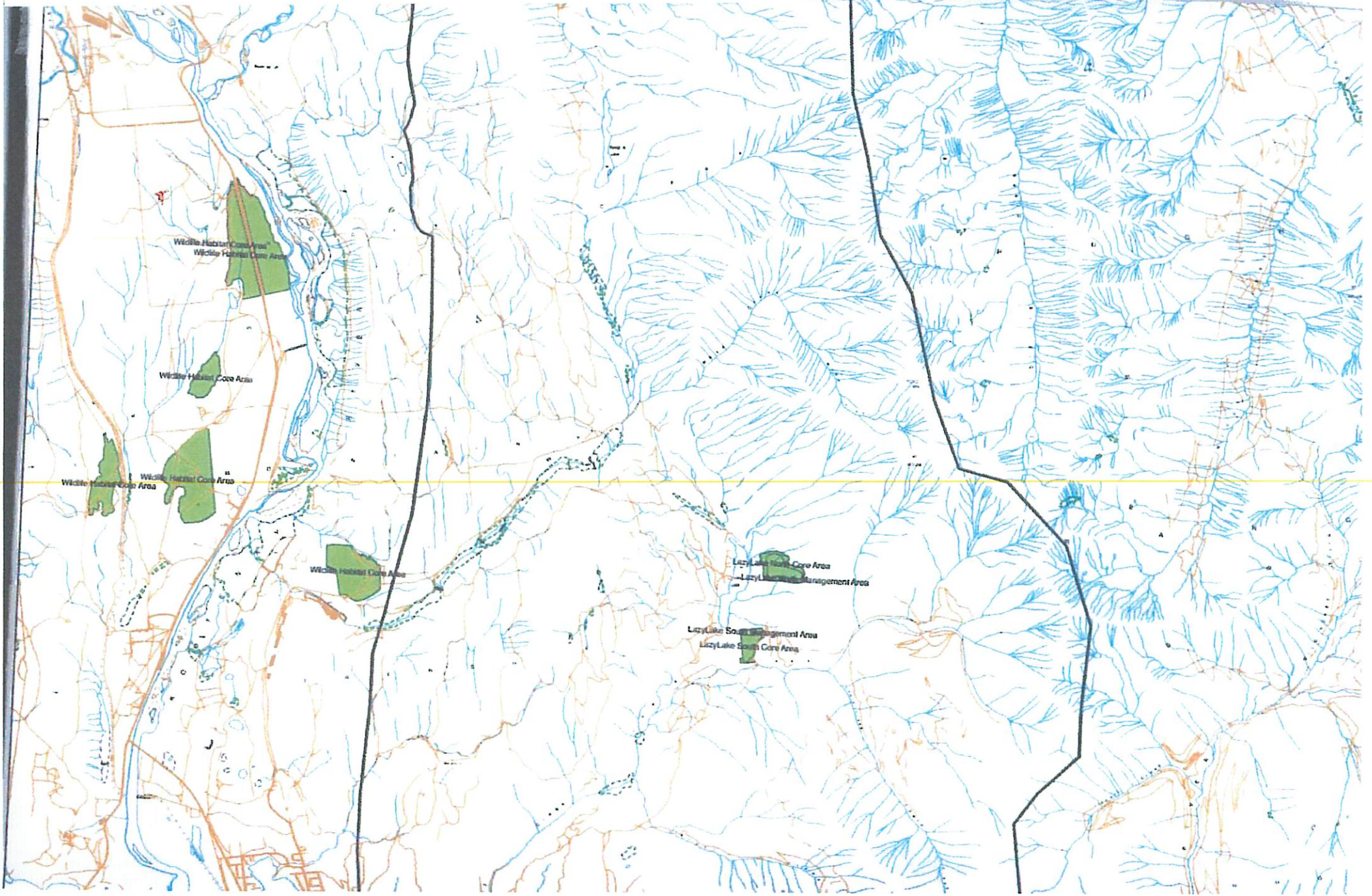
Population estimates of Rocky Mountain bighorn sheep in the Kootenay Region 1985 to 2005 (revised December 2005)

Region	Herd	1986	1991	1997	2001	2005	
4-01	Flathead	40	40	40	40	60	
4-02	Phillips Creek	35	70	70	60	70	
4-02	Maguire[1]	30	60	40	20	20	
4-02	Wigwam[2]	150	270	160	160	270	
4-21	Wildhorse[3]	20	50	30	20	20	
4-21	Estella	75	80	60	20	10	
4-21	Premier Ridge	100	160	80	20	40	
4-21	Marmalade	40	90	80	55	65	
4-21	Coyote/Blackfoot	30	50	50	50	40	
4-22	Elko/Lizard[4]	70	50	50	50	50	
4-22	Bull River	85	140	70	80	100	
4-23	Elk Valley West/Hornaday	50	50	50	40	40	
4-23	Crossing/Canyon	50	50	50	75	75	
4-23	Upper Elk Valley West	50	50	50	70	70	
4-23	Upper Elk Valley East	30	30	30	40	40	
4-23	Fording	70	70	85	120	130	
4-23	Ewin/Sheep Mt	250	160	150	150	170	
4-23	Crowsnest north	20	20	40	80	80	
4-23	Crowsnest south	10	10	10	0	0	
4-24	Whiteswan	60	60	60	75	100	
4-25	Columbia Lake[5]	250	220	120	120	150	
4-25	Windermere/Radium	230	210	190	180	300	
4-25	Mt Assiniboine	80	80	80	80	80	
4-36	Kicking Horse	0	15	30	25	40	
Total		**1825**	**2085**	**1675**	**1630**	**2020**	

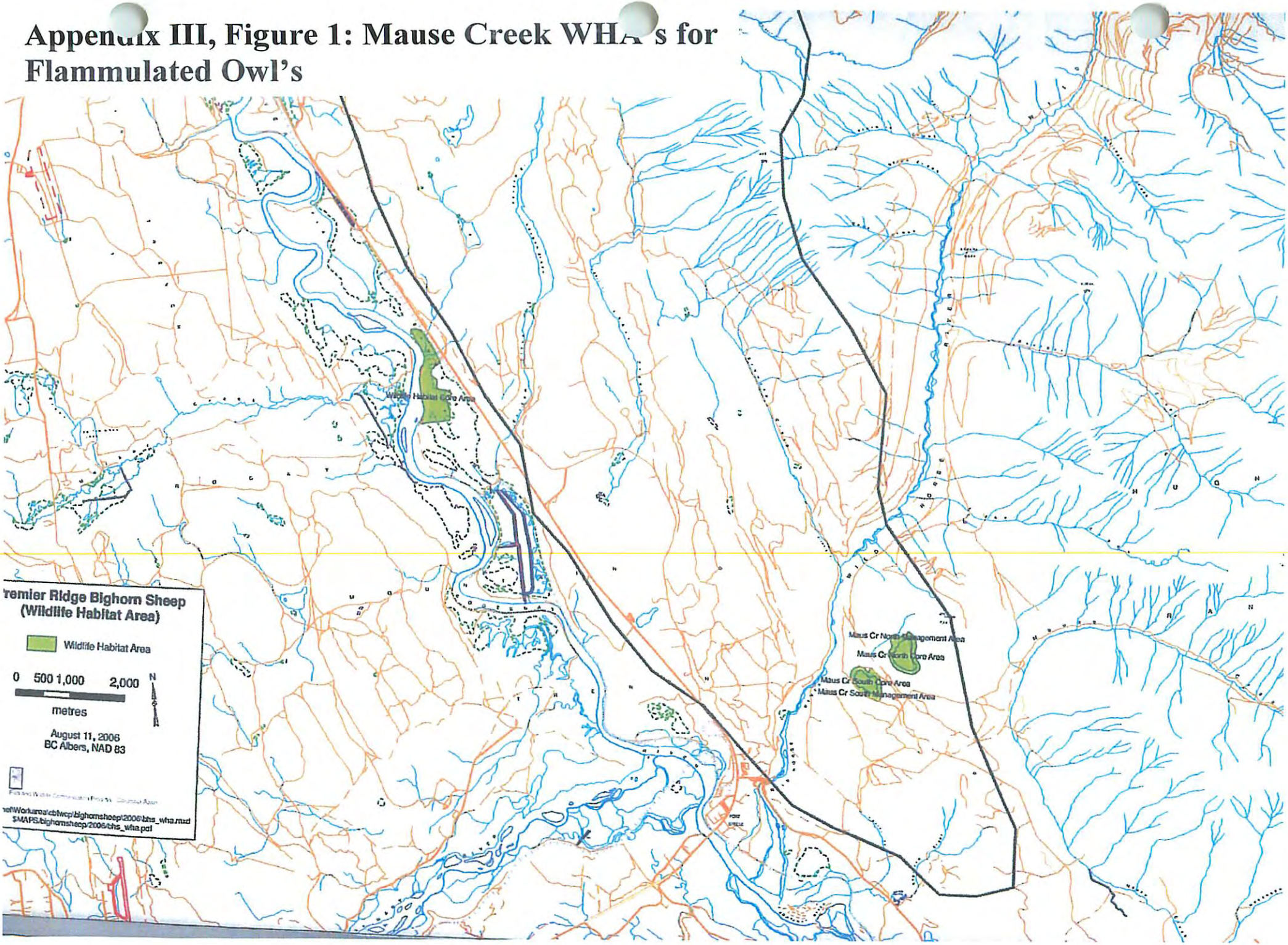
1: 36 sheep transplanted to Maguire Cr: 1984-89.
2: 64 sheep transplanted to Wigwam Flats from Stoddart: 1986-88
3: 28 sheep transplanted to Wildhorse area: 1986-87.
4: 39 sheep transplanted to Lizard Range: 1984-86.
5: 121 sheep moved from Columbia Lake to other herds: 1984-1987.

Appendix III: Wildlife Habitat Areas For Flammulated Owls, Mause Creek and Lazy Lake Areas

Appendix III, Figure 2: Lazy Lake WHA's for Flammulated Owls



Appendix III, Figure 1: Mause Creek WHA's for Flammulated Owl's



Appendix IV: Table of Rare and Endangered Wildlife, Plants and Plant Communities in the Rocky Mountain Forest District

Scientific Name	English Name	Global Rank	Prov Rank	BC Status
Anemone occidentalis - Carex nigricans	western pasqueflower - black alpine sedge	GNR	S2	Red
Artemisia tridentata / Pseudoroegneria spicata - Balsamorhiza sagittata	big sagebrush / bluebunch wheatgrass - arrowleaf balsamroot	GNR	S2	Red
Distichlis spicata var. stricta - Puccinellia nuttalliana	alkali saltgrass - Nuttall's alkaligrass	GNR	S1	Red
Festuca campestris - Pseudoroegneria spicata	rough fescue - bluebunch wheatgrass	GNR	S2	Red
Picea engelmannii x glauca - Populus tremuloides / Aralia nudicaulis	hybrid white spruce - trembling aspen / wild sarsaparilla	GNR	S2	Red
Pinus ponderosa - Populus tremuloides / Rosa woodsii	ponderosa pine - trembling aspen / prairie rose	GNR	S1	Red
Pinus ponderosa / Pseudoroegneria spicata - Lupinus sericeus	ponderosa pine / bluebunch wheatgrass - silky lupine	GNR	S2	Red
Pinus ponderosa / Symphoricarpos albus / Poa spp.	ponderosa pine / common snowberry / bluegrasses	GNR	S2	Red
Populus balsamifera ssp. *trichocarpa / Cornus stolonifera - Rosa nutkana*	black cottonwood / red-osier dogwood - Nootka rose	GNR	S1S2	Red
Populus tremuloides - Populus balsamifera ssp. *trichocarpa / Symphoricarpos albus / Equisetum arvense*	trembling aspen - black cottonwood / common snowberry / common horsetail	GNR	S1	Red
Pseudoroegneria spicata - Balsamorhiza sagittata	bluebunch wheatgrass - arrowleaf balsamroot	GNR	S2	Red
Pseudoroegneria spicata - Koeleria macrantha	bluebunch wheatgrass - junegrass	GNR	S2	Red
Pseudotsuga menziesii - Larix occidentalis / Calamagrostis rubescens	Douglas-fir - western larch / pinegrass	GNR	S2	Red
Pseudotsuga menziesii - Pinus ponderosa / Physocarpus malvaceus	Douglas-fir - ponderosa pine / mallow ninebark	GNR	S1	Red
Pseudotsuga menziesii / Mahonia nervosa / Cryptogramma acrostichoides	Douglas-fir / dull Oregon-grape / parsley fern	GNR	S2?	Red
Pseudotsuga menziesii / Symphoricarpos albus / Balsamorhiza sagittata	Douglas-fir / common snowberry / arrowleaf balsamroot	GNR	S2	Red
Scientific Name	**English Name**	**Global Rank**	**Prov Rank**	**BC Status**
Puccinellia nuttalliana - Hordeum jubatum	Nuttall's alkaligrass - foxtail barley	GNR	S2	Red
Purshia tridentata / Pseudoroegneria spicata	antelope-brush / bluebunch wheatgrass	GNR	S2	Red
Symphoricarpos occidentalis / Festuca idahoensis	western snowberry - Idaho fescue	GNR	S2?	Red
Tsuga heterophylla / Symphoricarpos albus	western hemlock / common snowberry	GNR	S2	Red
Tsuga heterophylla / Vaccinium myrtilloides - Paxistima myrsinites	western hemlock / velvet-leaved blueberry - falsebox	GNR	S1	Red

Table 1. Terrestrial animals and plants at risk as identified and managed for by BC Timber Sales Kootenay Business Area

Number	Common name	CDC status	COSEWIC	IWMS
Amphibians				
1	Coeur d'Alene salamander	Blue	Special concern	X
2	Great basin spadefoot	Blue	Threatened	X
3	Northern leopard frog	Red	Endangered	X
4	Rocky Mountain tailed frog	Red	Endangered	X
5	Tiger salamander	Red	Endangered	X
6	Western toad	Yellow	Special Concern	
Reptiles				
7	Gopher snake	Blue	Threatened	X
8	Western rattlesnake	Blue	Threatened	
9	Racer	Blue	Special Concern	
10	Western skink	Blue	Special Concern	
11	Rubber boa	Yellow	Special Concern	
Birds				
12	Burrowing owl	Red	Endangered	X
13	Flammulated owl	Blue	Special Concern	X
14	Lewis' woodpecker	Red	Special Concern	X
15	Long-billed curlew	Blue	Special Concern	X
16	Short-eared owl	Blue	Special Concern	X
17	Western Screech-owl	Red	Endangered	X
18	Western yellow-breasted chat	Red	Endangered	X
19	White-headed woodpecker	Red	Endangered	X
20	Williamson's sapsucker	Red	Endangered	
21	Western grebe	Red	Not listed	
22	American avocet	Red	Not listed	
23	Fosters tern	Red	Data deficient	
24	Great blue heron (*Ardea herodias herodias*)	Blue	Not listed	
Mammals				
25	Badger	Red	Endangered	X
26	Caribou	Red	Threatened	X
27	Fringed myotis	Blue	Data Deficient	X
28	Grizzly bear	Blue	Special Concern	X
29	Wolverine	Blue	Special Concern	X
30	Fisher	Blue	Not Determined	X
31	Least chipmunk (*Neotamias minimus selkirki*)	Red	Not listed	
32	Red tailed chipmunk (*N. ruficaudus ruficaudus*)	Red	Not listed	
33	Northern pocket gopher	Red	Not listed	
Number	**Common name**	**CDC status**	**COSEWIC**	**IWMS**
34	Bighorn sheep	Blue	Not listed	
Butterflies				
35	Dione copper	Red	Not listed	
Dragonflies				
36	Vivid dancer	Red	Not listed	
37	River jewelwing	Red	Not listed	
38	Olive clubtail	Red	Not listed	
Plants				
39	Lemmon's holy fern	Red	Threatened	
40	Southern maiden-hair	Red	Endangered	
41	Spalding's campion	Red	Endangered	
42	Giant helleborine	Blue	Special Concern	

Table 2. Ecological communities at risk as identified and managed for by BC Timber Sales Kootenay Business Area.

Appendix V: Archeological Overview Assessment near Quartz Lake by Wayne Choquette, 2004

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Consultant Archaeologist
P.O. Box 25, Yahk, B.C. V0B 2P0
Phone/Fax: 250-424-5361

Peter Davidson Ecosystems and Range
3247-37st S,
Cranbrook, V1C6Z9

February 3, 2005

Re: Archaeological Field Assessment of proposed ecological restoration in the vicinity of Quartz (Rockbluff) Lake

The following is an archaeological overview assessment of forestry activities proposed to assist in the restoration of open canopy forest adjacent to Quartz (Rockbluff) Lake. The project area was examined in the field on November 10 and December 1, 2004.

Description of Project Area

The project area is situated where the base of the west slope of the Rocky Mountains meets the east side of the Rocky Mountain Trench. The terrain is characterized by the very steep southwest to west slopes of the Hughes Range and more gentle southeasterly to southerly slopes at the south end of Premier Ridge. These two areas are separated by a rock-walled canyon occupied by Quartz Lake and a variety of lower elevation landforms including alluvial and colluvial fans, erosional terraces possibly graded to a proglacial lake, and an expanse of exposed bedrock and very large boulders that are the product of a catastrophic flood which swept through the canyon at some time in the post-glacial past. The lower elevation landforms are not the subject of the presently proposed ecological restoration, which instead focuses on the more densely ingrown sloping terrain above.

Archaeological Potential

The archaeological potential of the project area was mapped as part of Landscape Unit I4 (Choquette 1999) and four polygons (I4-27 - 30) were delineated in the immediate vicinity. These encompass lower elevation landforms, based on models predicting the possible occurrence of evidence of precontact human activity sufficiently intensive as to leave archaeologically detectable remains. Numerous archaeological sites have been recorded in the Premier Ridge locality, including camps, workshops and a quarry on the rock face above Quartz Lake. Small scale excavations in the campground at the

south end of Premier Lake revealed the presence of three discrete archaeological components spanning much of the postglacial period (Choquette 1974a and b, 1986). The earlier two components contained evidence of tool making from stone obtained in the immediate vicinity, from the known quarry and from an as-yet-unlocated but much more heavily used source. The latter is probably in the early Proterozoic Aldridge Formation (Hoy and Carter 1988) which underlies the entire project area in addition to much of the surrounding landscape in this part of the Rocky Mountain Trench.

Two models based on precontact human land and resource use patterns derived from the regional heritage record guided the definition of the polygons in the immediate project area vicinity. These models are related to occupation of the recently deglaciated landscape by Palaeo-Indians prior to about 8000 years ago and to the later focus on the kettle lakes in the vicinity between 6000 and 3000 years ago. In all of the models, the greatest accumulation and variety of material remains would have resulted from the quarrying of stone and early stage tool manufacture and/or from the human domestic activities associated with occupation of temporary camps. Regardless of the time period, human habitation would have tended to be in proximity to reliable water. While none occurs in the area specifically proposed for ecological restoration, both sizeable lakes and perennial watercourses occupy the valley bottoms in the general project area.

In both models, human inhabitation was part of a land/resource use pattern that included resource procurement on the surrounding landscape. Some of the bedrock (quartz, quartzite and siltstone) is well suited for stone tool manufacture and quarrying and tool manufacture are both well represented in the known archaeological sites in this landscape. As mentioned previously, the source of much of the artifactual deposits in the nearby archaeological sites is from a source that has not yet been specifically located; given the presence of the Aldridge Formation, there was a possibility that the source was in the project area although most indications are that it is further north. In addition, the occupants of the nearby sites would have exploited local subsistence resources such as plants and especially ungulates. Deer, mountain sheep and elk would have been present as long as there was vegetation (12,000 or more years). Activities associated with resource procurement and processing also might produce accumulations of material residue amenable to archaeological analysis.

Besides their influence on the integrity of archaeological deposits due to erosion and exposure, topography and slope obviously exerted significant influence on the accumulation of precontact cultural deposits by the influence of gravity on human movement. As much of the project area is very steeply sloping, it would be anticipated that significant archaeological remains would be restricted to level and gently sloping landforms.

Archaeological Impact Assessment

The locations identified in the field as being where thinning, spacing and piling/burning may be carried out were traversed, with a focus on examination of subsurface exposures. The latter consisted of exposed bedrock ledges, deflated areas, game trails and tree throw root balls. No precontact archaeological deposits or features were observed in any of the areas proposed for ecological restoration although one almost completely undisturbed habitation site was found on a terrace in the valley bottom within Archaeological Potential Polygon I4-28, outside the ecological restoration area.

On the basis of these results, *it is concluded that the proposed ecological restoration activities pose no threat to any significant archaeological deposits or features.* It can also be concluded that the absence of stone artifacts is evidence that the unknown lithic source is not within the present project area. Given the presence of habitation sites on lower elevation landforms, it is apparent that the sloping terrain in this locality was largely left to the ungulates for range. Thus the absence of intensive archaeological remains within the project area should not be construed as indicating low importance to the Ktunaxa traditional value system.

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I trust this meets your present needs. If you have any questions or if you require any further information, please do not hesitate to contact me.

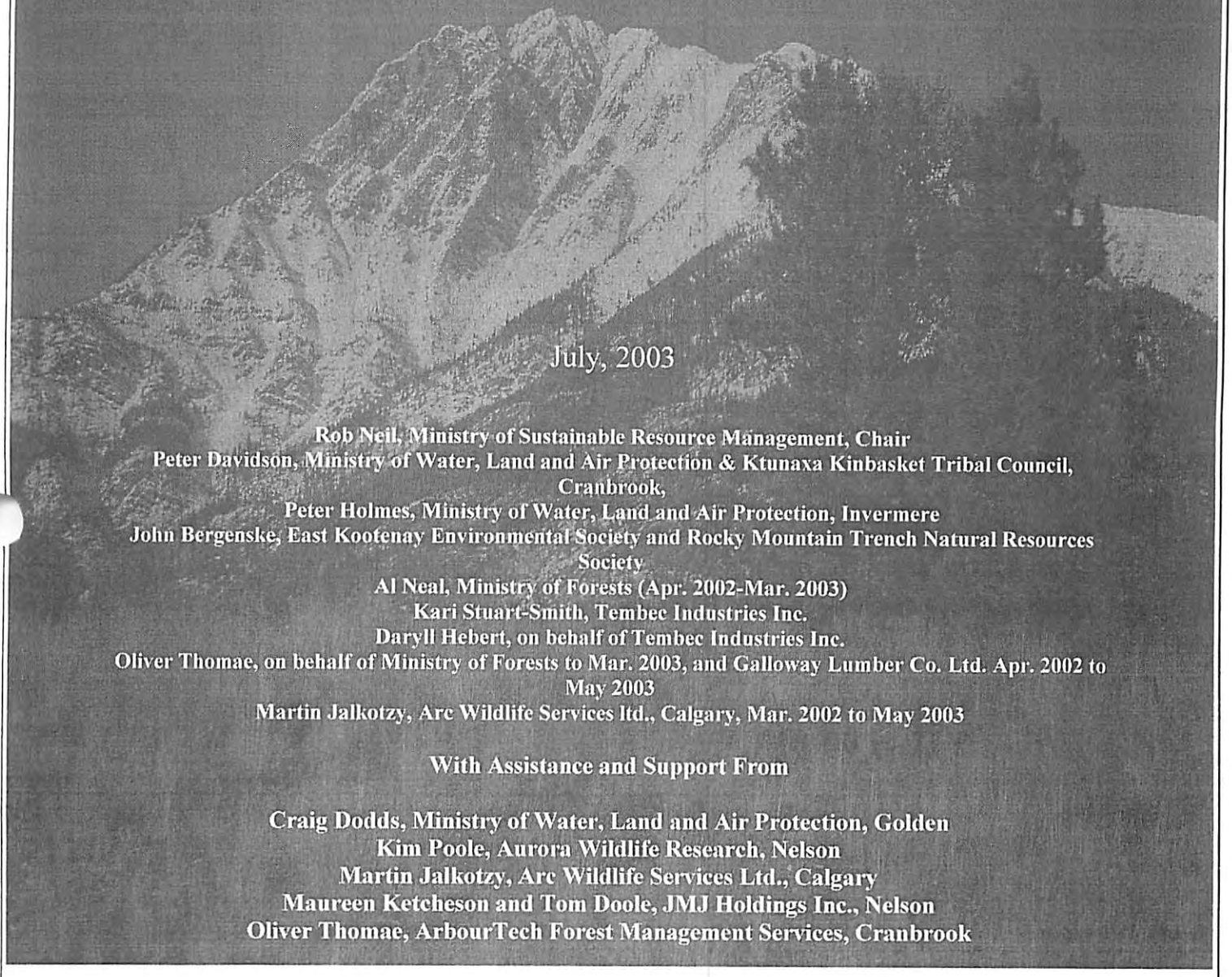
Yours Sincerely,

Wayne Choquette

cc. Ray Warden and Robert Williams, Ktunaxa/Kinbasket Treaty Council

Appendix VII: Some key pages of the "Report and Recommendations of the East Kootenay Ungulate Winter Range Committee," 2003

Report and Recommendations of the East Kootenay Ungulate Winter Range Committee



July, 2003

Rob Neil, Ministry of Sustainable Resource Management, Chair
Peter Davidson, Ministry of Water, Land and Air Protection & Ktunaxa Kinbasket Tribal Council, Cranbrook,
Peter Holmes, Ministry of Water, Land and Air Protection, Invermere
John Bergenske, East Kootenay Environmental Society and Rocky Mountain Trench Natural Resources Society
Al Neal, Ministry of Forests (Apr. 2002-Mar. 2003)
Kari Stuart-Smith, Tembec Industries Inc.
Daryll Hebert, on behalf of Tembec Industries Inc.
Oliver Thomae, on behalf of Ministry of Forests to Mar. 2003, and Galloway Lumber Co. Ltd. Apr. 2002 to May 2003
Martin Jalkotzy, Arc Wildlife Services ltd., Calgary, Mar. 2002 to May 2003

With Assistance and Support From

Craig Dodds, Ministry of Water, Land and Air Protection, Golden
Kim Poole, Aurora Wildlife Research, Nelson
Martin Jalkotzy, Arc Wildlife Services Ltd., Calgary
Maureen Ketcheson and Tom Doole, JMJ Holdings Inc., Nelson
Oliver Thomae, ArbourTech Forest Management Services, Cranbrook

BRITISH COLUMBIA

Table 5. Landscape Level Cover and Forage Objectives for East Kootenay Ungulate Winter Range.

Habitat Type	Ungulate Winter Range Management Objective	Primary Ungulate Species	Landscape Level Minimum Requirement[3]	Cover and Forage Definitions	Comments
Open Range	Promote preferred forage production.	Elk, Bighorn sheep Mule deer Whitetailed deer Mountain goat	Cover N/A See comments. Forage N/A See footnote.	Preferred forage is climax grass and dryland shrub communities.	Cover requirements will be met by adjacent open forest stocking standards and managed forest retention areas.
Open Forest	Promote preferred forage production in understory.	Elk, Bighorn sheep Mule deer White-tailed deer Mountain goat	Cover N/A See comments. Forage N/A See footnote.	Preferred forage is climax grass and dryland shrub communities.	Cover requirements will be met through open forest tree retention requirements and adjacent managed forest retention areas.
Managed Forest (Dry)	Maintain a component of early seral vegetation through time.	Elk Bighorn sheep Mule deer White-tailed deer	Cover 10% Forage 10%	Age ≥100, and Evergreen[4] CC ≥20% , or Layer 1 age ≥ 100 years. ≤30 year-old forest	Applies to mapped dry managed forest. Preference for Fd leading stands is encouraged.
Managed Forest (Transitional)	Maintain a component of early seral vegetation through time.	Moose, Elk Mule deer White-tailed deer	Cover 20% Including up to 10% Forage 10%	Height ≥ 15m, and Evergreen CC ≥40%. ≥100 years Fd, Sx leading ≤30 year-old forest	Applies to mapped transitional managed forest within ungulate winter range. Applies to suitable stands if available.
Managed Forest (Mesic)	Maintain a component of early seral vegetation through time.	Elk Mule deer	Cover 30% Including mature & old 20% Forage 10%	Height ≥ 15m, and Evergreen CC ≥40% ≥100 year-old forest ≤30 year-old forest	Applies to mapped mesic managed forest. Prefer non-Pl leading where available. Partial cut stands with rank 1 layer meeting these specifications can qualify.
Managed Forest (Moist)	Maintain a component of early seral vegetation through time.	Moose	Cover 20% Forage 10%	Height ≥ 15m, and Evergreen CC ≥40% ≤30 year-old forest	Applies to mapped moist managed forest within ungulate winter range.
Managed Forest (Wet)	Maintain a component of early seral vegetation through time.	Moose	Cover 30% Forage 10%	Height ≥ 15m, and Evergreen CC ≥40% ≤30 year-old forest	Applies to mapped wet managed forest within ungulate winter range.
Riparian, Deciduous and Shrub Lands	Maintain high shrub production interspersed with good snow interception cover.	Moose, Elk Mule deer Whitetailed deer	Where ecologically suited, maintain or enhance climax (non-pine) conifer and deciduous forest		Riparian stands meeting cover definition can contribute to managed forest cover objectives.
Avalanche Tracks	Retain cover along high and mod. avalanche zones.	Moose, Elk	Retain all forest within track complexes and 50m of forest outside of complexes[5]. Retain 100m of cover adjacent to both sides of isolated tracks. Maximum harvest 20% of basal area on one side of avalanche track.		
Alpine/ Subalpine	Retain cover along moderate to high capability habitat	Mountain goat	Retain available forested habitat patches adjacent to moderate to high value habitats.		
Alpine Grasslands	Retain cover along moderate to high capability habitat	Bighorn sheep Mountain goat	Retain 100m wide forested habitat cover patches adjacent to moderate to high value habitats.		

[3] Ideally manage for forage targets of 100% on Open Range and Open Forest sites, and at least 20% on managed forest sites. Forage maintenance and enhancement is a multi-jurisdictional responsibility and is not expected to be achieved by forest licensees alone. Licensees, ranchers, government, restoration committees, and other agencies are encourages to collaborate to achieve forage objectives through slashing and burning programs.

[4] Evergreen crown closure means all conifers except larch counted at full relative crown closure; and larch and deciduous at 50% of their relative crown closure.

[5] Avalanche complexes are defined as a series of snow avalanche tracks alternating with strips of forest (>2 tracks/km, or <500m between tracks.

Table C. Stand/Site Level Management Objectives and Stocking Standards for East Kootenay Ungulate Winter Range Management.[6]

Habitat Type	Target Stocking Standard (Stems/ha)	Minimum Stocking Standard (Stems/ha)	Maximum Stocking Standard (Stems/ha)	Species Preference for Residual Trees[7]	Free-Growing Window
Open Range	**20** including 5 of the largest 1/3 of the diameter range	**0** 0	**75** 20 of the largest 1/3 of the diameter range	Favour Py in PPdh2, and Douglas-fir with a component of deciduous trees where available in other BECs.	**0-2** years
Open Forest[8]	**150** including 30 of the largest 1/3 of the diameter range	**76** including 20 of the largest 1/3 of the diameter range	**400** 50 of the largest 1/3 of the diameter range	Favour Py in PPdh2, and Douglas-fir with a component of deciduous trees and Lw where available in other BECs.	**1-3** years
Managed Forest (Dry)	(300, 400, 500), **600** Multi-layered stocking standards	(300, 400, 500), **600** Multi-layered stocking standards	Provincial standards[9]	Favour climax trees, including Lw with a component of decid. trees where available.	**12-20** years; **3** yrs where stocked with L1&2.
Managed Forest (Transitional)	Provincial standards	Provincial standards	Provincial standards[16]	Favour deciduous and groups of climax tree species.	**12-20** years
Managed Forest (Mesic)					
Managed Forest (Moist)					
Managed Forest (Wet)					
Riparian, Deciduous and Shrub Lands	Normal riparian standards. See Best Management Practices	Normal riparian standards See Best Management Practices	Normal riparian standards See Best Management Practices	Favour large crowned Fd, Sx, Act, Cw, Bl	N/A See Best Management Practices
Avalanche Tracks Reserve Zone	N/A	70% of existing stand basal area	N/A	Prefer Sx, Bl retention.	**1-3** years
Alpine/ Subalpine	N/A	N/A	N/A	N/A	N/A
Alpine Grasslands	N/A	N/A	N/A	N/A	N/A

[6] Up to 10% of an operator's plans may deviate from these standards where a suitable rationale is provided and a commitment is made to do a follow-up assessment of the effectiveness of the alternative standards at achieving forage and timber objectives.

[7] Species preference must consider other wildlife, biodiversity, silviculture and forest health factors balanced with these objectives.

[8] These stand targets are based on growth models which indicate that at least one half of site timber potential will be produced, and forage response data that indicate that preferred grass (eg. bluebunch wheatgrass and rough fescue) and browse species (eg. Saskatoon) can be sustained if stands are managed to these levels.

[9] "Management should not exceed the maximum stocking standard. Co-operation among licensees, government, restoration committees and other agencies will be required in circumstances where excess regeneration beyond the maximum is retained on site. Harvest activity should be consistent with ecosystem restoration objectives for that site. It is recognized that more than one entry may be required to achieve long-term objectives. Treatment plans should indicate how long-term objectives will ultimately be achieved.

Table D. Stand/Site Level Tree Retention Best Management Practices for East Kootenay Ungulate Winter Range.

Habitat Type	Intertree Spacing	Tree Layer	Diameter	Target Number[10]	Preferred Height	Layer 1 Tree Characteristics
Open Range	Range 3-500 m (Avg. 22.4m)	1a 1b 2 3 4	>=30 cm dbh >=12.5 cm dbh >7.5-<12.5 cm dbh 1.3 m tall to < 7.5 cm dbh <1.3 m tall	} 5 } 5 10 0	} >=15 m } >5m-10m >1.3m-5m	Retain large crowned veteran trees, and standing dead trees where available.
Open Forest	Range 3-18 m[11] (Avg. 8.8m)	1a 1b 2 3 4	>=30 cm dbh >=12.5 cm dbh >7.5-<12.5 cm dbh 1.3 m tall to < 7.5 cm dbh <1.3 m tall	} 30 } 50 70 0	} >=15 m } >5m-10m >1.3m-5m	Retain large-crowned veteran trees, and standing dead trees where available. Retain tall well-formed trees for future harvesting opportunity.
Managed Forest (Dry)	Range 2-9 m (Avg. 4.4)	1a 1b 2 3 4	>=30 cm dbh >=12.5 cm dbh >7.5-<12.5 cm dbh 1.3 m tall to < 7.5 cm dbh <1.3 m tall	} } 300 400 500 600	} >=15 m } >5m-10m >1.3m-5m	Multi-layered stocking standards apply as described in the Nelson Forest Region, Establishment to Free-Growing guidebook.
Managed Forest (Transitional) **Managed Forest (Mesic)** **Managed Forest (Moist)** **Managed Forest (Wet)**	Normal Practices Apply	N/A	Normal Practices Apply	Normal Practices Apply	Normal Practices Apply	Retain large-crowned veteran trees, and standing dead trees where available.
Riparian, Deciduous and Shrub Lands	Variable	N/A	Promote rejuvenation of deciduous trees and shrubs with scattered wildlife trees where available.	N/A	N/A	Retain large-crowned veteran trees, and standing dead trees where available.
Avalanche Tracks Applies to mod. to high quality tracks only.	N/A	N/A	Prefer greater than 30cm dbh as indicator of crown mass to intercept snow.	N/A	>=15m height	Retain large cover trees along the edges of avalanche tracks.
Alpine/ Subalpine	N/A	N/A		N/A		
Alpine Grasslands	N/A	N/A		N/A		

[10] Surveys: Open Range estimated to have stocking within the prescribed levels may be surveyed using "walkthrough method" but inventory information must be gathered. Open Range over prescribed levels, and Open Forest, should be surveyed using multilayer plot tally, 5.64m radius (1/100ha) plots distributed on uniform 100x100m grid, with optional prism sweep for layer one trees, and estimated heights. Countable heignt for maximum density will be 1.0cm. Further details may be obtained from the Ministry of Forests.

[11] It is recommended that no more than 2 well-spaced trees be retained within 3m of each other at a time. Uniform spacing maximizes timber production; irregular spacing increases forage production.

Table E. Stand/Site Level Forage Best Management Practices for East Kootenay Ungulate Winter Range.

Habitat Type	Forage Management	Cover Tree Distribution	Treatments	Range Practices
Open Range	Promote healthy climax grassland community.	Vary from small clusters to scattered individual trees. Retain some cover adjacent to high elevation grasslands.	Burn periodically to reduce encroachment and enhance preferred forage. Sustained noxious weed control is required to restore grassland communities. Focus restoration treatments on priority areas where range restoration will achieve maximum benefits. Seed roads and landings with native seed if available to discourage noxious weed invasion and restore forage productivity.	Range stewardship plans and range use plans must be consistent with regulations and should set grazing rotations that maintain health and vigour of climax grasses, and leave late season growth for winter use by ungulates.
Open Forest	Promote healthy climax shrubs, forbs, and grasses.	Some variability is acceptable but tree distribution should ensure all trees can achieve merchantable characteristics in a few decades to facilitate re-entry. Irregular tree distribution will increase forage production.	Focus restoration treatments on priority areas where range restoration will achieve maximum benefits. Slashing to eliminate excess regeneration and poor quality stems is encouraged. Follow up burns may be necessary to eliminate excess regeneration and rejuvenate grass and shrub species such as Saskatoon and ceanothus. Treat noxious weeds to discourage invasion. Seed roads and landings with native seed if available to discourage noxious weed invasion and restore forage productivity.	Range stewardship plans and range use plans must be consistent with regulations and should set grazing rotations that maintain health and vigour of climax grasses, and leave late season growth for winter use by ungulates.
Managed Forest (Dry) Managed Forest (Transitional) Managed Forest (Mesic) Managed Forest (Moist) Managed Forest (Wet)	Where considered compatible with regeneration objectives, promote grass and shrub species.	Irregular cover edges along openings are preferred by most ungulates. Use varied wildlife tree retention configurations with patches and scattered single trees. Fd, and Sx are preferred cover tree species. Retain cover along ridges and knolls, adjacent to forage areas, and near riparian zones and seeps where possible.	Juvenile spacing helps to extend forage production. Irregular spacing helps to extend forage production. Slashing decadent shrub species helps to rejuvenate them. Treat noxious weeds to reduce invasion. Cut some deciduous stems to promote suckering.	Range stewardship plans and range use plans must be consistent with regulations and should set grazing rotations that maintain health and vigour of climax grasses, and leave late season growth for winter use by ungulates.
Riparian, Deciduous, Shrublands	Promote dogwood, willow and other ungulate forage species.	Retain or promote stands and scattered clumps of coniferous trees among and adjacent to deciduous and shrub dominated vegetation types. Favour Sx, Cw and Act.	Some coniferous removal, particularly Pl, from riparian habitat is acceptable to promote shrub production.	Maintain natural or create artificial barriers to avoid disruption of riparian habitats by livestock. Select watering sites with minimal soil and vegetation sensitivity.
Avalanche Tracks	Maintained by natural processes	Retain wildlife tree patches and other cover reserves adjacent to avalanche tracks.	On high and moderate rated avalanche tracks, retain forest within track complexes and 50m of cover outside of complexes. Retain 100m of cover adjacent to both sides of isolated tracks.	N/A
Alpine/ Subalpine	N/A	N/A	N/A	N/A
Alpine Grasslands	N/A	N/A	N/A	N/A

BRITISH COLUMBIA

ORDER – UNGULATE WINTER RANGE – U-4-006 - CRANBROOK TSA

The following order applies to the area identified within the attached Schedule A and takes effect on the 10 day of February, 2005.

This order is given under the authority of sections 12(1) and 9(2) of the *Government Actions Regulation* (B.C. Reg. 582/2004).

The Deputy Minister of Water, Land and Air Protection orders that:

1. the ungulate winter range shown in the map set out in the attached Schedule A (#U-4-006) is established;
2. the ungulate winter range shown in the map set out in the attached Schedule A U-4-006, Cranbrook TSA) is established for moose (*Alces alces shirasi*), white-tailed deer (*Odocoileus virginianus ochrourus*), mule deer (*Odocoileus hemionus hemionus*), elk (*Cervus elaphus nelsoni*), bighorn sheep (*Ovis Canadensis canadensis*) and mountain goat (*Oreamnos americanus*);
3. the general wildlife measures outlined in Schedule 1 are established for the ungulate winter range as shown on the attached Schedule A; and
4. pursuant to section 7(3) of the *Forest Planning and Practices Regulation* the person(s) required to prepare a forest stewardship plan are hereby exempted from the obligation to prepare results or strategies in relation to the objective set out in section 7(1) of the *Forest Planning and Practices Regulation* for the winter survival of ungulates in the Cranbrook Timber Supply Area.

Schedule 1 – General Wildlife Measures - Forestry

1. Forest practices carried out within the boundaries of ungulate winter range polygons as shown on Schedule A must result in, as the case may be,
   (i) stand stocking, or
   (ii) retention of forest cover
   that is not less than the forest cover retention requirements that apply as a percentage of the total area of each Habitat Type in a Landscape Unit as:
   (iii) set out in Column 3 of Table 1, and
   (iv) as defined in Column 4 of Table 1.

   Notes:
   (ii) Forest cover retention requirements, in hectares, that apply to the total area of a Habitat Type in a Landscape Unit, are to be determined as set out in Appendix 1 attached to this Order.

2. Forest practices carried out within the boundaries of ungulate winter range polygons as shown on Schedule A must not result in more than 33% of any Managed Forest Habitat Type being less than 21 years in age.

   Note: The maximum area, in hectares, of early seral representation for any Managed Forest Habitat Type is to be determined as set out in Appendix 1 attached to this Order.

3. These General Wildlife Measures do not apply for the purposes of timber salvage to address wildfire or serious forest health issues.

4. These General Wildlife Measures do not apply for the purposes of exploration, development and production activities when these activities have been authorized for purposes of subsurface resource exploration, development or production by the *Mineral Tenure Act*, the *Coal Act*, the *Mines Act*, the *Petroleum and Natural Gas Act*, the *Pipeline Act* or the *Geothermal Resources Act*.

Table 1. Forest Cover Requirements for Ungulate Winter Range

		Column 3	Column 4
Habitat Type	**Ungulate Species**	**Landscape and Stand Level Forest Cover Retention Requirements**	**Definitions that pertain to Forest Cover Retention Requirements**
Open Range	Elk, Bighorn sheep, Mule deer, White-tailed deer, Mountain goat	Stocking standards: 5 – 75 stems/ha	Include 5 – 20 stems/ha of the largest 1/3 of the diameter range
Open Forest	Elk, Bighorn sheep, Mule deer, White-tailed deer, Mountain goat	Stocking standards: 76 – 400 stems/ha	Include 20 – 50 stems/ha of the largest 1/3 of the diameter range
Managed Forest (Dry)	Elk, Bighorn sheep, Mule deer, White-tailed deer	Mature Cover 10% (min)	>100 years and evergreen[1] CC ≥ 20%, or layer 1 age >100 years
		Stocking standards: Multi-layered stocking standards – provincial standard	
Managed Forest (Transitional)	Moose, Elk, Mule deer, White-tailed deer	Snow Interception Cover 10% (min), and	>60 years and evergreen CC ≥ 40%.
		Mature Cover 10% (min)	>100 years, Fd or Sx leading and evergreen CC ≥ 40%
Managed Forest (Mesic)	Elk, Mule deer	Snow Interception Cover 10% (min), and	>60 years, and evergreen CC ≥ 40%
		Mature Cover 20% (min)	>100 years, Fd or Sx leading and evergreen CC ≥ 40%
Managed Forest (Moist)	Moose	Snow Interception Cover 20% (min)	>60 years and evergreen CC ≥ 40%
Managed Forest (Wet)	Moose	Snow Interception Cover 30% (min)	>60 years and evergreen CC ≥ 40%

[1] Evergreen crown closure means all conifers except larch counted at full relative crown closure; and larch and deciduous at 50% of their relative crown closure.

Avalanche Tracks	Moose, Elk	50 m of forest cover adjacent to high value[2] habitat within avalanche tracks.	>60 years old

[2] High value habitat within an avalanche track is defined as an area that is supporting herb or low shrub vegetation communities as defined in the *BC Land Cover Classification Scheme*.

Signed this 10 day of Feb, 2005
Gordon Macatee, Deputy Minister
Ministry of Water, Land and Air Protection

APPENDIX 1

1. The forest cover retention requirements, in hectares, for each Habitat Type in the ungulate winter range polygons of a landscape unit are derived from the sum of the area of a Habitat Type found within all the UWR polygons of the landscape unit.

   For example, if the total area of a Habitat Type in the ungulate winter range of a Landscape Unit is 1000 ha, then the forest cover retention requirement is the prescribed % of that total area as set out and defined in Table 1. If we were considering "Dry Managed Forest" the requirement would be 100 ha. (10% of 1000 ha.).

   Once derived, the forest cover retention requirement is to be applied across UWR polygons in the landscape unit.

   When applied, broad spatial distribution of the required forest cover retention is desirable to maintain a close interspersion of the forest cover to winter forage areas. Distribution is not required to be proportionately applied to each location of the Habitat Type in UWR of a Landscape Unit.

2. The maximum amount of early seral representation, in hectares, for the Managed Forest Habitat Types in the ungulate winter range polygons of a landscape unit are derived from the sum of the area of a Habitat Type found within all the UWR polygons of the landscape unit.

   For example, if the total area of a Managed Forest Habitat Type in the ungulate winter range of a Landscape Unit is 1000 ha, then the maximum amount of early seral representation, in hectares, is the 33% of that total area of that Habitat Type in the polygons of UWR in the Landscape Unit - the amount of early seral representation would be 330 ha. (33% of 1000 ha.).

   Once derived, the maximum early seral amount is to be applied across UWR polygons in the landscape unit.

3. In instances where forest retention requirements are in deficit or early seral representation is exceeded, a person proposing forestry activities may apply for an exemption from the requirement to comply with the applicable General Wildlife Measures. Authority to consider an exemption is provided in section 92(1) of the *Forest Planning and Practices Regulation.*

   A spatially explicit recruitment strategy submitted to the Minister's delegate with a request for exemption will assist in timely consideration of the exemption request, and will inform the conditions, if any, of the exemption that may be granted prior to commencement of forestry activities.

4. Where an area in an ungulate winter range polygon is subject to a field verified ecosystem restoration plan, a person proposing to carry out activities under that field verified ecosystem restoration plan may apply for an exemption from the requirement to comply with the applicable General Wildlife Measures, in as much as the field verified ecosystem restoration plan conflicts with the General Wildlife Measures. Authority to consider an exemption is provided in section 92(1) of the *Forest Planning and Practices Regulation.*

   A copy of the field verified ecosystem restoration plan should be submitted with the exemption request to the Minister's delegate to assist in timely consideration of the exemption request. The plan will inform the conditions, if any, of the exemption that may be granted prior to commencement or continuation of activities consistent with the field verified ecosystem restoration plan.

   Future Ecosystem Restoration Plans should take direction from the stocking standards and cover retention targets in Schedule 1.

5. In instances where field verification of site series determines an area is a different Habitat Type than that shown in Schedule A, the forest retention targets for the Habitat Type determined through site series field verification will apply. The site series associated with each Habitat Type is shown in Table 2. The minimum operational planning scale for field verification is two hectares.

Table 2. Site Series Descriptions for Habitat Types

Habitat Type	Concept Definition	Intended Field Verified Ecosystem Units
Open Range	Lands ecologically suited to production of bunchgrasses and dryland shrub species. Snow accumulations are typically low. (includes existing open range, meadows, cultivated and similar cover classes with </=10% tree crown closure)	PPdh2, 02a, 02b, 01 IDFdm2, un, 02,03; IDFdm2a, un2, 02; MSdk, 02 ICHdm, 02; (& Rock talus sites)
Open Forest	Lands ecologically suited for production of large-crowned open forest with bunchgrasses and dryland shrub species. Snow accumulations are typically light. (typically </=40% tree crown closure, multi-storied stand structure, and low stocking levels)	PPdh2, 03, 04 IDFdm2, un, 01 warm, & neutral <1000m (except in LUs I32, I35 and I38) IDFdm2a, un2, 03 Fd leading MSdk, 03 Fd leading; ICHdw, 02; ICHdm, 03 Fd leading ICHmk1 except Golden, 02; ESSFdk, 02; ICHwk1, 02; ICHvk1, 02
Managed Forest (Dry)	Lands ecologically suited for Fd and/or Py dominated forest. These provide forage values for 1-3 decades during the forest regeneration phase. Stands may also be partial cut to help promote forage. Snow is typically light to moderate.	IDFdm2, un, 01 cool, and neutral >1000m, 04, 05 (except in LUs I32, I35 and I38) Golden ICHmk1 02; ICHmw1 02
Managed Forest (Transitional)	Lands ecologically suited for Douglas-fir climax stands often having a heavy lodgepole pine and larch component. These provide forage for 1-3 decades during the forest regeneration phase. Snowpack is typically light to moderate.	IDFdm2a, un2, 03 Non-Fd leading, 04, 01, 05 IDFdm2 04, 01, 05 in LUs I32, I35 and I38.
Managed Forest (Mesic)	Lands ecologically suited to pine leading stands which provide forage values for 1-3 decades during the forest regeneration phase. Moderate snow accumulations necessitate the retention of cover.	MSdk, 03 Non-Fd leading, 04, 01, 05 where elk, deer capability mapped.
Managed Forest (Moist)	Moist ecosystems providing forage values for 1-3 decades during the forest regeneration phase. Moderate snow necessitates retention of cover.	MSdk, 03 Non-Fd leading, 04, 01, 05 where moose capability only mapped. ICHdw, 01a, 01b, 03, 04; ICHdm, 03 non-Fd leading, 01, 04, 05
Managed Forest	Wetter ecosystems providing forage values for 1-3 decades during the	All other site series not listed above or below in

(Wet)	forest regeneration phase. Moderate to deep snow necessitates retention of cover.	ICHmk1, ESSFdm1, ESSFdm2, ESSFdk, ICHmw1, ESSFmm1, ESSFwm, ICHwk1, ICHvk1 ESSFwc2, ESSFvc

6. All forest stands within the areas identified in Schedule A which are inoperable or constrained for timber harvesting and meet the characteristics described in Table 1, can contribute to meeting these measures. Private land, Christmas tree permits, Federal land and Parks and Protected Areas do not contribute to these measures.

7. Forest age and crown closure are based on the best available information at the time of Forest Stewardship Plan approval, or upon plan extension, the information available when the plan is extended.

8. For purposes of timber harvesting, the maximum stocking standards for Open Range and Open Forest Habitat Types do not apply in instances where high densities of small tree stem sizes make it economically prohibitive to achieve the requirements. However, in these instances reasonable efforts to reduce small stem densities should be undertaken.

9. Up to 10% of the area within an operational plan, within a Landscape Unit, may deviate from the stand level measures for Open Forest to facilitate examination of the response of forage communities to variations in tree stocking. These areas must be identified and reported to the Regional Manager, Environmental Stewardship Division for information purposes.

10. Stand level measures for Open Range and Open Forest Habitat Types do not apply to areas where restoration activities have applied prescribed fire.

11. Partial cut stands can contribute to forest cover requirements for Managed Forest [Transitional and Mesic] Habitat Types if the Rank 1 layer is >60 years old and crown closure is ≥40% and for Managed Forest [Dry] Habitat Type if the Rank 1 layer is >100 years old and crown closure is ≥20%.

12. Within Managed Forest [Moist and Wet] Habitat Types, forest stands meeting the ages specified in Table 1, which have previously been subject to light partial cutting, can contribute to meeting these measures in instances where a Qualified Professional has confirmed through field assessment that these stands have suitable snow interception characteristics. Documentation confirming this field assessment is to include the size and location of these stands and is to be submitted to the Regional Manager, WLAP, Environmental Stewardship Division for information purposes.

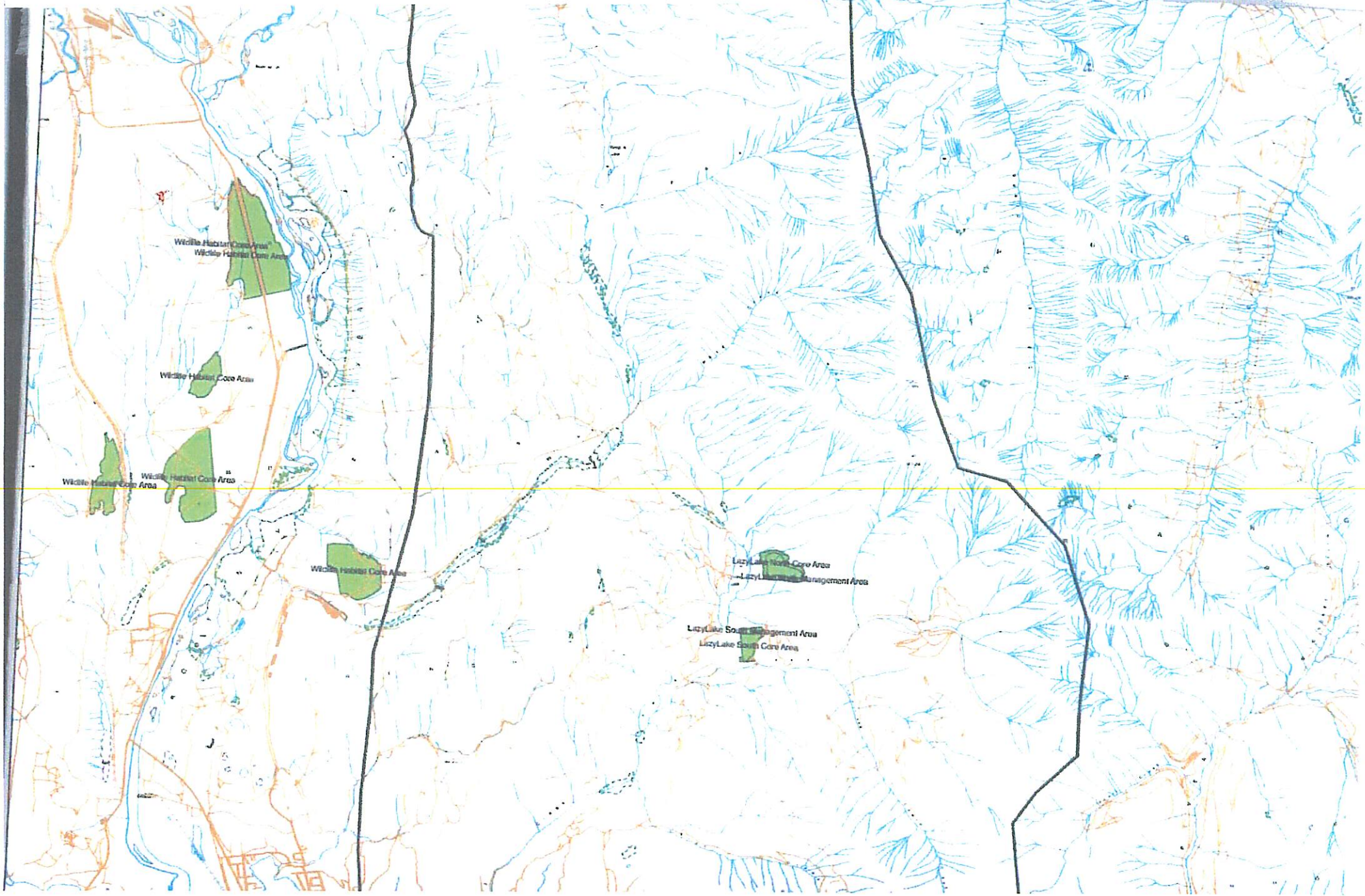
13. Forest stands with suitable snow interception characteristics which are younger than the ages prescribed in Table 1 can contribute to meeting these measures in instances where a Qualified Professional has confirmed through field assessment that the younger stands have suitable snow interception characteristics. Documentation confirming this field

assessment is to include the size and location of these stands and is to be submitted to the Regional Manager, WLAP, Environmental Stewardship Division for information purposes.

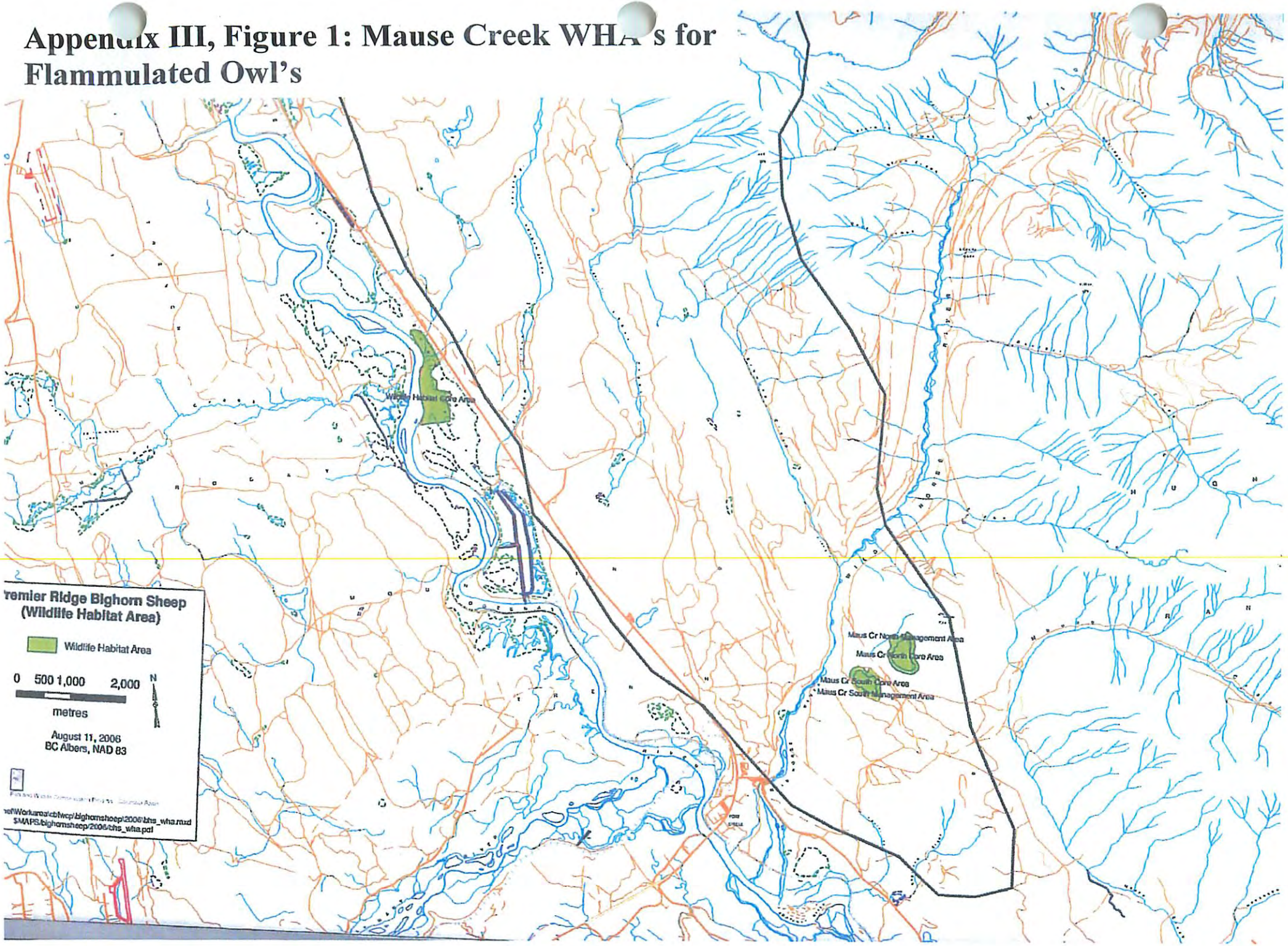
Appendix I: Orthophotographic Coverage of Proposed Treatment Areas

Appendix III: Wildlife Habitat Areas For Flammulated Owls, Mause Creek and Lazy Lake Areas

Appendix III, Figure 2: Lazy Lake WHA's for Flammulated Owls



Appendix III, Figure 1: Mause Creek WHA's for Flammulated Owl's



Appendix IV: Table of Rare and Endangered Wildlife, Plants and Plant Communities in the Rocky Mountain Forest District

Scientific Name	English Name	Global Rank	Prov Rank	BC Status
Anemone occidentalis - Carex nigricans	western pasqueflower - black alpine sedge	GNR	S2	Red
Artemisia tridentata / Pseudoroegneria spicata - Balsamorhiza sagittata	big sagebrush / bluebunch wheatgrass - arrowleaf balsamroot	GNR	S2	Red
Distichlis spicata var. stricta - Puccinellia nuttalliana	alkali saltgrass - Nuttall's alkaligrass	GNR	S1	Red
Festuca campestris - Pseudoroegneria spicata	rough fescue - bluebunch wheatgrass	GNR	S2	Red
Picea engelmannii x glauca - Populus tremuloides / Aralia nudicaulis	hybrid white spruce - trembling aspen / wild sarsaparilla	GNR	S2	Red
Pinus ponderosa - Populus tremuloides / Rosa woodsii	ponderosa pine - trembling aspen / prairie rose	GNR	S1	Red
Pinus ponderosa / Pseudoroegneria spicata - Lupinus sericeus	ponderosa pine / bluebunch wheatgrass - silky lupine	GNR	S2	Red
Pinus ponderosa / Symphoricarpos albus / Poa spp.	ponderosa pine / common snowberry / bluegrasses	GNR	S2	Red
Populus balsamifera ssp. *trichocarpa / Cornus stolonifera - Rosa nutkana*	black cottonwood / red-osier dogwood - Nootka rose	GNR	S1S2	Red
Populus tremuloides - Populus balsamifera ssp. *trichocarpa / Symphoricarpos albus / Equisetum arvense*	trembling aspen - black cottonwood / common snowberry / common horsetail	GNR	S1	Red
Pseudoroegneria spicata - Balsamorhiza sagittata	bluebunch wheatgrass - arrowleaf balsamroot	GNR	S2	Red
Pseudoroegneria spicata - Koeleria macrantha	bluebunch wheatgrass - junegrass	GNR	S2	Red
Pseudotsuga menziesii - Larix occidentalis / Calamagrostis rubescens	Douglas-fir - western larch / pinegrass	GNR	S2	Red
Pseudotsuga menziesii - Pinus ponderosa / Physocarpus malvaceus	Douglas-fir - ponderosa pine / mallow ninebark	GNR	S1	Red
Pseudotsuga menziesii / Mahonia nervosa / Cryptogramma acrostichoides	Douglas-fir / dull Oregon-grape / parsley fern	GNR	S2?	Red
Pseudotsuga menziesii / Symphoricarpos albus / Balsamorhiza sagittata	Douglas-fir / common snowberry / arrowleaf balsamroot	GNR	S2	Red
Scientific Name	**English Name**	**Global Rank**	**Prov Rank**	**BC Status**
Puccinellia nuttalliana - Hordeum jubatum	Nuttall's alkaligrass - foxtail barley	GNR	S2	Red
Purshia tridentata / Pseudoroegneria spicata	antelope-brush / bluebunch wheatgrass	GNR	S2	Red
Symphoricarpos occidentalis / Festuca idahoensis	western snowberry - Idaho fescue	GNR	S2?	Red
Tsuga heterophylla / Symphoricarpos albus	western hemlock / common snowberry	GNR	S2	Red
Tsuga heterophylla / Vaccinium myrtilloides - Paxistima myrsinites	western hemlock / velvet-leaved blueberry - falsebox	GNR	S1	Red

Table 1. Terrestrial animals and plants at risk as identified and managed for by BC Timber Sales Kootenay Business Area

Number	Common name	CDC status	COSEWIC	IWMS
Amphibians				
1	Coeur d'Alene salamander	Blue	Special concern	X
2	Great basin spadefoot	Blue	Threatened	X
3	Northern leopard frog	Red	Endangered	X
4	Rocky Mountain tailed frog	Red	Endangered	X
5	Tiger salamander	Red	Endangered	X
6	Western toad	Yellow	Special Concern	
Reptiles				
7	Gopher snake	Blue	Threatened	X
8	Western rattlesnake	Blue	Threatened	
9	Racer	Blue	Special Concern	
10	Western skink	Blue	Special Concern	
11	Rubber boa	Yellow	Special Concern	
Birds				
12	Burrowing owl	Red	Endangered	X
13	Flammulated owl	Blue	Special Concern	X
14	Lewis' woodpecker	Red	Special Concern	X
15	Long-billed curlew	Blue	Special Concern	X
16	Short-eared owl	Blue	Special Concern	X
17	Western Screech-owl	Red	Endangered	X
18	Western yellow-breasted chat	Red	Endangered	X
19	White-headed woodpecker	Red	Endangered	X
20	Williamson's sapsucker	Red	Endangered	
21	Western grebe	Red	Not listed	
22	American avocet	Red	Not listed	
23	Fosters tern	Red	Data deficient	
24	Great blue heron (*Ardea herodias herodias*)	Blue	Not listed	
Mammals				
25	Badger	Red	Endangered	X
26	Caribou	Red	Threatened	X
27	Fringed myotis	Blue	Data Deficient	X
28	Grizzly bear	Blue	Special Concern	X
29	Wolverine	Blue	Special Concern	X
30	Fisher	Blue	Not Determined	X
31	Least chipmunk (*Neotamias minimus selkirki*)	Red	Not listed	
32	Red tailed chipmunk (*N. ruficaudus ruficaudus*)	Red	Not listed	
33	Northern pocket gopher	Red	Not listed	
Number	**Common name**	**CDC status**	**COSEWIC**	**IWMS**
34	Bighorn sheep	Blue	Not listed	
Butterflies				
35	Dione copper	Red	Not listed	
Dragonflies				
36	Vivid dancer	Red	Not listed	
37	River jewelwing	Red	Not listed	
38	Olive clubtail	Red	Not listed	
Plants				
39	Lemmon's holy fern	Red	Threatened	
40	Southern maiden-hair	Red	Endangered	
41	Spalding's campion	Red	Endangered	
42	Giant helleborine	Blue	Special Concern	

Table 2. Ecological communities at risk as identified and managed for by BC Timber Sales Kootenay Business Area.

Appendix V: Archeological Overview Assessment near Quartz Lake by Wayne Choquette, 2004

Wayne T. Choquette
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Peter Davidson Ecosystems and Range
3247-37st S,
Cranbrook, V1C6Z9

February 3, 2005

Re: Archaeological Field Assessment of proposed ecological restoration in the vicinity of Quartz (Rockbluff) Lake

The following is an archaeological overview assessment of forestry activities proposed to assist in the restoration of open canopy forest adjacent to Quartz (Rockbluff) Lake. The project area was examined in the field on November 10 and December 1, 2004.

Description of Project Area

The project area is situated where the base of the west slope of the Rocky Mountains meets the east side of the Rocky Mountain Trench. The terrain is characterized by the very steep southwest to west slopes of the Hughes Range and more gentle southeasterly to southerly slopes at the south end of Premier Ridge. These two areas are separated by a rock-walled canyon occupied by Quartz Lake and a variety of lower elevation landforms including alluvial and colluvial fans, erosional terraces possibly graded to a proglacial lake, and an expanse of exposed bedrock and very large boulders that are the product of a catastrophic flood which swept through the canyon at some time in the post-glacial past. The lower elevation landforms are not the subject of the presently proposed ecological restoration, which instead focuses on the more densely ingrown sloping terrain above.

Archaeological Potential

The archaeological potential of the project area was mapped as part of Landscape Unit I4 (Choquette 1999) and four polygons (I4-27 - 30) were delineated in the immediate vicinity. These encompass lower elevation landforms, based on models predicting the possible occurrence of evidence of precontact human activity sufficiently intensive as to leave archaeologically detectable remains. Numerous archaeological sites have been recorded in the Premier Ridge locality, including camps, workshops and a quarry on the rock face above Quartz Lake. Small scale excavations in the campground at the

south end of Premier Lake revealed the presence of three discrete archaeological components spanning much of the postglacial period (Choquette 1974a and b, 1986). The earlier two components contained evidence of tool making from stone obtained in the immediate vicinity, from the known quarry and from an as-yet-unlocated but much more heavily used source. The latter is probably in the early Proterozoic Aldridge Formation (Hoy and Carter 1988) which underlies the entire project area in addition to much of the surrounding landscape in this part of the Rocky Mountain Trench.

Two models based on precontact human land and resource use patterns derived from the regional heritage record guided the definition of the polygons in the immediate project area vicinity. These models are related to occupation of the recently deglaciated landscape by Palaeo-Indians prior to about 8000 years ago and to the later focus on the kettle lakes in the vicinity between 6000 and 3000 years ago. In all of the models, the greatest accumulation and variety of material remains would have resulted from the quarrying of stone and early stage tool manufacture and/or from the human domestic activities associated with occupation of temporary camps. Regardless of the time period, human habitation would have tended to be in proximity to reliable water. While none occurs in the area specifically proposed for ecological restoration, both sizeable lakes and perennial watercourses occupy the valley bottoms in the general project area.

In both models, human inhabitation was part of a land/resource use pattern that included resource procurement on the surrounding landscape. Some of the bedrock (quartz, quartzite and siltstone) is well suited for stone tool manufacture and quarrying and tool manufacture are both well represented in the known archaeological sites in this landscape. As mentioned previously, the source of much of the artifactual deposits in the nearby archaeological sites is from a source that has not yet been specifically located; given the presence of the Aldridge Formation, there was a possibility that the source was in the project area although most indications are that it is further north. In addition, the occupants of the nearby sites would have exploited local subsistence resources such as plants and especially ungulates. Deer, mountain sheep and elk would have been present as long as there was vegetation (12,000 or more years). Activities associated with resource procurement and processing also might produce accumulations of material residue amenable to archaeological analysis.

Besides their influence on the integrity of archaeological deposits due to erosion and exposure, topography and slope obviously exerted significant influence on the accumulation of precontact cultural deposits by the influence of gravity on human movement. As much of the project area is very steeply sloping, it would be anticipated that significant archaeological remains would be restricted to level and gently sloping landforms.

Archaeological Impact Assessment

The locations identified in the field as being where thinning, spacing and piling/burning may be carried out were traversed, with a focus on examination of subsurface exposures. The latter consisted of exposed bedrock ledges, deflated areas, game trails and tree throw root balls. No precontact archaeological deposits or features were observed in any of the areas proposed for ecological restoration although one almost completely undisturbed habitation site was found on a terrace in the valley bottom within Archaeological Potential Polygon I4-28, outside the ecological restoration area.

On the basis of these results, *it is concluded that the proposed ecological restoration activities pose no threat to any significant archaeological deposits or features.* It can also be concluded that the absence of stone artifacts is evidence that the unknown lithic source is not within the present project area. Given the presence of habitation sites on lower elevation landforms, it is apparent that the sloping terrain in this locality was largely left to the ungulates for range. Thus the absence of intensive archaeological remains within the project area should not be construed as indicating low importance to the Ktunaxa traditional value system.

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1988 Geology of the Fernie W1/2 Map Sheet. BC Ministry of Energy, Mines and Petroleum Resources Open File Map No. 1988-14.

I trust this meets your present needs. If you have any questions or if you require any further information, please do not hesitate to contact me.

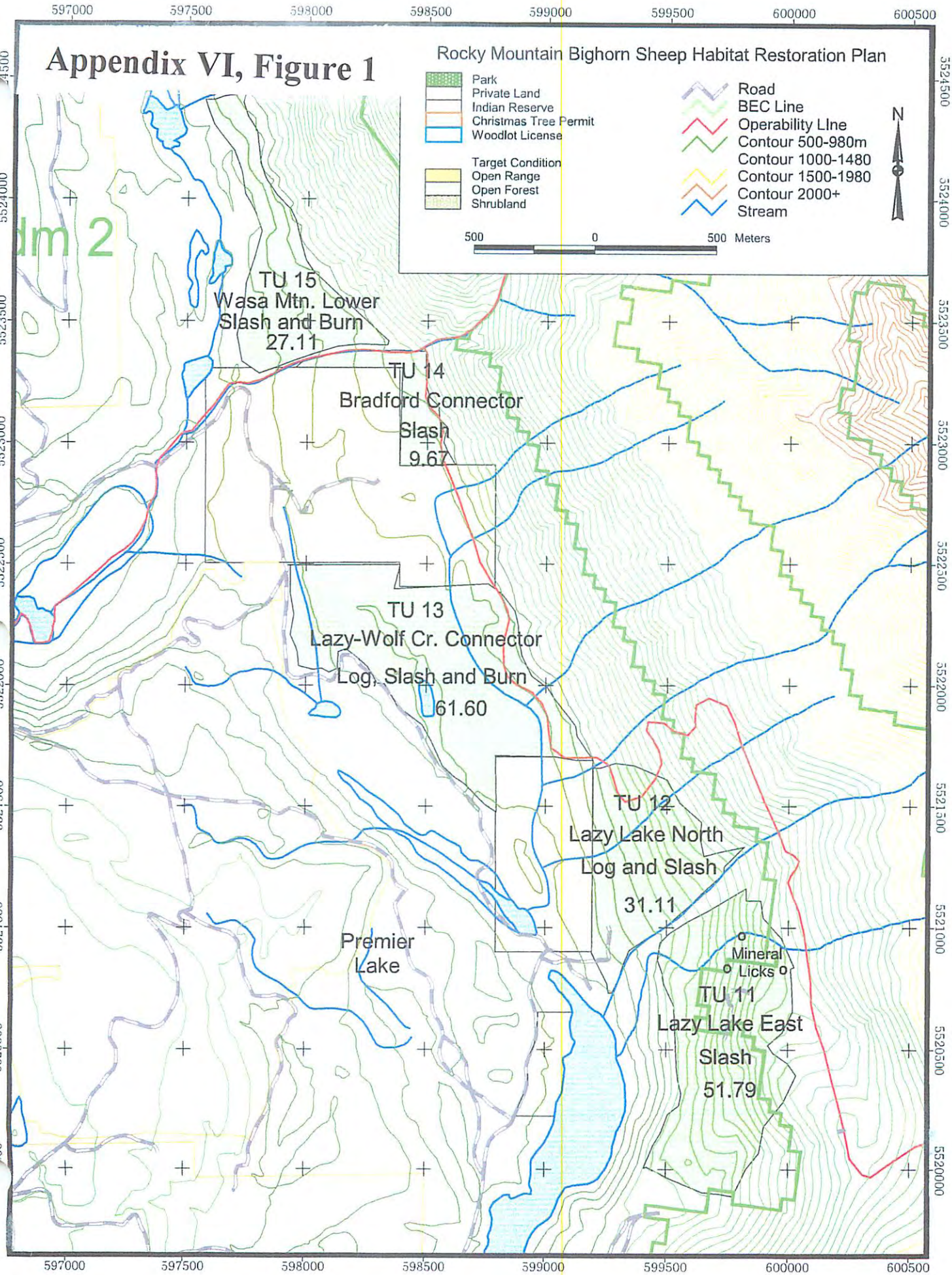
Yours Sincerely,

Wayne Choquette

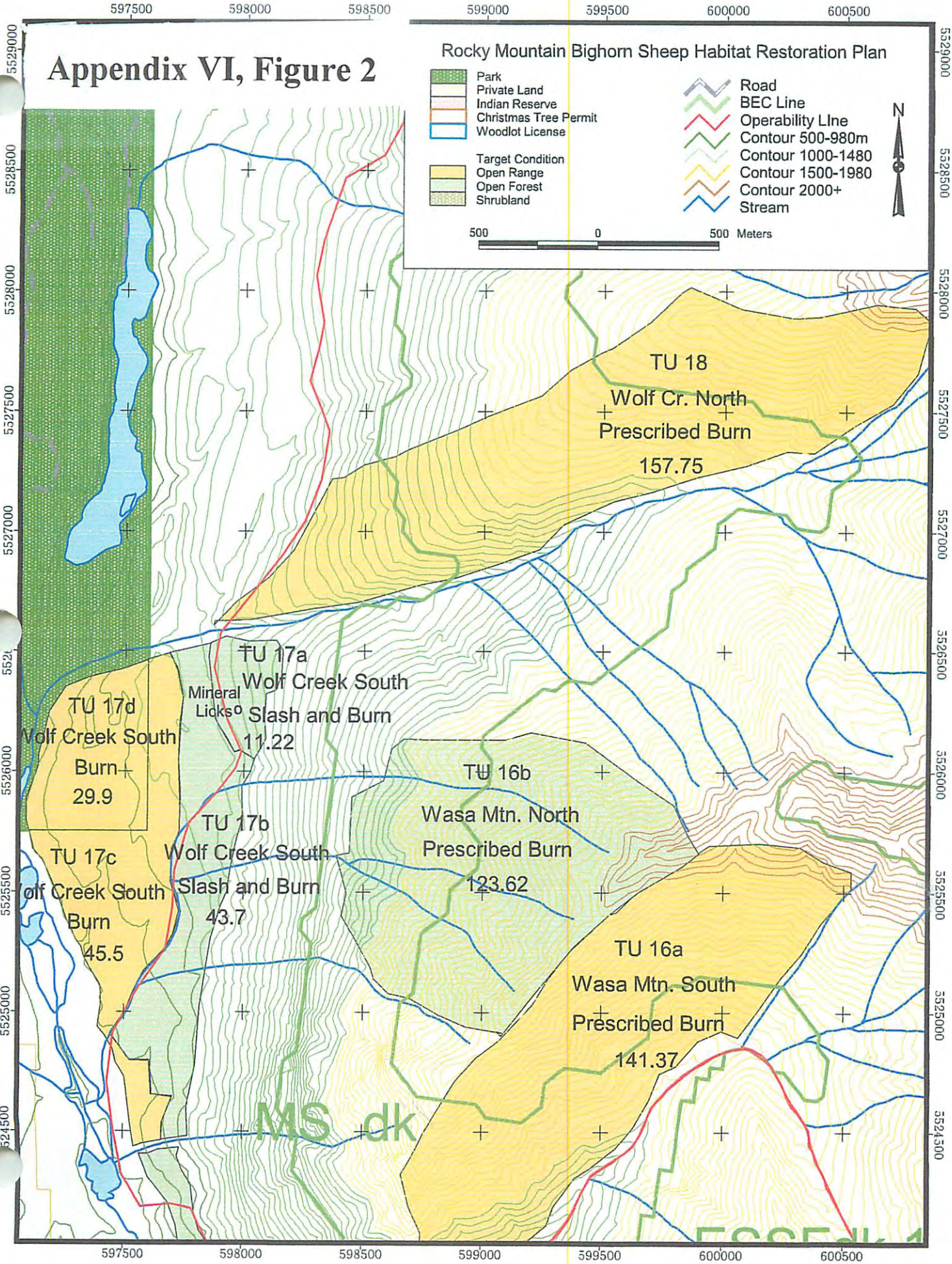
cc. Ray Warden and Robert Williams, Ktunaxa/Kinbasket Treaty Council

Appendix VI: Arcview Mapping of Treatment Areas: Figures 1-9

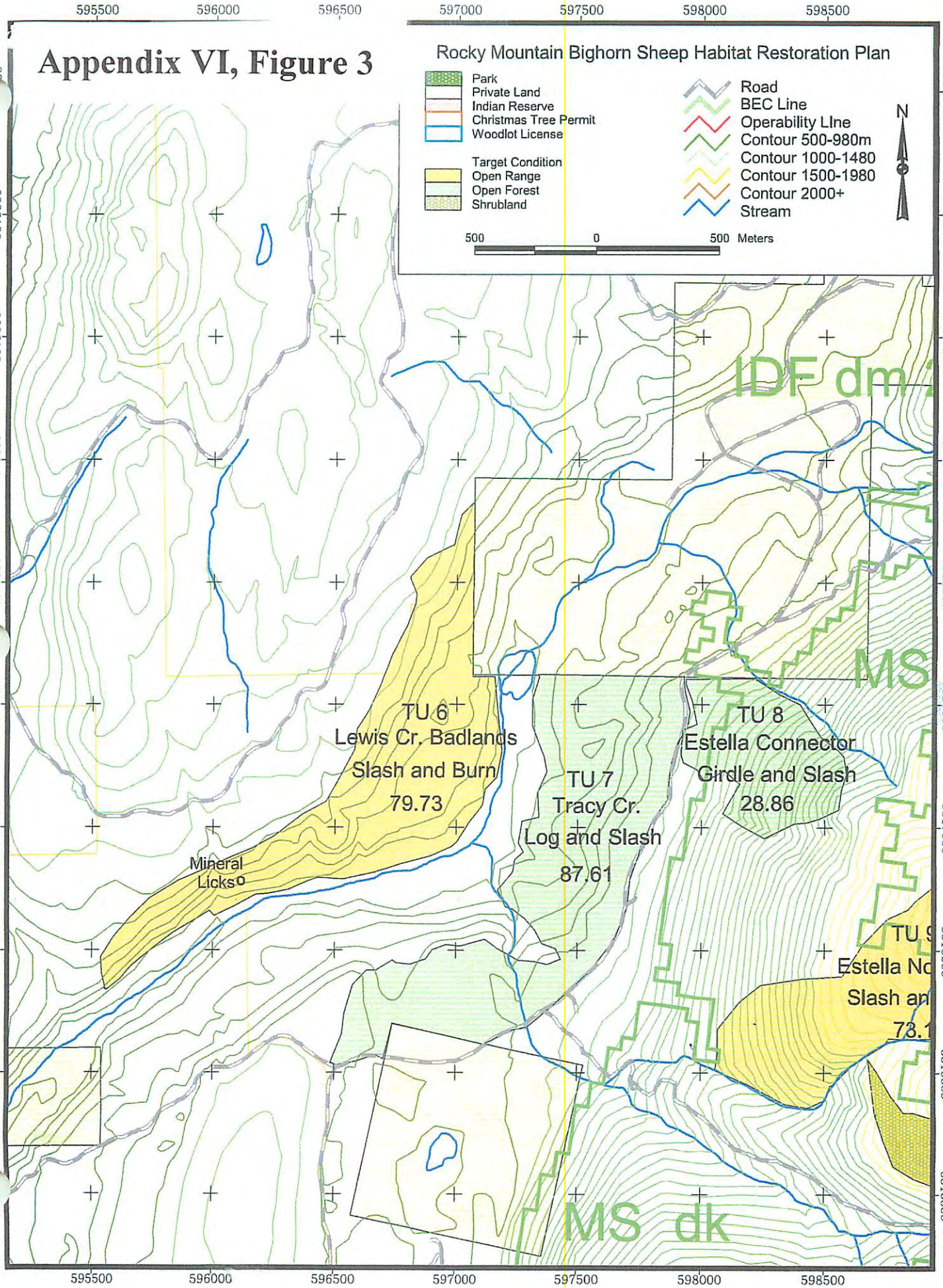
Appendix VI, Figure 1



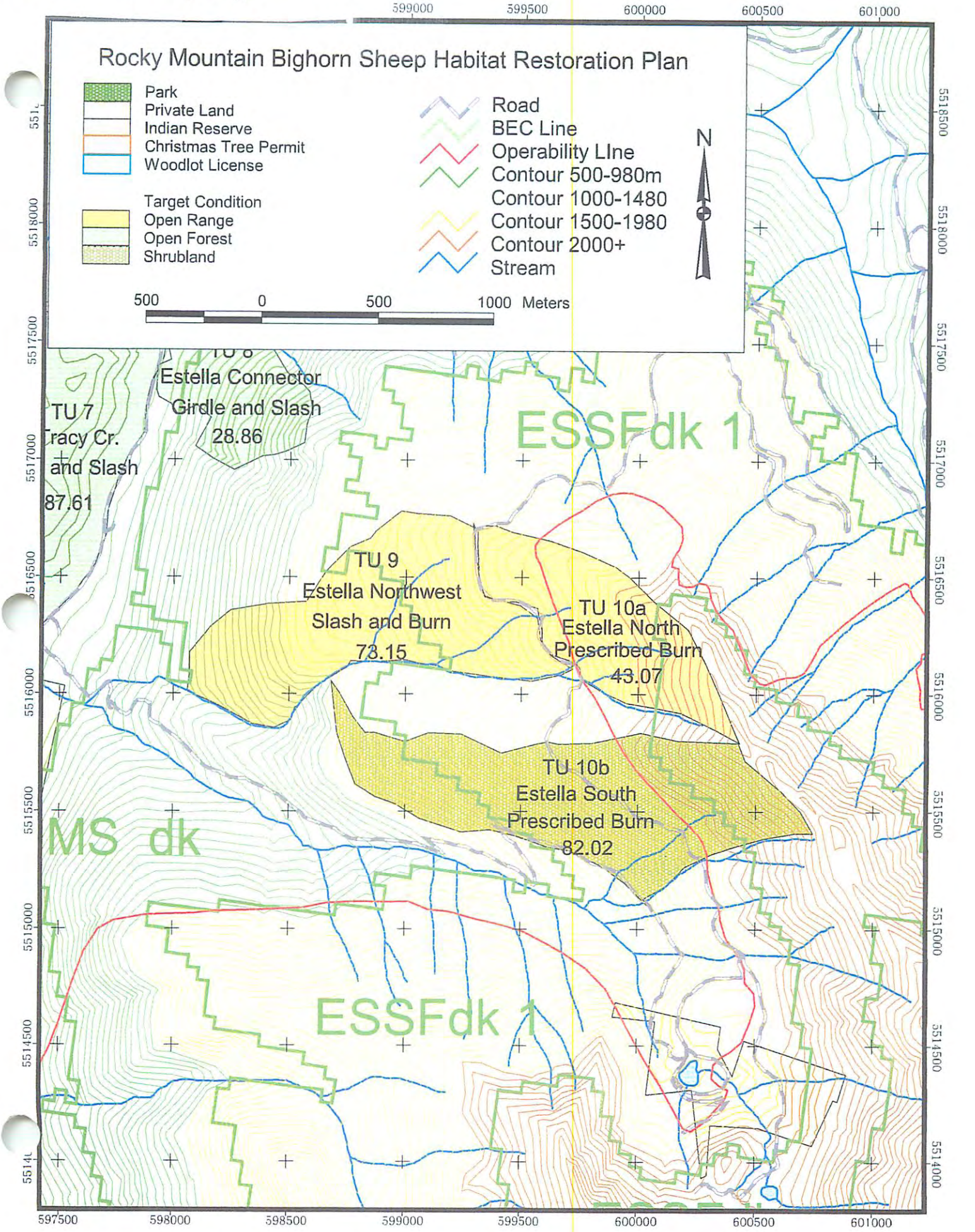
Appendix VI, Figure 2



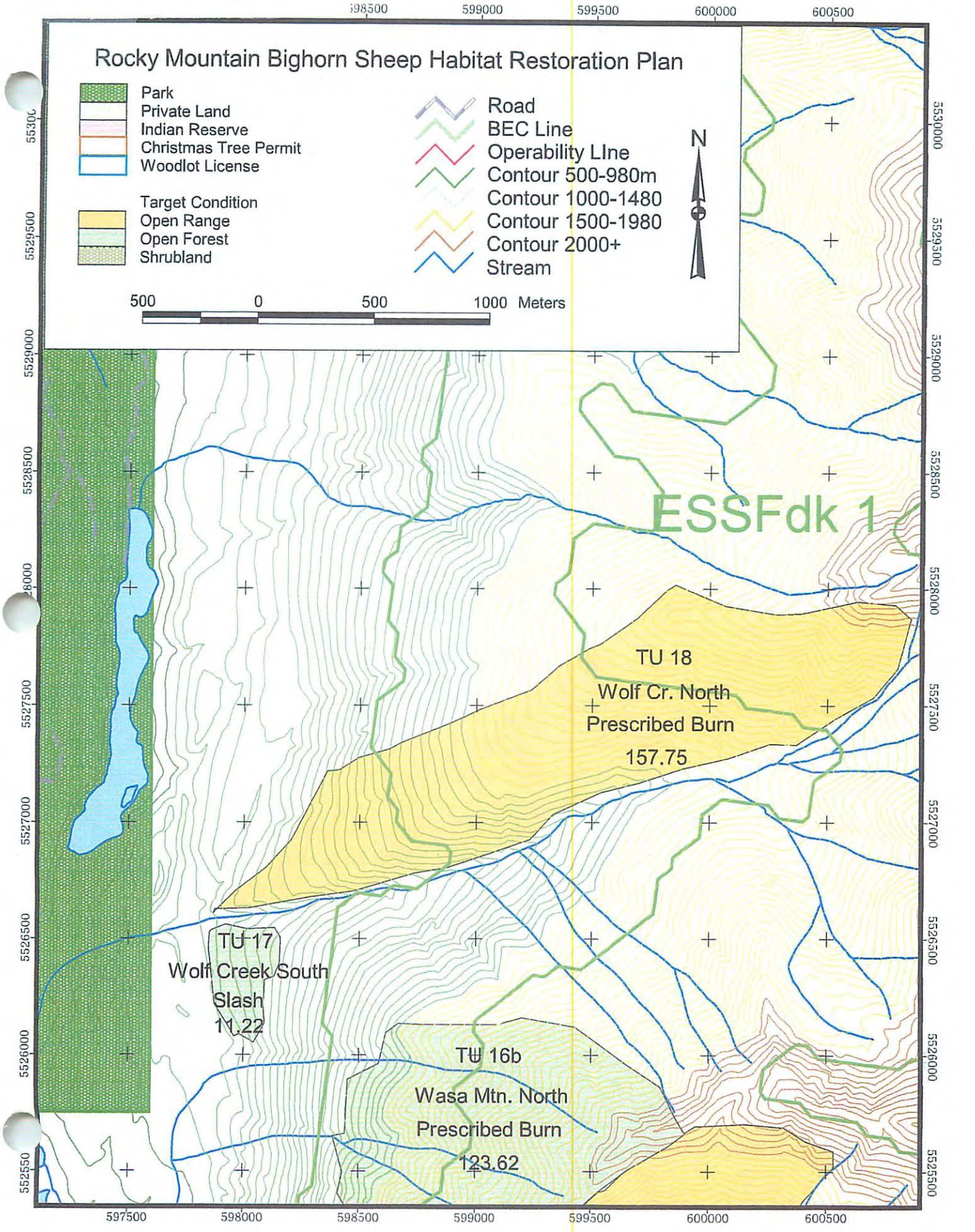
Appendix VI, Figure 3



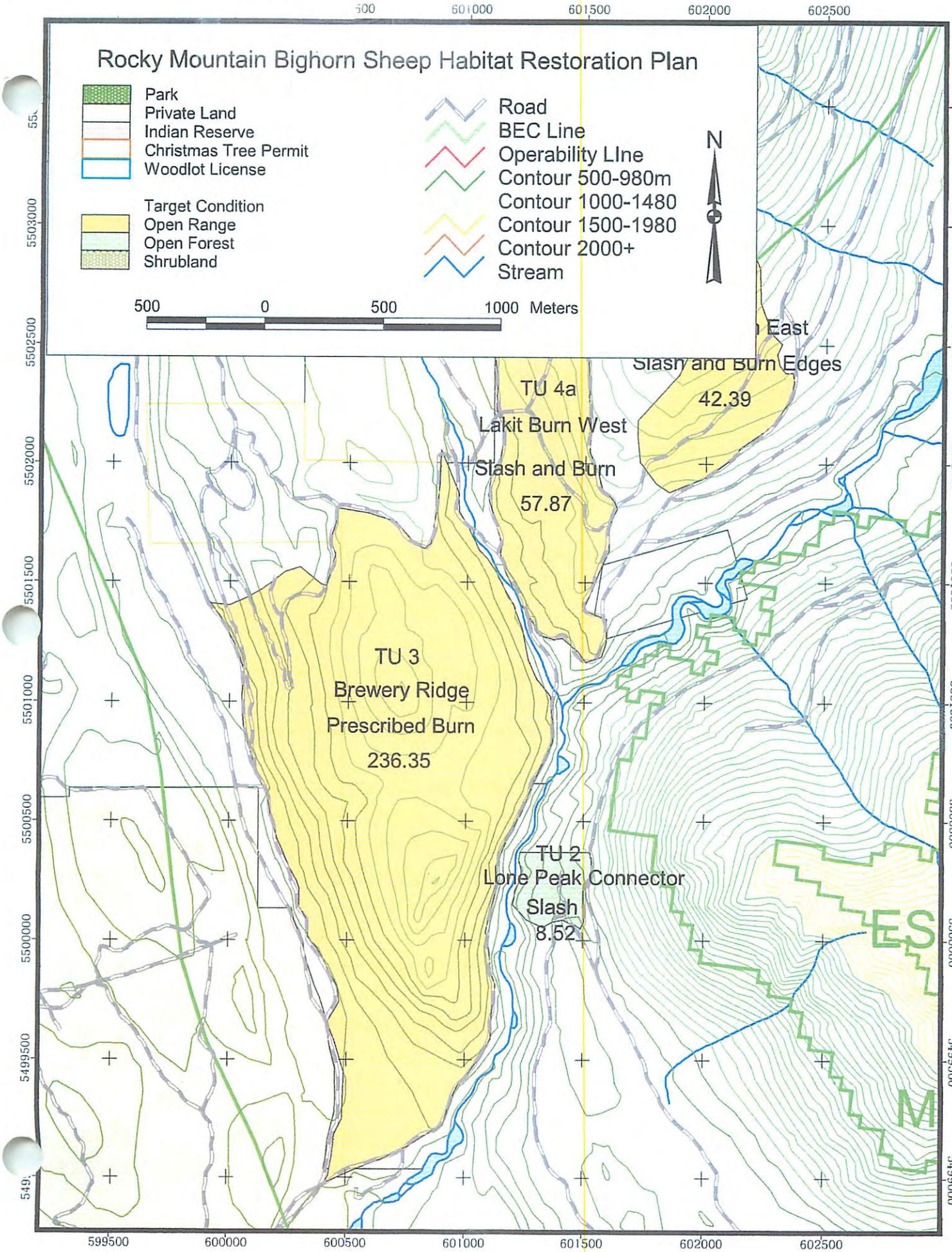
Appendix VI, Figure 4



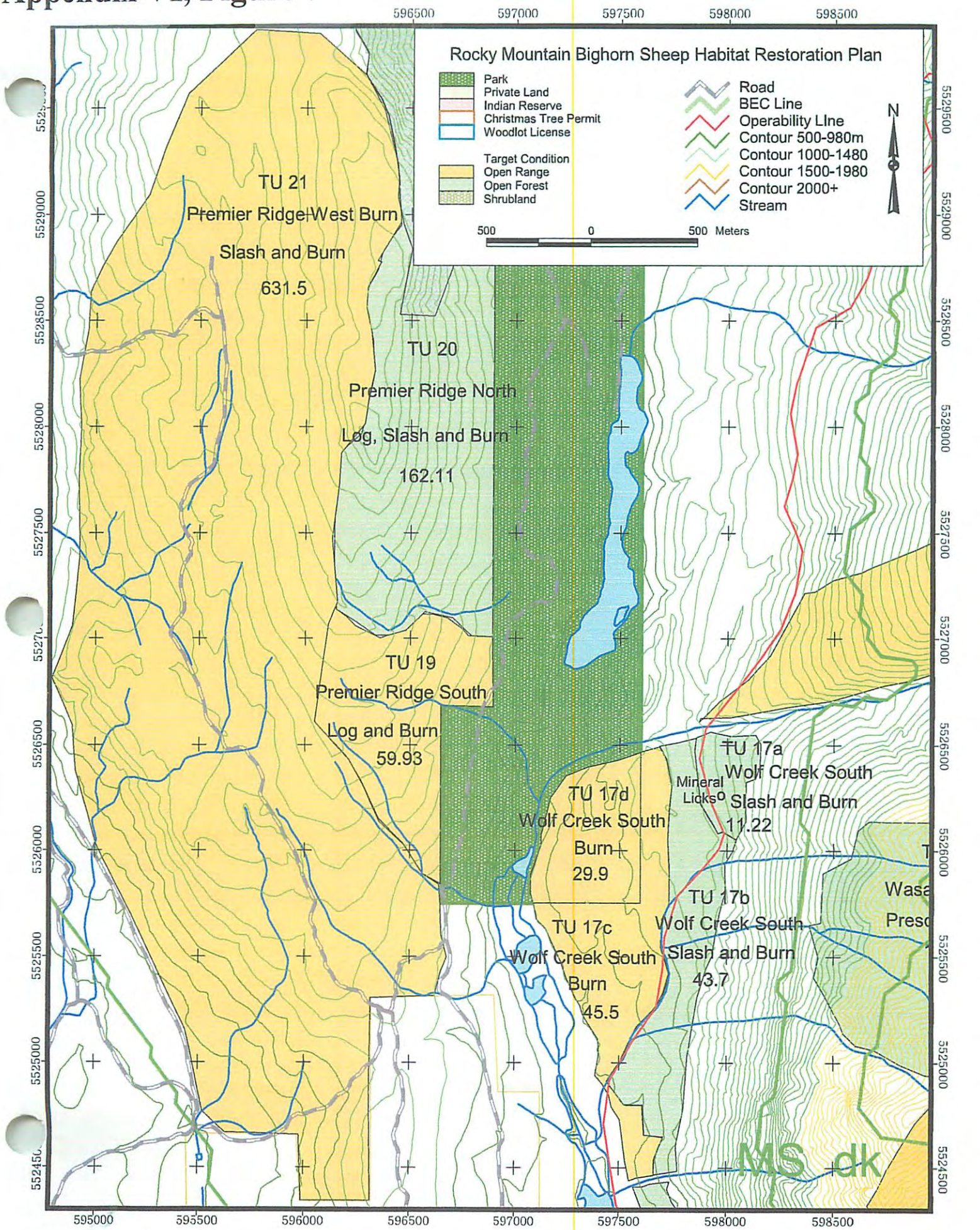
Appendix VI, Figure 5



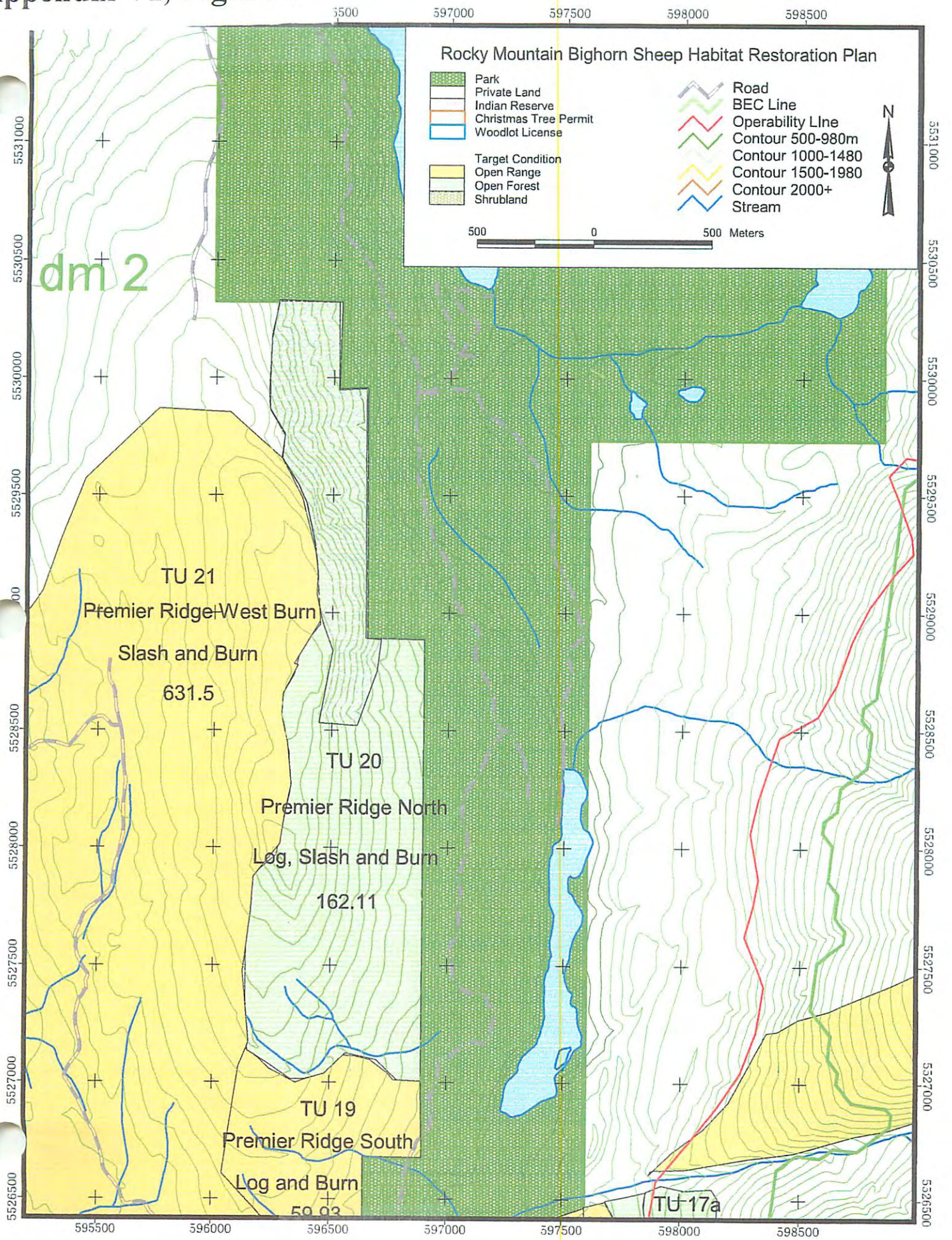
Appendix VI, Figure 6



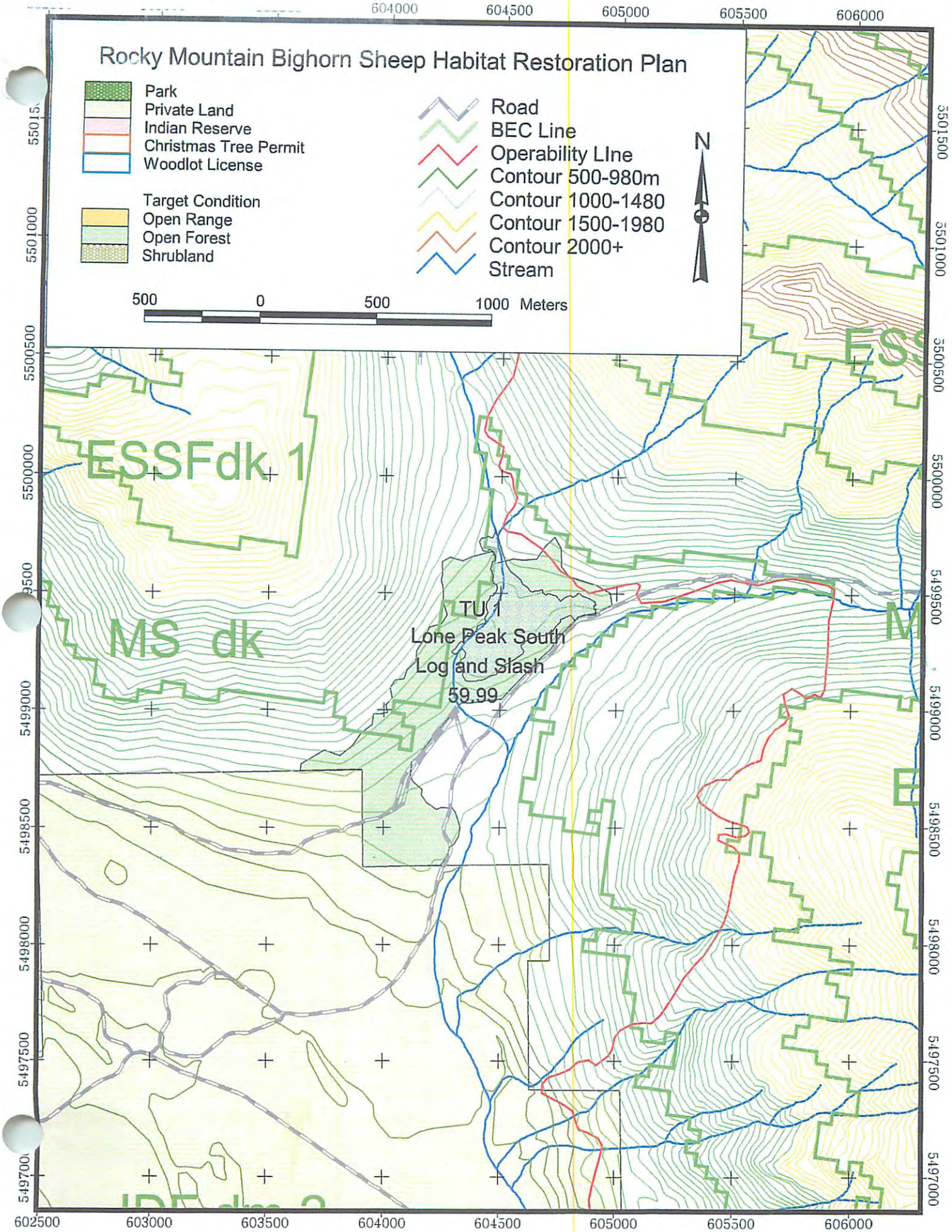
Appendix VI, Figure 7



Appendix VI, Figure 8

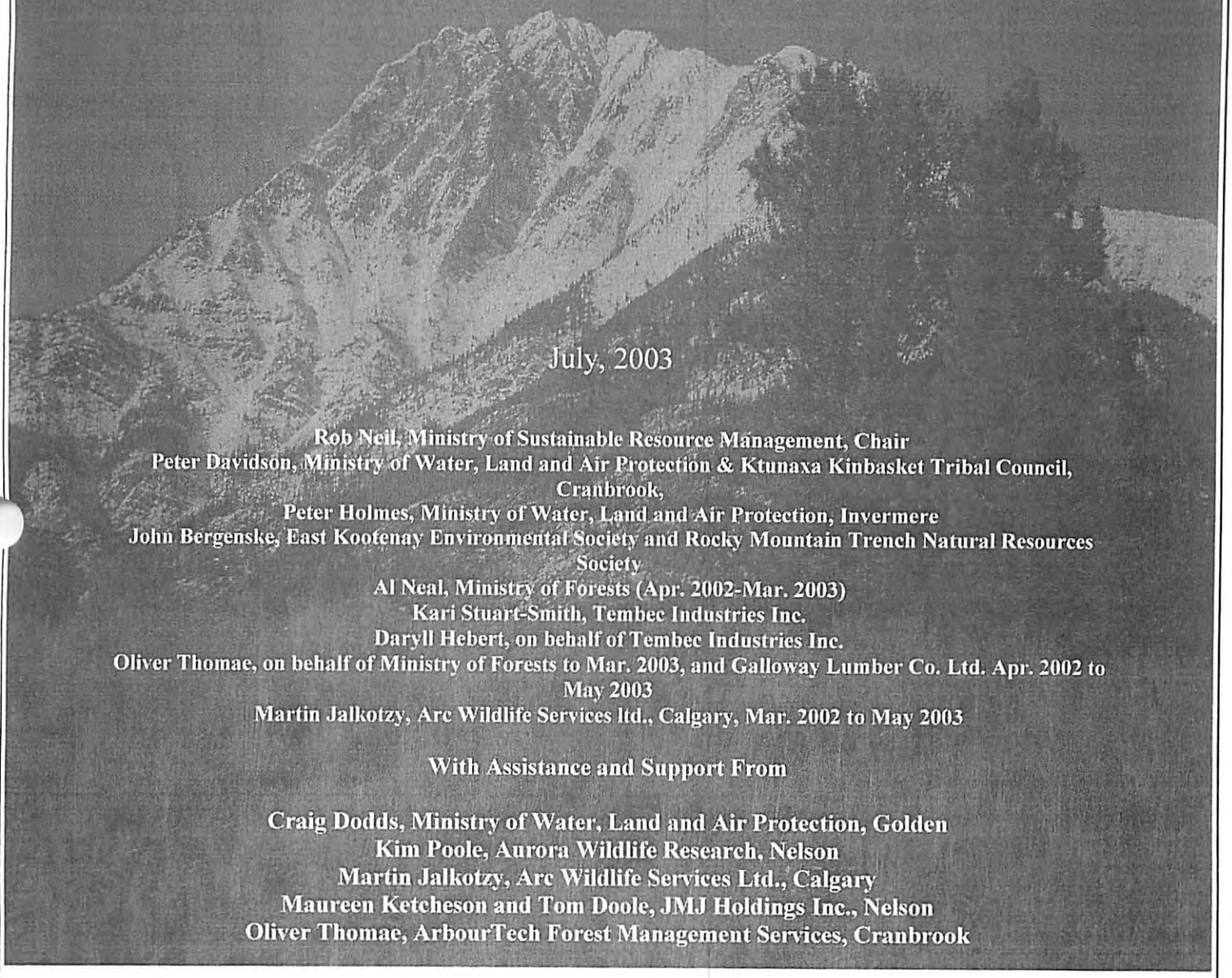


AppendixVI, Figure 9



Appendix VII: Some key pages of the "Report and Recommendations of the East Kootenay Ungulate Winter Range Committee," 2003

Report and Recommendations of the East Kootenay Ungulate Winter Range Committee



July, 2003

Rob Neil, Ministry of Sustainable Resource Management, Chair
Peter Davidson, Ministry of Water, Land and Air Protection & Ktunaxa Kinbasket Tribal Council, Cranbrook,
Peter Holmes, Ministry of Water, Land and Air Protection, Invermere
John Bergenske, East Kootenay Environmental Society and Rocky Mountain Trench Natural Resources Society
Al Neal, Ministry of Forests (Apr. 2002-Mar. 2003)
Kari Stuart-Smith, Tembec Industries Inc.
Daryll Hebert, on behalf of Tembec Industries Inc.
Oliver Thomae, on behalf of Ministry of Forests to Mar. 2003, and Galloway Lumber Co. Ltd. Apr. 2002 to May 2003
Martin Jalkotzy, Arc Wildlife Services ltd., Calgary, Mar. 2002 to May 2003

With Assistance and Support From

Craig Dodds, Ministry of Water, Land and Air Protection, Golden
Kim Poole, Aurora Wildlife Research, Nelson
Martin Jalkotzy, Arc Wildlife Services Ltd., Calgary
Maureen Ketcheson and Tom Doole, JMJ Holdings Inc., Nelson
Oliver Thomae, ArbourTech Forest Management Services, Cranbrook

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Table b. Landscape Level Cover and Forage Objectives for East Kootenay Ungulate Winter Range.

Habitat Type	Ungulate Winter Range Management Objective	Primary Ungulate Species	Landscape Level Minimum Requirement[3]	Cover and Forage Definitions	Comments
Open Range	Promote preferred forage production.	Elk, Bighorn sheep Mule deer Whitetailed deer Mountain goat	Cover N/A See comments. Forage N/A See footnote.	Preferred forage is climax grass and dryland shrub communities.	Cover requirements will be met by adjacent open forest stocking standards and managed forest retention areas.
Open Forest	Promote preferred forage production in understory.	Elk, Bighorn sheep Mule deer White-tailed deer Mountain goat	Cover N/A See comments. Forage N/A See footnote.	Preferred forage is climax grass and dryland shrub communities.	Cover requirements will be met through open forest tree retention requirements and adjacent managed forest retention areas.
Managed Forest (Dry)	Maintain a component of early seral vegetation through time.	Elk Bighorn sheep Mule deer White-tailed deer	Cover 10% Forage 10%	Age ≥100, and Evergreen[4] CC ≥20% , or Layer 1 age ≥ 100 years. ≤30 year-old forest	Applies to mapped dry managed forest. Preference for Fd leading stands is encouraged.
Managed Forest (Transitional)	Maintain a component of early seral vegetation through time.	Moose, Elk Mule deer White-tailed deer	Cover 20% Including up to 10% Forage 10%	Height ≥ 15m, and Evergreen CC ≥40%. ≥100 years Fd, Sx leading ≤30 year-old forest	Applies to mapped transitional managed forest within ungulate winter range. Applies to suitable stands if available.
Managed Forest (Mesic)	Maintain a component of early seral vegetation through time.	Elk Mule deer	Cover 30% Including mature & old 20% Forage 10%	Height ≥ 15m, and Evergreen CC ≥40% ≥100 year-old forest ≤30 year-old forest	Applies to mapped mesic managed forest. Prefer non-Pl leading where available. Partial cut stands with rank 1 layer meeting these specifications can qualify.
Managed Forest (Moist)	Maintain a component of early seral vegetation through time.	Moose	Cover 20% Forage 10%	Height ≥ 15m, and Evergreen CC ≥40% ≤30 year-old forest	Applies to mapped moist managed forest within ungulate winter range.
Managed Forest (Wet)	Maintain a component of early seral vegetation through time.	Moose	Cover 30% Forage 10%	Height ≥ 15m, and Evergreen CC ≥40% ≤30 year-old forest	Applies to mapped wet managed forest within ungulate winter range.
Riparian, Deciduous and Shrub Lands	Maintain high shrub production interspersed with good snow interception cover.	Moose, Elk Mule deer Whitetailed deer	Where ecologically suited, maintain or enhance climax (non-pine) conifer and deciduous forest		Riparian stands meeting cover definition can contribute to managed forest cover objectives.
Avalanche Tracks	Retain cover along high and mod. avalanche zones.	Moose, Elk	Retain all forest within track complexes and 50m of forest outside of complexes[5]. Retain 100m of cover adjacent to both sides of isolated tracks. Maximum harvest 20% of basal area on one side of avalanche track.		
Alpine/ Subalpine	Retain cover along moderate to high capability habitat	Mountain goat	Retain available forested habitat patches adjacent to moderate to high value habitats.		
Alpine Grasslands	Retain cover along moderate to high capability habitat	Bighorn sheep Mountain goat	Retain 100m wide forested habitat cover patches adjacent to moderate to high value habitats.		

[3] Ideally manage for forage targets of 100% on Open Range and Open Forest sites, and at least 20% on managed forest sites. Forage maintenance and enhancement is a multi-jurisdictional responsibility and is not expected to be achieved by forest licensees alone. Licensees, ranchers, government, restoration committees, and other agencies are encourages to collaborate to achieve forage objectives through slashing and burning programs.

[4] Evergreen crown closure means all conifers except larch counted at full relative crown closure; and larch and deciduous at 50% of their relative crown closure.

[5] Avalanche complexes are defined as a series of snow avalanche tracks alternating with strips of forest (>2 tracks/km, or <500m between tracks.

Table C. Stand/Site Level Management Objectives and Stocking Standards for East Kootenay Ungulate Winter Range Management.[6]

Habitat Type	Target Stocking Standard (Stems/ha)	Minimum Stocking Standard (Stems/ha)	Maximum Stocking Standard (Stems/ha)	Species Preference for Residual Trees[7]	Free-Growing Window
Open Range	**20** including 5 of the largest 1/3 of the diameter range	**0** 0	**75** 20 of the largest 1/3 of the diameter range	Favour Py in PPdh2, and Douglas-fir with a component of deciduous trees where available in other BECs.	**0-2** years
Open Forest[8]	**150** including 30 of the largest 1/3 of the diameter range	**76** including 20 of the largest 1/3 of the diameter range	**400** 50 of the largest 1/3 of the diameter range	Favour Py in PPdh2, and Douglas-fir with a component of deciduous trees and Lw where available in other BECs.	**1-3** years
Managed Forest (Dry)	(300, 400, 500), **600** Multi-layered stocking standards	(300, 400, 500), **600** Multi-layered stocking standards	Provincial standards[9]	Favour climax trees, including Lw with a component of decid. trees where available.	**12-20** years; **3** yrs where stocked with L1&2.
Managed Forest (Transitional)	Provincial standards	Provincial standards	Provincial standards[16]	Favour deciduous and groups of climax tree species.	**12-20** years
Managed Forest (Mesic)					
Managed Forest (Moist)					
Managed Forest (Wet)					
Riparian, Deciduous and Shrub Lands	Normal riparian standards. See Best Management Practices	Normal riparian standards See Best Management Practices	Normal riparian standards See Best Management Practices	Favour large crowned Fd, Sx, Act, Cw, Bl	N/A See Best Management Practices
Avalanche Tracks Reserve Zone	N/A	70% of existing stand basal area	N/A	Prefer Sx, Bl retention.	**1-3** years
Alpine/ Subalpine	N/A	N/A	N/A	N/A	N/A
Alpine Grasslands	N/A	N/A	N/A	N/A	N/A

[6] Up to 10% of an operator's plans may deviate from these standards where a suitable rationale is provided and a commitment is made to do a follow-up assessment of the effectiveness of the alternative standards at achieving forage and timber objectives.

[7] Species preference must consider other wildlife, biodiversity, silviculture and forest health factors balanced with these objectives.

[8] These stand targets are based on growth models which indicate that at least one half of site timber potential will be produced, and forage response data that indicate that preferred grass (eg. bluebunch wheatgrass and rough fescue) and browse species (eg. Saskatoon) can be sustained if stands are managed to these levels.

[9] "Management should not exceed the maximum stocking standard. Co-operation among licensees, government, restoration committees and other agencies will be required in circumstances where excess regeneration beyond the maximum is retained on site. Harvest activity should be consistent with ecosystem restoration objectives for that site. It is recognized that more than one entry may be required to achieve long-term objectives. Treatment plans should indicate how long-term objectives will ultimately be achieved.

Table D. Stand/Site Level Tree Retention Best Management Practices for East Kootenay Ungulate Winter Range.

Habitat Type	Intertree Spacing	Tree Layer	Diameter	Target Number[10]	Preferred Height	Layer 1 Tree Characteristics
Open Range	Range 3-500 m (Avg. 22.4m)	1a 1b 2 3 4	>=30 cm dbh >=12.5 cm dbh >7.5-<12.5 cm dbh 1.3 m tall to < 7.5 cm dbh <1.3 m tall	} 5 } 5 10 0	} >=15 m } >5m-10m >1.3m-5m	Retain large crowned veteran trees, and standing dead trees where available.
Open Forest	Range 3-18 m[11] (Avg. 8.8m)	1a 1b 2 3 4	>=30 cm dbh >=12.5 cm dbh >7.5-<12.5 cm dbh 1.3 m tall to < 7.5 cm dbh <1.3 m tall	} 30 } 50 70 0	} >=15 m } >5m-10m >1.3m-5m	Retain large-crowned veteran trees, and standing dead trees where available. Retain tall well-formed trees for future harvesting opportunity.
Managed Forest (Dry)	Range 2-9 m (Avg. 4.4)	1a 1b 2 3 4	>=30 cm dbh >=12.5 cm dbh >7.5-<12.5 cm dbh 1.3 m tall to < 7.5 cm dbh <1.3 m tall	} } 300 400 500 600	} >=15 m } >5m-10m >1.3m-5m	Multi-layered stocking standards apply as described in the Nelson Forest Region, Establishment to Free-Growing guidebook.
Managed Forest (Transitional) **Managed Forest (Mesic)** **Managed Forest (Moist)** **Managed Forest (Wet)**	Normal Practices Apply	N/A	Normal Practices Apply	Normal Practices Apply	Normal Practices Apply	Retain large-crowned veteran trees, and standing dead trees where available.
Riparian, Deciduous and Shrub Lands	Variable	N/A	Promote rejuvenation of deciduous trees and shrubs with scattered wildlife trees where available.	N/A	N/A	Retain large-crowned veteran trees, and standing dead trees where available.
Avalanche Tracks Applies to mod. to high quality tracks only.	N/A	N/A	Prefer greater than 30cm dbh as indicator of crown mass to intercept snow.	N/A	>=15m height	Retain large cover trees along the edges of avalanche tracks.
Alpine/ Subalpine	N/A	N/A		N/A		
Alpine Grasslands	N/A	N/A		N/A		

[10] Surveys: Open Range estimated to have stocking within the prescribed levels may be surveyed using "walkthrough method" but inventory information must be gathered. Open Range over prescribed levels, and Open Forest, should be surveyed using multilayer plot tally, 5.64m radius (1/100ha) plots distributed on uniform 100x100m grid, with optional prism sweep for layer one trees, and estimated heights. Countable height for maximum density will be 1.0cm. Further details may be obtained from the Ministry of Forests.

[11] It is recommended that no more than 2 well-spaced trees be retained within 3m of each other at a time. Uniform spacing maximizes timber production; irregular spacing increases forage production.

Table E. Stand/Site Level Forage Best Management Practices for East Kootenay Ungulate Winter Range.

Habitat Type	Forage Management	Cover Tree Distribution	Treatments	Range Practices
Open Range	Promote healthy climax grassland community.	Vary from small clusters to scattered individual trees. Retain some cover adjacent to high elevation grasslands.	Burn periodically to reduce encroachment and enhance preferred forage. Sustained noxious weed control is required to restore grassland communities. Focus restoration treatments on priority areas where range restoration will achieve maximum benefits. Seed roads and landings with native seed if available to discourage noxious weed invasion and restore forage productivity.	Range stewardship plans and range use plans must be consistent with regulations and should set grazing rotations that maintain health and vigour of climax grasses, and leave late season growth for winter use by ungulates.
Open Forest	Promote healthy climax shrubs, forbs, and grasses.	Some variability is acceptable but tree distribution should ensure all trees can achieve merchantable characteristics in a few decades to facilitate re-entry. Irregular tree distribution will increase forage production.	Focus restoration treatments on priority areas where range restoration will achieve maximum benefits. Slashing to eliminate excess regeneration and poor quality stems is encouraged. Follow up burns may be necessary to eliminate excess regeneration and rejuvenate grass and shrub species such as Saskatoon and ceanothus. Treat noxious weeds to discourage invasion. Seed roads and landings with native seed if available to discourage noxious weed invasion and restore forage productivity.	Range stewardship plans and range use plans must be consistent with regulations and should set grazing rotations that maintain health and vigour of climax grasses, and leave late season growth for winter use by ungulates.
Managed Forest (Dry) **Managed Forest (Transitional)** **Managed Forest (Mesic)** **Managed Forest (Moist)** **Managed Forest (Wet)**	Where considered compatible with regeneration objectives, promote grass and shrub species.	Irregular cover edges along openings are preferred by most ungulates. Use varied wildlife tree retention configurations with patches and scattered single trees. Fd, and Sx are preferred cover tree species. Retain cover along ridges and knolls, adjacent to forage areas, and near riparian zones and seeps where possible.	Juvenile spacing helps to extend forage production. Irregular spacing helps to extend forage production. Slashing decadent shrub species helps to rejuvenate them. Treat noxious weeds to reduce invasion. Cut some deciduous stems to promote suckering.	Range stewardship plans and range use plans must be consistent with regulations and should set grazing rotations that maintain health and vigour of climax grasses, and leave late season growth for winter use by ungulates.
Riparian, Deciduous, Shrublands	Promote dogwood, willow and other ungulate forage species.	Retain or promote stands and scattered clumps of coniferous trees among and adjacent to deciduous and shrub dominated vegetation types. Favour Sx, Cw and Act.	Some coniferous removal, particularly Pl, from riparian habitat is acceptable to promote shrub production.	Maintain natural or create artificial barriers to avoid disruption of riparian habitats by livestock. Select watering sites with minimal soil and vegetation sensitivity.
Avalanche Tracks	Maintained by natural processes	Retain wildlife tree patches and other cover reserves adjacent to avalanche tracks.	On high and moderate rated avalanche tracks, retain forest within track complexes and 50m of cover outside of complexes. Retain 100m of cover adjacent to both sides of isolated tracks.	N/A
Alpine/ Subalpine	N/A	N/A	N/A	N/A
Alpine Grasslands	N/A	N/A	N/A	N/A

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ORDER – UNGULATE WINTER RANGE – U-4-006 - CRANBROOK TSA

The following order applies to the area identified within the attached Schedule A and takes effect on the 10 day of February, 2005.

This order is given under the authority of sections 12(1) and 9(2) of the *Government Actions Regulation* (B.C. Reg. 582/2004).

The Deputy Minister of Water, Land and Air Protection orders that:

1. the ungulate winter range shown in the map set out in the attached Schedule A (#U-4-006) is established;
2. the ungulate winter range shown in the map set out in the attached Schedule A U-4-006, Cranbrook TSA) is established for moose (*Alces alces shirasi*), white-tailed deer (*Odocoileus virginianus ochrourus*), mule deer (*Odocoileus hemionus hemionus*), elk (*Cervus elaphus nelsoni*), bighorn sheep (*Ovis Canadensis canadensis*) and mountain goat (*Oreamnos americanus*);
3. the general wildlife measures outlined in Schedule 1 are established for the ungulate winter range as shown on the attached Schedule A; and
4. pursuant to section 7(3) of the *Forest Planning and Practices Regulation* the person(s) required to prepare a forest stewardship plan are hereby exempted from the obligation to prepare results or strategies in relation to the objective set out in section 7(1) of the *Forest Planning and Practices Regulation* for the winter survival of ungulates in the Cranbrook Timber Supply Area.

Schedule 1 – General Wildlife Measures - Forestry

1. Forest practices carried out within the boundaries of ungulate winter range polygons as shown on Schedule A must result in, as the case may be,
   (i) stand stocking, or
   (ii) retention of forest cover
   that is not less than the forest cover retention requirements that apply as a percentage of the total area of each Habitat Type in a Landscape Unit as:
   (iii) set out in Column 3 of Table 1, and
   (iv) as defined in Column 4 of Table 1.

   Notes:

   (ii) Forest cover retention requirements, in hectares, that apply to the total area of a Habitat Type in a Landscape Unit, are to be determined as set out in Appendix 1 attached to this Order.

2. Forest practices carried out within the boundaries of ungulate winter range polygons as shown on Schedule A must not result in more than 33% of any Managed Forest Habitat Type being less than 21 years in age.

   Note: The maximum area, in hectares, of early seral representation for any Managed Forest Habitat Type is to be determined as set out in Appendix 1 attached to this Order.

3. These General Wildlife Measures do not apply for the purposes of timber salvage to address wildfire or serious forest health issues.

4. These General Wildlife Measures do not apply for the purposes of exploration, development and production activities when these activities have been authorized for purposes of subsurface resource exploration, development or production by the *Mineral Tenure Act*, the *Coal Act*, the *Mines Act*, the *Petroleum and Natural Gas Act*, the *Pipeline Act* or the *Geothermal Resources Act*.

Table 1. Forest Cover Requirements for Ungulate Winter Range

		Column 3	Column 4
Habitat Type	**Ungulate Species**	**Landscape and Stand Level Forest Cover Retention Requirements**	**Definitions that pertain to Forest Cover Retention Requirements**
Open Range	Elk, Bighorn sheep, Mule deer, White-tailed deer, Mountain goat	Stocking standards: 5 – 75 stems/ha	Include 5 – 20 stems/ha of the largest 1/3 of the diameter range
Open Forest	Elk, Bighorn sheep, Mule deer, White-tailed deer, Mountain goat	Stocking standards: 76 – 400 stems/ha	Include 20 – 50 stems/ha of the largest 1/3 of the diameter range
Managed Forest (Dry)	Elk, Bighorn sheep, Mule deer, White-tailed deer	Mature Cover 10% (min)	>100 years and evergreen[1] CC ≥ 20%, or layer 1 age >100 years
		Stocking standards: Multi-layered stocking standards – provincial standard	
Managed Forest (Transitional)	Moose, Elk, Mule deer, White-tailed deer	Snow Interception Cover 10% (min), and	>60 years and evergreen CC ≥ 40%.
		Mature Cover 10% (min)	>100 years, Fd or Sx leading and evergreen CC ≥ 40%
Managed Forest (Mesic)	Elk, Mule deer	Snow Interception Cover 10% (min), and	>60 years, and evergreen CC ≥ 40%
		Mature Cover 20% (min)	>100 years, Fd or Sx leading and evergreen CC ≥ 40%
Managed Forest (Moist)	Moose	Snow Interception Cover 20% (min)	>60 years and evergreen CC ≥ 40%
Managed Forest (Wet)	Moose	Snow Interception Cover 30% (min)	>60 years and evergreen CC ≥ 40%

[1] Evergreen crown closure means all conifers except larch counted at full relative crown closure; and larch and deciduous at 50% of their relative crown closure.

Avalanche Tracks	Moose, Elk	50 m of forest cover adjacent to high value[2] habitat within avalanche tracks.	>60 years old

[2] High value habitat within an avalanche track is defined as an area that is supporting herb or low shrub vegetation communities as defined in the *BC Land Cover Classification Scheme*.

Signed this 10 day of Feb, 2005
Gordon Macatee, Deputy Minister
Ministry of Water, Land and Air Protection

APPENDIX 1

1. The forest cover retention requirements, in hectares, for each Habitat Type in the ungulate winter range polygons of a landscape unit are derived from the sum of the area of a Habitat Type found within all the UWR polygons of the landscape unit.

   For example, if the total area of a Habitat Type in the ungulate winter range of a Landscape Unit is 1000 ha, then the forest cover retention requirement is the prescribed % of that total area as set out and defined in Table 1. If we were considering "Dry Managed Forest" the requirement would be 100 ha. (10% of 1000 ha.).

   Once derived, the forest cover retention requirement is to be applied across UWR polygons in the landscape unit.

   When applied, broad spatial distribution of the required forest cover retention is desirable to maintain a close interspersion of the forest cover to winter forage areas. Distribution is not required to be proportionately applied to each location of the Habitat Type in UWR of a Landscape Unit.

2. The maximum amount of early seral representation, in hectares, for the Managed Forest Habitat Types in the ungulate winter range polygons of a landscape unit are derived from the sum of the area of a Habitat Type found within all the UWR polygons of the landscape unit.

   For example, if the total area of a Managed Forest Habitat Type in the ungulate winter range of a Landscape Unit is 1000 ha, then the maximum amount of early seral representation, in hectares, is the 33% of that total area of that Habitat Type in the polygons of UWR in the Landscape Unit - the amount of early seral representation would be 330 ha. (33% of 1000 ha.).

   Once derived, the maximum early seral amount is to be applied across UWR polygons in the landscape unit.

3. In instances where forest retention requirements are in deficit or early seral representation is exceeded, a person proposing forestry activities may apply for an exemption from the requirement to comply with the applicable General Wildlife Measures. Authority to consider an exemption is provided in section 92(1) of the *Forest Planning and Practices Regulation.*

   A spatially explicit recruitment strategy submitted to the Minister's delegate with a request for exemption will assist in timely consideration of the exemption request, and will inform the conditions, if any, of the exemption that may be granted prior to commencement of forestry activities.

4. Where an area in an ungulate winter range polygon is subject to a field verified ecosystem restoration plan, a person proposing to carry out activities under that field verified ecosystem restoration plan may apply for an exemption from the requirement to comply with the applicable General Wildlife Measures, in as much as the field verified ecosystem restoration plan conflicts with the General Wildlife Measures. Authority to consider an exemption is provided in section 92(1) of the *Forest Planning and Practices Regulation.*

   A copy of the field verified ecosystem restoration plan should be submitted with the exemption request to the Minister's delegate to assist in timely consideration of the exemption request. The plan will inform the conditions, if any, of the exemption that may be granted prior to commencement or continuation of activities consistent with the field verified ecosystem restoration plan.

   Future Ecosystem Restoration Plans should take direction from the stocking standards and cover retention targets in Schedule 1.

5. In instances where field verification of site series determines an area is a different Habitat Type than that shown in Schedule A, the forest retention targets for the Habitat Type determined through site series field verification will apply. The site series associated with each Habitat Type is shown in Table 2. The minimum operational planning scale for field verification is two hectares.

Table 2. Site Series Descriptions for Habitat Types

Habitat Type	Concept Definition	Intended Field Verified Ecosystem Units
Open Range	Lands ecologically suited to production of bunchgrasses and dryland shrub species. Snow accumulations are typically low. (includes existing open range, meadows, cultivated and similar cover classes with </=10% tree crown closure)	PPdh2, 02a, 02b, 01 IDFdm2, un, 02,03; IDFdm2a, un2, 02; MSdk, 02 ICHdm, 02; (& Rock talus sites)
Open Forest	Lands ecologically suited for production of large-crowned open forest with bunchgrasses and dryland shrub species. Snow accumulations are typically light. (typically </=40% tree crown closure, multi-storied stand structure, and low stocking levels)	PPdh2, 03, 04 IDFdm2, un, 01 warm, & neutral <1000m (except in LUs I32, I35 and I38) IDFdm2a, un2, 03 Fd leading MSdk, 03 Fd leading; ICHdw, 02; ICHdm, 03 Fd leading ICHmk1 except Golden, 02; ESSFdk, 02; ICHwk1, 02; ICHvk1, 02
Managed Forest (Dry)	Lands ecologically suited for Fd and/or Py dominated forest. These provide forage values for 1-3 decades during the forest regeneration phase. Stands may also be partial cut to help promote forage. Snow is typically light to moderate.	IDFdm2, un, 01 cool, and neutral >1000m, 04, 05 (except in LUs I32, I35 and I38) Golden ICHmk1 02; ICHmw1 02
Managed Forest (Transitional)	Lands ecologically suited for Douglas-fir climax stands often having a heavy lodgepole pine and larch component. These provide forage for 1-3 decades during the forest regeneration phase. Snowpack is typically light to moderate.	IDFdm2a, un2, 03 Non-Fd leading, 04, 01, 05 IDFdm2 04, 01, 05 in LUs I32, I35 and I38.
Managed Forest (Mesic)	Lands ecologically suited to pine leading stands which provide forage values for 1-3 decades during the forest regeneration phase. Moderate snow accumulations necessitate the retention of cover.	MSdk, 03 Non-Fd leading, 04, 01, 05 where elk, deer capability mapped.
Managed Forest (Moist)	Moist ecosystems providing forage values for 1-3 decades during the forest regeneration phase. Moderate snow necessitates retention of cover.	MSdk, 03 Non-Fd leading, 04, 01, 05 where moose capability only mapped. ICHdw, 01a, 01b, 03, 04; ICHdm, 03 non-Fd leading, 01, 04, 05
Managed Forest	Wetter ecosystems providing forage values for 1-3 decades during the	All other site series not listed above or below in

(Wet)	forest regeneration phase. Moderate to deep snow necessitates retention of cover.	ICHmk1, ESSFdm1, ESSFdm2, ESSFdk, ICHmw1, ESSFmm1, ESSFwm, ICHwk1, ICHvk1 ESSFwc2, ESSFvc

6. All forest stands within the areas identified in Schedule A which are inoperable or constrained for timber harvesting and meet the characteristics described in Table 1, can contribute to meeting these measures. Private land, Christmas tree permits, Federal land and Parks and Protected Areas do not contribute to these measures.

7. Forest age and crown closure are based on the best available information at the time of Forest Stewardship Plan approval, or upon plan extension, the information available when the plan is extended.

8. For purposes of timber harvesting, the maximum stocking standards for Open Range and Open Forest Habitat Types do not apply in instances where high densities of small tree stem sizes make it economically prohibitive to achieve the requirements. However, in these instances reasonable efforts to reduce small stem densities should be undertaken.

9. Up to 10% of the area within an operational plan, within a Landscape Unit, may deviate from the stand level measures for Open Forest to facilitate examination of the response of forage communities to variations in tree stocking. These areas must be identified and reported to the Regional Manager, Environmental Stewardship Division for information purposes.

10. Stand level measures for Open Range and Open Forest Habitat Types do not apply to areas where restoration activities have applied prescribed fire.

11. Partial cut stands can contribute to forest cover requirements for Managed Forest [Transitional and Mesic] Habitat Types if the Rank 1 layer is >60 years old and crown closure is ≥40% and for Managed Forest [Dry] Habitat Type if the Rank 1 layer is >100 years old and crown closure is ≥20%.

12. Within Managed Forest [Moist and Wet] Habitat Types, forest stands meeting the ages specified in Table 1, which have previously been subject to light partial cutting, can contribute to meeting these measures in instances where a Qualified Professional has confirmed through field assessment that these stands have suitable snow interception characteristics. Documentation confirming this field assessment is to include the size and location of these stands and is to be submitted to the Regional Manager, WLAP, Environmental Stewardship Division for information purposes.

13. Forest stands with suitable snow interception characteristics which are younger than the ages prescribed in Table 1 can contribute to meeting these measures in instances where a Qualified Professional has confirmed through field assessment that the younger stands have suitable snow interception characteristics. Documentation confirming this field

assessment is to include the size and location of these stands and is to be submitted to the Regional Manager, WLAP, Environmental Stewardship Division for information purposes.