

**Part II:**

**Environmental Assessment**  
**(Biodiversity / Wildlife / Fisheries)**

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**Summary of Environmental Implications: Base Case vs Recommended Land Use Plan**

ACCOUNT	BASE CASE IMPLICATIONS	LAND USE PLAN vs. BASE CASE
<p><b>Ecosystem Representation &amp; Protected Areas</b></p>	<ul style="list-style-type: none"> <li>• 3.4% of Plan Area in existing parks and government’s “RPAT” proposed Protected Areas (PPAs) provide an additional 6.4%; Base Case thus assumes 9.8% in PAs.</li> <li>• 9 of 15 ecosections and 8 of 16 subzone/variants receive additional representation.</li> <li>• However, sub-boreal spruce (SBS) ecosystems (valley-bottoms) are under represented in the existing and RPAT candidate PAs.</li> </ul>	<ul style="list-style-type: none"> <li>• 13.8% of Plan Area in Protected Areas (additional 10.4% in new parks of which Frog-Gataga comprises 5.3% or 339,012 ha).</li> <li>• 9 of 15 ecosections and 8 of 16 subzone/variants receive additional representation, as in Base Case; <i>Frog-Gataga</i> PPA significantly increases (2.5 times) representation of the KEM ecosection (from 6.2% to 15.6%).</li> <li>• However, other ecosection/subzones receive somewhat less representation (total ha) compared to RPAT PPAs. In particular, SBS ecosystems (valley-bottoms) remain under-represented (i.e., &lt; 5% in PAs)</li> <li>• Relatively large size of <i>Frog-Gataga</i> PPA including its juxtaposition with <i>Denetiah</i> Provincial Park increases natural viability and overall effectiveness of PPA (e.g., maintains natural processes, connectivity).</li> </ul>
<p><b>Biodiversity</b></p> <ul style="list-style-type: none"> <li>• <b>Old Growth</b></li> <li>• <b>Connectivity</b></li> <li>• <b>Red and Blue-Listed Species</b></li> </ul>	<ul style="list-style-type: none"> <li>• Relatively large percentage (48%) of coniferous old growth occurs on the Timber Harvesting Land Base (THLB).</li> <li>• 29% of old growth (THLB) allocated to <i>Enhanced</i> RMZs; 6% to <i>Special Management</i>.</li> <li>• Natural levels of biodiversity to decline over long term as the amount of mature &amp; old coniferous forest declines and human disturbance increases.</li> <li>• Existing management practices (e.g., implementation of <i>Biodiversity Guidebook</i>, <i>Forest Practices Code</i>, IWMS, <i>Environmental Assessment Act</i>) partly reduce the risks.</li> </ul> <p>⇒ <b>Overall Risk: High</b></p>	<ul style="list-style-type: none"> <li>• More old growth (THLB) allocated to <i>Enhanced</i> RMZs (62%); 1 ESSF &amp; 4 SBS biogeoclimatic subzones exceed 50% in <i>Enhanced</i> (Low Biodiversity) RMZs (inconsistent with current FPC LUPG policy direction). However, more old growth is also allocated to <i>Special Management</i> RMZs (13%) vs. Base Case.</li> <li>• Reduced impact to riparian ecosystems due to <i>Special Management</i> designation for key water bodies contained in Ingenika, Nation Lakes, upper Finlay River (Thutade), Lower Akie and Selywn RMZs/subzones.</li> <li>• Management objectives &amp; strategies reduce risks to some red &amp; blue-listed species including songbirds, arctic grayling, &amp; bull trout.</li> <li>• Overall, reduced risks to components of biodiversity in northern RMZs ; however, increased risks to central &amp; southern RMZs due to concentration of <i>Enhanced</i> RMZs</li> </ul> <p>⇒ <b>Risk in northern RMZs: Low-Moderate</b>          ⇒ <b>Risk in central/southern RMZs: High</b></p>
<b>WILDLIFE/FISH</b>		
<p><b>Moose</b></p>	<ul style="list-style-type: none"> <li>• 55% of <i>High</i> suitability moose habitat in <i>General</i> RMZs and another 27% in <i>Enhanced</i> RMZs; loss of mature forest cover and increased road access suggest moderate to high risks in such RMZs.</li> <li>• Omineca winter range (floodplain plus adjacent forests) captured in RPAT <i>Omineca</i> PPA (low risk).</li> <li>• Overall, increased road access from mineral and forest development increase risks over the long term, particularly in southern portion of Plan Area.</li> </ul> <p>⇒ <b>Overall Risk: Moderate-High</b></p>	<ul style="list-style-type: none"> <li>• 11% of <i>High</i> suitability moose habitat in <i>General</i> RMZs and 50% in <i>Enhanced</i> RMZs. Allocation of habitat to <i>Enhanced</i> RMZs suggest increased risks to moose in central and southern portions of Plan Area. However, <i>Special</i> management subzones (e.g., Ingenika) including the Lower Akie designation as a <i>Known Ungulate Winter Range</i> (FPC), partly reduces risks.</li> <li>• Similar to Base Case, Omineca winter range (floodplain plus adjacent forests) captured in <i>Omineca</i> PPA.</li> <li>• Reduced risks to moose habitat situated in northern RMZs due to <i>Frog-Gataga</i> PPA and NORM-MAC/MK designation.</li> <li>• Overall, risks to moose are higher in the south compared to the northern portions of Plan Area.</li> </ul> <p>⇒ <b>Overall Risk: Moderate</b></p>

**Summary of Environmental Implications: Base Case vs Recommended Land Use Plan**  
**(cont.)**

ACCOUNT	BASE CASE IMPLICATIONS	LAND USE PLAN vs. BASE CASE
<b>Grizzly Bear (Blue-listed Identified Wildlife)</b>	<ul style="list-style-type: none"> <li>• 6.2% of high suitability grizzly bear habitat in PAs; another 8.2% in <i>Special</i> RMZs); 82% in <i>General</i> RMZs; 4% in <i>Enhanced</i>.</li> <li>• Although some stand-level management is expected (e.g., WHAs, buffering of avalanche chutes), lack of management direction (e.g., seral stage distributions/ road access) from a FPC <i>Higher Level Plan</i> increases risks to grizzly bears over the long term.</li> </ul> <p>⇒ <b>Overall Risk: High</b></p>	<ul style="list-style-type: none"> <li>• 12.3% of high suitability grizzly bear habitat in PAs; another 44% in relatively low risk RMZs (<i>Wildland/Special</i>); 18% in <i>Enhanced</i> RMZs.</li> <li>• Relatively low risk RMZs (<i>PAs/Wildland/Special</i>) as well as proposed <i>Grizzly Bear Management Strategy</i> provides enhanced protection and reduces risks to grizzly bears, particularly in northern RMZs. However, grizzly bear habitat remains at higher risk in southern portion of Plan Area where <i>Enhanced</i> RMZs are concentrated.</li> </ul> <p>⇒ <b>Overall Risk: Moderate</b></p>
<b>Woodland Caribou</b>	<ul style="list-style-type: none"> <li>• 25% of high suitability caribou habitat in low risk RMZs (<i>Special/PAs</i>); 75% in higher risk RMZs (<i>General/Enhanced</i>).</li> <li>• 59% of caribou habitat that occurs on the THLB is within <i>General/Enhanced</i> RMZs.</li> <li>• <i>Omineca</i> and <i>Chase</i> RPAT PAs provide core protection for Wolverine &amp; Chase Herds, however, low elevation winter ranges remain vulnerable primarily due to lack of management direction from a <i>Higher Level Plan</i>.</li> </ul> <p>⇒ <b>Overall Risk: High-Very High</b></p>	<ul style="list-style-type: none"> <li>• 65% of high suitability caribou habitat in low risk RMZs (<i>PAs/Special/Caribou Management</i>); 35% in higher risk RMZs (<i>General/Enhanced</i>).</li> <li>• 54% of caribou habitat that occurs on the THLB allocated to <i>General/Enhanced</i> RMZs.</li> <li>• Less full protection for Chase and Wolverine Caribou Herds than RPAT PAs.</li> <li>• <i>Caribou Management Strategy</i> (CMS) and area-specific strategies #2 and #3 provide enhanced protection for caribou calving areas and mountain caribou habitat; however, lack of explicit age class objectives for low elevation pine-lichen forests (Strategy #1) suggest terrestrial lichen feeding caribou remain vulnerable to forest development activities, particularly in <i>Klawli</i> RMZ.</li> </ul> <p>⇒ <b>Overall Risk: Moderate-High</b></p>
<b>Fisheries</b>	<ul style="list-style-type: none"> <li>• 8 of 57 Fish Units at risk due to large proportion of watershed allocated to <i>Enhanced</i> RMZs. Most Fish Units expected to have moderate to low impacts.</li> <li>• lacks access management direction</li> </ul> <p>⇒ <b>Overall Risk: Moderate</b></p>	<ul style="list-style-type: none"> <li>• 17 of 57 Fish Units at risk due to large proportion of watershed allocated to <i>Enhanced</i> RMZs. Remaining Units expected to have low-moderate impacts.</li> <li>• Access management strategies beneficial but limited.</li> <li>• Objectives for red &amp; blue listed species (bull trout, Arctic grayling) are beneficial, but concerns remain regarding high amount of <i>Enhanced</i> RMZs in south part of Plan Area.</li> <li>• Significantly greater risks to fisheries values if <i>Omineca</i> and <i>Frog-Gataga</i> PAs are subject to future mining activities (i.e., Jackaroo and Ecstall)</li> <li>• Some potential adverse impacts due to <i>ELUA</i> corridors within proposed PAs if roads are eventually built.</li> <li>• <i>Frog-Gataga PA, Wildland, &amp; Special Management</i> RMZs provide enhanced protection in north portion of Plan Area, which reduces risks vs. the Base Case</li> <li>• Concentration of <i>Enhanced</i> RMZs in central/south portion of Plan Area increases risks vs. the Base Case</li> </ul> <p>⇒ <b>Overall Risk: Moderate</b></p>

# TABLE OF CONTENTS

<b>1.0 INTRODUCTION</b> .....	<b>1</b>
<b>2.0 METHODS</b> .....	<b>1</b>
2.1 ASSUMPTIONS .....	1
2.2 AREA ANALYSIS .....	2
2.3 RISK ASSESSMENT.....	2
<b>3.0 BIODIVERSITY</b> .....	<b>2</b>
3.1 PROTECTED AREAS.....	2
3.2 ECOSYSTEM REPRESENTATION.....	5
<b>Base Case (i.e., without the Land Use Plan)</b> .....	5
<b>Land Use Plan</b> .....	5
3.3 OLD GROWTH AND SERAL STAGE DISTRIBUTION.....	8
<b>Base Case (i.e., without Land Use Plan)</b> .....	8
<b>Land Use Plan</b> .....	8
3.4 RED AND BLUE-LISTED SPECIES.....	10
<b>4.0 WILDLIFE</b> .....	<b>10</b>
4.1 MOOSE .....	10
<b>Base Case (i.e., without Land Use Plan)</b> .....	10
<b>Land Use Plan</b> .....	11
4.2. GRIZZLY BEAR .....	12
<b>Base Case (i.e., without Land Use Plan)</b> .....	12
<b>Land Use Plan</b> .....	12
4.3 WOODLAND CARIBOU .....	15
<b>Base Case (i.e., without Land Use Plan)</b> .....	15
<b>Land Use Plan</b> .....	16
<b>5.0 FISHERIES</b> .....	<b>17</b>
BASE CASE.....	17
LAND USE PLAN.....	17
<b>6.0 ACCESS RELATED ISSUES</b> .....	<b>20</b>
<b>7.0 OVERALL CONCLUSIONS</b> .....	<b>21</b>
<b>8.0 REFERENCES</b> .....	<b>21</b>

## 1.0 Introduction

This section assesses the environmental implications of implementing the *Mackenzie Recommended Land and Resource Management Plan* relative to the Base Case land use regime, and highlights the key differences and similarities between the proposed Plan and the Base Case.

## 2.0 Methods

### 2.1 Assumptions

All assumptions related to the potential impacts of land use changes on the environment including the risks to biodiversity were outlined in the previous assessment of scenarios (October 1999) as well as the Base Case report (September 1999); the key assumptions are contained in Table 1.

**Table 1: Key Assumptions used to Estimate Potential Environmental Land Use Impacts**

- *Consistent with the General Management Direction and the Timber Supply Analysis set out by the Mackenzie LRMP, Special, General and Enhanced Resource Management Zones are assumed to correspond to High, Intermediate and Low Biodiversity Emphasis respectively.*
- *Overall, the more closely that managed forests resemble natural forest conditions, the greater the probability that natural populations of all native species will be maintained. Therefore, risks to biodiversity increase with increasing intensity levels of resource development (i.e., Enhanced RMZs pose relatively higher risks to fish and wildlife habitat and populations than Special Management Zones). Lower Intensity Development RMZ's (e.g., Special Management or High Biodiversity Emphasis) provide more options and opportunities for maintaining native species and ecological processes.*
- *General and Enhanced RMZs assumed to pose the greatest risks to fish and wildlife populations over the long term due to negative cumulative effects from potential mineral and forest development activities (i.e., increased road access, human disturbance, human-animal conflicts, altered seral stage distributions).*
- *All fish/wildlife habitat that occurs on the Timber Harvesting Land Base (THLB) assumed at higher risk than excluded areas due to loss of valley bottom mature/old forest cover, altered seral stage distributions, road access, and increased human disturbance in important seasonal habitats (e.g., caribou and moose winter range, riparian areas). Establishment of Old Growth Management Areas (OGMAs), Wildlife Habitat Areas (WHAs) and Wildlife Tree Retention (WTR) within the THLB assumed to partly reduce the risks.*
- *Enhanced/General RMZs) assumed to have the greatest amount of open (active) roads and therefore considered to pose high risks to fish and wildlife populations (i.e., increased access). Similarly, General or Enhanced Resource Management Zones are assumed to pose the greatest risks to landscape connectivity and population viability due to less forest interior conditions and significantly altered seral stage distributions which can create dispersal barriers (i.e. large amounts of early seral) for some species.*
- *High Metallic Mineral Potential areas assumed to pose moderate risks to environmental values due to increased road access, ground disturbance, potential acid mine drainage and heavy metal leaching as well as increased human disturbance. All mitigation measures and environmental protection standards identified in the Mining Project Review Process and required under the Environmental Assessment Act assumed to partly reduce risks to some environmental values (e.g. water quality).*
- *Access management strategies (e.g., gates, permanent deactivation etc.) assumed to partly mitigate potential long-term adverse effects of increased road access.*
- *Special Management and/or Protected Areas preferred options for managing vulnerable species such as woodland caribou, grizzly bear, mountain goat, Stone's sheep and bull trout.*

## 2.2 Area Analysis

Eight Resource Management Zone (RMZ) categories were used to compare the proposed Land Use Plan to the Base Case including (1) *Existing Protected Areas*, (2) proposed *Protected Areas* (without *Frog-Gataga*), (3) proposed *Frog-Gataga PA* (4) *Wildland RMZs* (5) *Special Management RMZs*, (6) *Caribou Management areas* (strategies #2 and #3 only), (7) *General RMZs*, and (8) *Enhanced/Settlement RMZs*. Three wildlife species were used as resource indicators including woodland caribou, moose, and grizzly bear; all habitat suitability mapping (1:250,000) was provided by BC Environment (Prince George) and additional regional habitat mapping was not available. Fisheries units were used as to estimate impacts to fisheries values.

## 2.3 Risk Assessment

Using quantitative (GIS) area statistics and applying the assumptions, a relative *risk assessment* approach is used to assess the potential impacts of land use designations on environmental values.

**Risk is defined as the probability or likelihood of an adverse event occurring over the short or long term. For the purposes of this assessment, an adverse event or outcome includes such things as a decrease in habitat quantity or quality, increased mortality, altered predator-prey relationships, population declines, or reduced water quality/quantity.**

Potential causal factors that may result in adverse outcomes include timber harvesting, mining, road development and increased human disturbance. In general, risks were assumed to be positively correlated with increasing land use intensity to reflect altered future landscape conditions. A brief rationale supporting each relative risk level is described below. Relative risk levels used to interpret the significance of the RMZ designations to environmental values are shown below (Table 2). Overall, a combination of quantitative area statistics, assumptions, and informed professional judgment were used to assign relative risk levels.

## 3.0 Biodiversity

### 3.1 Protected Areas

The Protected Area Strategy (PAS) is designed to protect large representative examples of natural diversity as well as smaller areas with significant special features. The PAS goal is to increase Protected Areas to 12% of the gross land base within the Province, ideally capturing 12% of each unique ecosystem. However, the provincial goal of protecting 12% of all ecosystems is precluded by over-representation in existing Protected Areas (PAs). Additionally, regional targets vary as a result of other considerations such as internationally or provincially significant wildlife species or provincially rare or unique ecosystems. The Land Use Coordination Office assigned a PA target of 10.8% to the Mackenzie Plan Area (including existing PAs), which is used as a target for ecosystem representation. Prior to the introduction of the PAS, existing parks and ecological reserves comprised approximately 3.4% of the Plan Area. As a result of the PAS initiative, Regional Protected Areas Strategy Teams (RPAT) were designated by government throughout the province and charged with identifying prospective PAs according to the criteria described in the Base Case report (i.e. representativeness, viability, degree of naturalness, diversity, vulnerability, significance). The RPAT proposed PAs were subsequently reviewed and modified by the LRMP process to incorporate local knowledge and

accommodate local values.

**Table 2: Relative Risk Levels used to Estimate Potential Impacts on Environmental Values**

<b>RMZ</b>	<b>Relative Risk Levels</b>	<b>Rationale</b>
<i>Protected Areas</i> (Existing and Proposed)	Very Low- Low	<ul style="list-style-type: none"> <li>Resource development precluded; future conditions anticipated to change the least. i.e., natural levels of biodiversity potentially maintained. Usually unroaded and undisturbed; wilderness values maintained. However, risks can be higher due to surrounding resource development activities (i.e., inadequate buffers).</li> <li>Depending on the size of PA and species of concern, populations expected to remain stable.</li> </ul>
<i>Wildland Management</i>	Low	<ul style="list-style-type: none"> <li>Emphasis on maintaining conservation values; timber harvesting precluded; mineral development allowed with non-roaded access encouraged during mineral exploration.</li> <li>All roaded access for mineral development expected to be temporary.</li> </ul>
<i>Special Management</i>	Low-Moderate	<ul style="list-style-type: none"> <li>Typically, managed to meet <i>High Biodiversity</i> age class objectives; maintains 75% natural mature/old forest cover; Open road network and fragmentation tends to be minimized. <i>Coordinated Access Management Plans</i> generally in place. If managed to meet <i>High BEO</i>, most species expected to remain stable over the short and long term; otherwise, some populations may experience some local declines.</li> </ul>
<i>Caribou Management Strategies #2 &amp; #3</i>	Low-Moderate	<ul style="list-style-type: none"> <li>Forest cover constraints indicate areas will be managed to meet <i>High Biodiversity</i> age class objectives; maintains 75% natural mature/old forest cover. Small patch sizes mimic more closely natural disturbance patterns of wetter ESSF subzones.</li> </ul>
<i>General Resource Management</i>	Moderate-High	<ul style="list-style-type: none"> <li>Typically, managed to meet <i>Intermediate Biodiversity</i> age class objectives; reduced mature and old forest cover (50% natural), increasing road network. Although the intent of this zone is often to balance economic and environmental values - species that require larger tracts of mature and old forest, less human disturbance become increasingly vulnerable. Risks may be very high if enhanced timber production as well as mineral development occurs simultaneously (i.e., cumulative effects).</li> <li>Mature and old-dependent species expected to decline over the long term.</li> </ul>
<i>Enhanced Resource Development/Settlement</i>	High-Very High	<ul style="list-style-type: none"> <li>Generally, the intent of these RMZs are to manage landscape units using a <i>Low Biodiversity Emphasis Option</i> which results in significantly reduced mature and old forest cover (25% natural); open road networks are maximized; reduced forest interior conditions and habitat connectivity. Cumulative impacts from resource development activities (forestry/mining) are high.</li> <li>Species dependent on early seral stages expected to benefit whereas mature and old-dependent species expected to significantly decline over the short-term.</li> </ul>

**Note:** This table should only be considered as a rough guide to relative risk levels. Current management practices (e.g., *Forest Practices Code, Mineral Exploration Code*), lower level planning processes, as well as future management strategies outlined by the Mackenzie LRMP could partly mitigate potential negative impacts to environmental values and therefore, reduce (to some degree) the relative risk level. Similarly, a lack of explicit management strategies within an RMZ would increase relative risk levels.

### 3.2 Ecosystem Representation

In order to estimate accurately the amount of ecosystem representation in existing as well as new Protected Areas, it is necessary to account for areas adjacent to the Mackenzie LRMP that share common biogeoclimatic subzone/variant boundaries (Map 16) and ecosections. This approach provides an indication of the amount of ecosection and subzone/variant representation at the provincial level, and in particular the contribution of the Mackenzie proposed Protected Areas to the provincial total. The amount of each ecosection and subzone/variant in Protected Areas is shown in Tables 3 & 4 for the Base Case and Recommended Land Use Plan.

#### Base Case (i.e., without the Land Use Plan)

The RPAT proposed Protected Areas (PPAs) in the Base Case would provide increased representation in 9 of 15 ecosections and 8 of 16 subzone/variants (Tables 3 & 4). Although these PPAs provide enhanced representation of ATp, ESSF, SWB and BWBS biogeoclimatic zones, all of the sub-boreal spruce (SBS) ecosystems remain under-represented (1-6%). Representation of sub-boreal ecosystems is largely provided in three of the smaller PPAs (*Ed Bird-Estella Lakes*, *Muscovite Lakes*, *Heather-Dina Lakes*). It is important to note, however, that in achieving other PAS objectives such as viability and degree of naturalness, it is difficult to achieve balanced ecosystem representation. The viability of the Base Case PPAs is supported by the fact that all of the Goal 1 PPAs, with the exception of the *Kennedy* PPA, are over 5,000 ha in size, which ensures greater viability compared to a larger number of smaller PPAs. Three large (75,000-156,000 ha) PPAs (*Russel Range*, *Omineca*, *Chase*) comprise most (~84%) of the total proposed Protected Area and each has a high degree of naturalness and viability.

The *Omineca* and *Chase* PPAs significantly increase representation of the *Southern Omineca Mountains* (SOM) and the *Western Muskwa Ranges* (WMR) ecosections (18% and 10% respectively). Although the RPAT PPAs also significantly increase representation of the *Parsnip Trench* (PAT) ecosection from 0 to 4%, this ecosection remains under-represented as well as other sub-boreal forests. Achieving viable representative examples of sub-boreal forest is somewhat constrained by the lack of large undisturbed areas. In general, the ability of PPAs to capture all PAS objectives (i.e. representativeness, special features, wildlife values) is constrained by the 10.8% PA target for the Plan Area, lack of undisturbed areas within the region, and other PPAs put forth by other LRMPs that share common ecosections and biogeoclimatic subzones.

Overall, the Base Case RPAT PPAs represent a balance of management objectives (i.e. recreation, heritage, wildlife, and ecosystem representation). Although some PPAs contribute to over 12% ecosystem representation, some including the *Omineca*, *Chase* and *Russel* PPAs contribute to the protection of wildlife and other key values within the Plan Area.

#### Land Use Plan

The recommended Land Use Plan significantly increases the amount of land allocated to new Protected Areas (660,850 ha) compared to the Base Case (432,685 ha). This increase, however, is largely the result of increasing the size of one PPA (*Frog-Gataga*) from ~28,000 ha (RPAT) to 339,012 ha and decreasing the size of others. As a relatively large park, the *Frog-Gataga* PPA will have a high degree of naturalness and ecological viability compared to other smaller parks. In particular, natural processes such as hydrological processes and predator-prey relationships

**Table 3: Ecoregion Representation (%) in Protected Areas**

<b>Ecoregion</b>	<b>Total amount Provincial (ha)</b>	<b>Total amount in Plan Area (ha)</b>	<b>Base Case Representation (RPAT ha)</b>	<b>Land Use Plan Representation (ha)</b>
CAR	3 012 909	1 757 308	<b>5.8</b> RPAT (140 963)	<b>6.95</b> PPA (137 880) Frog-Gataga (38 887)
WMR	936 240	936 226	<b>14.4</b> RPAT (48 629)	<b>10.6</b> PPA (0) Frog-Gataga (12 787)
SOM	1 051 994	826 765	<b>18.1</b> RPAT (182 743)	<b>14.4</b> PPA (143 869) Frog-Gataga (0)
MIR	768 034	701 349	<b>8.6</b> RPAT (1 608)	<b>8.5</b> PPA (1 504) Frog-Gataga (0)
PAT	399 415	399 425	<b>4.2</b> RPAT (16 322)	<b>2.7</b> PPA (10 145) Frog-Gataga (0)
SBP	2 583 165	343 614	<b>43.0</b> RPAT (0)	<b>43.0</b> PPA (0) Frog-Gataga (0)
MAP	1 094 827	337 907	<b>5.1</b> RPAT (11 247)	<b>4.5</b> PPA (3 855) Frog-Gataga (0)
EMR	1 731 353	317 271	<b>34.7</b> RPAT (978)	<b>39.6</b> PPA (0) Frog-Gataga (85 655)
HAR	1 453 115	199 232	<b>14.2</b> (572)	<b>15.0</b> PPA (11 800) Frog-Gataga (0)
BAU	2 051 065	187 600	<b>2.9</b> RPAT (0)	<b>2.9</b> PPA (0) Frog-Gataga (0)
PEF	666 314	129 901	<b>6.7</b> RPAT (0)	<b>6.7</b> PPA (0) Frog-Gataga (0)
KEM	1 070 833	120 388	<b>6.2</b> RPAT (0)	<b>15.6</b> PPA (0) Frog-Gataga (100 404)
NEL	1 475 637	70 904	<b>3.7</b> RPAT (0)	<b>3.7</b> PPA (0) Frog-Gataga (0)
MCP	659 109	41 619	<b>1.01</b> RPAT (3 159)	<b>0.5</b> PPA (0) Frog-Gataga (0)
ESM	946 118	3 479	<b>8.9</b> RPAT (0)	<b>8.9</b> PPA (0) Frog-Gataga (0)
% of Plan Area (total ha)			<b>9.8</b> Existing (193 768) RPAT (432 685)	<b>13.4</b> Existing (193 768) PPA (321 838) Frog-Gataga (339 012)

\* Base Case percentages include total amount in existing and proposed RPAT Protected Areas. Hectares in brackets represent total RPAT contribution. Scenario percentages represent Mackenzie LRMP contributions + Provincial totals. The difference between the Base Case and Scenario columns represents the sole contribution of Mackenzie LRMP scenarios proposed Protected Areas. Numbers in brackets represent the total amount (ha) proposed by each scenario. Note that PAs in Plan total 13.8%, but GIS data excluded the portion of Kwadacha Park in the Ft. Nelson TSA.

**Table 4: Biogeoclimatic subzone/variant Representation (%) in Protected Areas**

Biogeoclimatic Subzone/Variant	Total amount (ha) Provincial	Total amount (ha) in Plan Area	Base Case Representation	Land Use Plan Representation
ATp	5 634 693	2 061 620	<b>21.3</b> RPAT (79 228)	<b>23.5</b> PPA (73 587) Frog-Gataga (128 721)
SWB mk	1 893 420	1 189 874	<b>16.4</b> RPAT (52 918)	<b>22.6</b> PPA (52 608) Frog-Gataga (113 836)
ESSFmv2	96 053	14 623	<b>4.0</b> RPAT (0)	<b>4.0</b> PPA (0) Frog-Gataga (0)
ESSFmv3	1 166 962	619 997	<b>8.6</b> RPAT (67 073)	<b>7.3</b> PPA (51 842) Frog-Gataga (0)
ESSFmv4	772 437	569 122	<b>10.0</b> RPAT (29 723)	<b>8.2</b> PPA (15 767) Frog-Gataga (0)
ESSFmc	490 796	226	<b>4.6</b> RPAT (0)	<b>4.6</b> PPA (0) Frog-Gataga (0)
ESSFwk2	1 016 144	282 348	<b>10.4</b> RPAT (0)	<b>11.0</b> PPA (6 744) Frog-Gataga (0)
SBSwk1	540 815	9 107	<b>1.07</b> RPAT (0)	<b>1.07</b> PPA (0) Frog-Gataga (0)
SBSwk2	326 817	247 456	<b>4.6</b> RPAT (4 633)	<b>3.8</b> PPA (2 129) Frog-Gataga (0)
SBSmk1	1 318 027	245 148	<b>3.3</b> RPAT (0)	<b>3.3</b> PPA (0) Frog-Gataga (0)
SBSmk2	268 010	386 175	<b>5.9</b> RPAT (15 230)	<b>4.0</b> PPA (10 174) Frog-Gataga (0)
SBSvk	357 551	14 664	<b>3.9</b> RPAT (191)	<b>3.9</b> PPA (149) Frog-Gataga (0)
BWBSdk1	1 195 616	710 077	<b>26.8</b> RPAT (157,226)	<b>30.9</b> PPA (108 837) Frog-Gataga (96 455)
BWBSwk1	18 177	5 578	<b>4.8</b> RPAT (0)	<b>4.8</b> PPA (0) Frog-Gataga (0)
BWBSwk2	35 983	9 921	<b>8.1</b> RPAT (0)	<b>8.1</b> PPA (0) Frog-Gataga (0)
BWBSmw1	37 967	7 052	<b>3.1</b> RPAT (0)	<b>3.1</b> PPA (0) Frog-Gataga (0)
% of Plan Area (total ha) Existing + PPA			<b>9.8</b> Existing (193 768) RPAT (432 685)	<b>13.4</b> Existing (193 768) PPA (321 838) Frog-Gataga (339 012)

\* Total subzone/variant area refers to the total amount that occurs in all ecoregions represented in the Mackenzie Plan Area.\*\* Base Case percentages include the total amount of each variant in *existing* Protected Areas (Mackenzie LRMP + Provincial). Land Use Plan percentages represent Mackenzie LRMP contribution PPA + Provincial. The difference between the Base Case and Land Use Plan column would represent the sole contribution of Mackenzie LRMP *proposed* Protected Areas. Numbers in brackets represent the total amount (ha) proposed .

should be maintained over the long term. To further increase the park's ability to sustain ecological integrity, the *Frog-Gataga* is surrounded by *Wildland* RMZs (*Frog, Braid, Upper Gataga, Bluff Creek*) and is also contiguous with another PA to the northwest of the Plan Area (*Denetiah*). These features reduce the amount of industrial disturbance including potential negative cumulative effects in areas immediately adjacent and increase the overall effectiveness of the *Frog-Gataga* PPA. Because the PPA also captures a significant amount of riparian floodplain habitat (*Frog, Gataga and Kechika Rivers*), its overall biodiversity value is relatively high. Despite these positive features of the *Frog-Gataga* PPA, there are three *Environment and Land Use Act (ELUA)* corridors proposed which have the potential to increase risks to wilderness and wildlife values. Although there is great uncertainty regarding whether as well as when access through the park would occur, these corridors have the potential to diminish the character of the park as well increase risks to wildlife populations.

In terms of representation, the *Frog-Gataga* significantly increases representation of the Kechika Mountains Ecoregion (KEM) from 6.2% in the Base Case to 15.6% (Table 3) and increases representation of three biogeoclimatic subzones including the ATp, SWBmk and BWBSdk1. Although these subzones are well represented provincially (from other ecoregions), they are captured mostly from the KEM ecoregion which is somewhat under-represented at 6.2%. Similar to the Base Case, the Plan provides increased representation in 9 of 15 ecoregions and 8 of 16 biogeoclimatic subzone/variants. However, the total amount of area (ha) is reduced in some instances (e.g., WMR, SOM) and increased in others (see Tables 3 & 4). The Plan also proposes three Goal 2 PAs including *Ed Bird-Estella Lakes, Ospika Cones* and *Heather Dina Lakes*. Together these PPAs capture regionally significant cultural, recreational and natural features (e.g., tufa formations).

### **3.3 Old Growth and Seral Stage Distribution**

#### **Base Case (i.e., without Land Use Plan)**

Almost half (48%) of the old growth coniferous forests within the Mackenzie Plan Area, occur on the timber harvesting land base (Table 5). In the Base Case, the majority of old growth is allocated to *General* (59%) and *Enhanced* (29%) RMZs. These RMZ designations combined with the projected age class distributions (TSR I & this analysis) suggest species wholly or partly dependent on old growth coniferous forests (e.g., marten) are at moderately high risk over the long term. Although inoperable areas (e.g., forested exclusions) may provide suitable habitat for some old growth dependent species and partly mitigate the decline of old growth on the timber harvesting landbase, the overall reduction in old growth availability suggests these species will occur at lower densities over time.

#### **Land Use Plan**

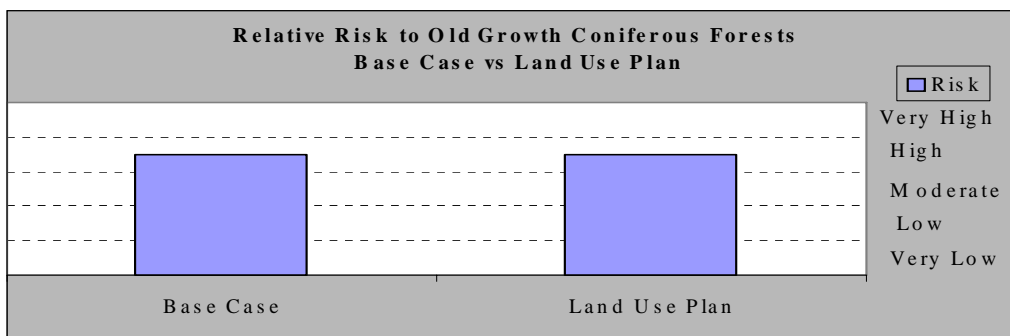
Although the Plan increases the amount of old growth allocated to *Special Management* from 6% to 13%, the Land Use Plan also proposes to allocate about twice as much old growth (THLB) to *Enhanced Resource Management* (61.6%) compared to 28.9% in the Base Case (Table 5). This suggests plant and animal species dependent on old growth will be at higher risk in specific portions of the Plan Area due to the increased rate of harvesting of mature and old forests (e.g. *Lower Akie, Buffalohead, Osilinka* RMZs).

**Table 5: Breakdown of Old Growth Coniferous Forests by RMZ Category**

Resource Management Zone Category	Base Case		Land Use Plan	
	% GLB	% THLB	% GLB	% THLB
<i>Existing Protected Areas</i>	NA	NA	NA	NA
<i>Proposed Protected Areas</i>	8.4	6.2	5.3	4.4
<i>Frog-Gataga PPA</i>			5.3	2.4
<i>Wildland RMZs</i>	N/A	N/A	4.8	1.3
<i>Special RMZs</i>	7.3	6.2	17.5	13.0
<i>Caribou Management # 2/3</i>	0	0	0.6	0.8
<i>General RMZs</i>	62.2	58.6	15.0	16.6
<i>Enhanced RMZs/(Settlement)</i>	21.8 (0.11)	28.9 (0.2)	51.5	61.6
Total Old Growth %	100	100	100	100

NA = not available; GLB Gross land base (total old growth coniferous = 280,078 ha) and THLB = timber harvesting land base (total = 133,794 ha) \* 133,794/280,078 = 47.8% of old growth occurs in THLB

In addition, the *Enhanced* RMZs include management direction that allows 1/3 drawdowns of mature and old forest (*Mackenzie Recommended LRMP*, p. 85). Because the *FPC Landscape Unit Planning Guide* policy is to allow only old forest to be drawn down, the Plan recommendation further increases the risk to mature and old forests. Although the biodiversity management guidelines outlined in the *General Management Direction* provides direction to maintain old growth attributes, the relatively large amount of old coniferous forests allocated to *Enhanced* RMZs suggests old growth attributes will be maintained at relatively low levels on the THLB. In fact, five subzone/variants exceed the *Biodiversity GuideBook* (1995) recommendation of allocating no more than 50% of a subzone to Low Biodiversity Emphasis (i.e., the *Enhanced* RMZs). These include: the ESSFmv3 (58.5%); SBSmk1 (84.8%); SBSmk2 (82%); SBSwk1 (96.5%) and the SBSwk2 (61.6%). This concentration of *Enhanced* RMZs in the central and southern portions of the Plan Area suggests species dependent on mature/old forests are at increased risk over the short and medium term. Stand level biodiversity is also at higher risk vs. the Base Case due to the Plan’s recommendation that proposes reduced wildlife tree retention targets. Overall, the reallocation of old growth forests from *General* to *Special* and *Enhanced* RMZs indicates both positive and negative impacts. Although the risks posed are higher in the south compared to the north, considering the whole Plan Area, the Land Use Plan is estimated to pose similarly high risks to old growth forests as the Base Case (Figure 1).



**Fig. 1: Ranking of the Base Case and Land Use Plan according to their relative risks to old growth.**

### 3.4 Red and Blue-Listed Species

The *General Management Direction* provides objectives and strategies to maintain or enhance habitat for species at risk (red and blue-listed) as well as regionally important wildlife species (yellow-listed). Although some habitat protection would likely occur as part of the *Identified Wildlife Management Strategy* (IWMS), these provisions provide greater certainty that certain species will be adequately addressed during landscape and stand level planning.

## 4.0 Wildlife

### 4.1 Moose

#### Base Case (i.e., without Land Use Plan)

The Base Case outlook for moose indicates that high suitability moose habitat is at moderate to high risk due to the relatively large proportion allocated to *General* (55%) and *Enhanced* RMZs (27%) (Table 6).

**Table 6: Breakdown of High Suitability Moose Habitat by RMZ Category**

Resource Management Zone Category	Base Case		Land Use Plan	
	% GLB	% THLB	% GLB	% THLB
<i>Existing Protected Areas</i>	0.06	0	0.1	0.0
<i>Proposed Protected Areas*</i>	13.7	11.2	13.9	10.9
<i>Frog-Gataga PPA</i>			6.7	3.2
<i>Wildland RMZs</i>	N/A	N/A	0.0	0.0
<i>Special RMZs</i>	1.9	1.4	18.8	14.3
<i>Caribou Management # 2/3</i>	0	0	0.2	0.2
<i>General RMZs</i>	54.8	52.8	10.8	13.4
<i>Enhanced RMZs/(Settlement)</i>	27.1 (2.5)	32.9 (1.7)	49.6	58.0
Total Moose Habitat**	100	100	100	100

GLB = Gross Land Base; THLB = Timber Harvesting Land Base. \* includes all proposed PAs except *Frog-Gataga*: \*\* Total moose habitat GLB = 156,400 ha; Total Moose habitat THLB =51,357 ha; 51,357/156,400 = 32.8 % of High suitability moose habitat occurs on the THLB.

Because these RMZ categories, especially *Enhanced*, were assumed to result in the greatest amount of resource development, both moose habitat quality and quantity in these RMZs were estimated to decline over time as mature forest cover in valley bottoms became limiting and road access increased. In particular, high suitability moose habitat is at highest risk in the southern portion of the Plan Area, including the *Blackwater*, *Philip* and *Misinchinka* RMZs. The *Enhanced/General* designations of these RMZs combined with the Low Biodiversity emphasis (interim) assigned to these areas indicate mature forest cover required to maintain winter range values may become limiting over time (i.e., 11-13% mature/old may be insufficient).

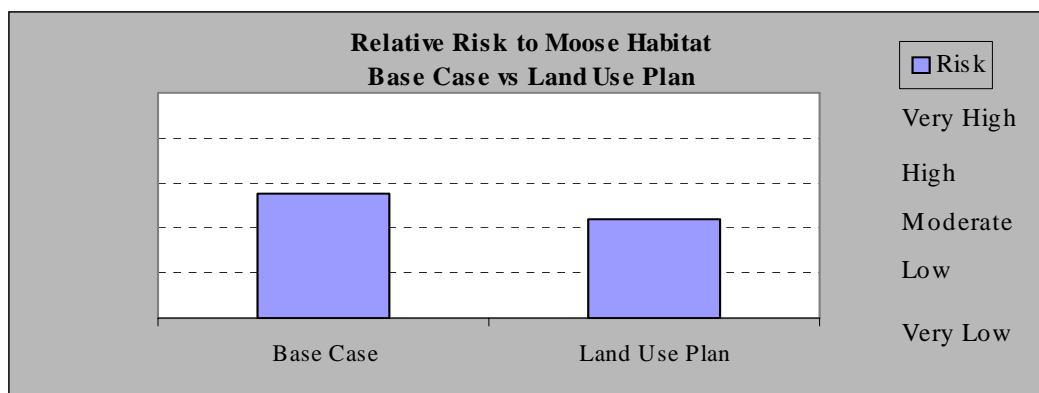
## Land Use Plan

The Land Use Plan provides an additional 6.9% of moose habitat in PAs (majority from the Frog-Gataga PPA) compared to the Base Case (Table 6). In addition, the Land Use Plan increases the amount of moose habitat allocated to *Special* RMZs from 2% in the Base Case to 19%. Although these are considered positive measures, the Land Use Plan also doubles the amount of moose habitat allocated to *Enhanced* RMZs from 27% to 50% (Table 6). This percentage is larger if one considers the amount of high suitability moose habitat that occurs on the THLB (58%; Table 6).

Therefore there are some offsetting effects that suggests moose will likely benefit in portions of the Plan Area (e.g., South Omineca, northern RMZs), but may be at higher risks in central and southern portions of the Plan Area. Although *Enhanced* RMZs will substantially increase the availability of forage in the short term (< 20 years, depending on vegetation management), it also suggests habitat quality/quantity will decline over the mid to long term as these forests reach mid seral stages and more mature forest cover is harvested. In addition, more road development will provide increased access into high value moose habitat areas increasing hunting pressure.

Although the LRMP *Objectives and Strategies* recommend managing seral stage distributions to maintain moose habitat over the long term, appropriate seral stage targets may not be attainable in some *Enhanced* RMZs. Therefore, moose habitat quality is expected to decline, particularly in the southern portions of the Plan Area where the *Enhanced* RMZ are concentrated. To reduce the potential negative impacts of increased road access and loss of mature forest cover, the Plan recommends that certain high value moose areas be designated as special management subzones (e.g., *Osilinka Valley, North Omineca, Ingenika*). These areas will partly mitigate potential adverse effects by maintaining more appropriate seral stage distributions. In addition, the recommendation to establish a *Known Ungulate Winter Range* (section 69, FPC) for the *Lower Akie* subzone also reduces the risks to moose in this *Enhanced* RMZ.

Overall, the area analysis and the *Objective and Strategies* proposed by the Mackenzie LRMP suggest the Recommended Land Use Plan poses somewhat lower risks (i.e., moderate) to moose compared to the Base Case (Figure 2).



**Fig. 2: Ranking of the Base Case and Land Use Plan according to their relative risks to moose.**

## 4.2. Grizzly Bear

### Base Case (i.e., without Land Use Plan)

The relatively large amount of habitat (82%) allocated to *General* RMZs as well as the lack of explicit access management strategies are the primary reasons grizzly bears are at moderate to high risk in the Base Case. Moreover, only about 14% of high suitability grizzly bear habitat (Map 17) is in RMZs that pose relatively low risks (i.e. PAs/Special RMZs) (Table 7). Although there would likely be some stand level management implemented as part of the Base Case (e.g., maintaining forest cover adjacent to avalanche chutes), overall, the lack of FPC *Higher Level Plan* recommendations suggests grizzly bears remain vulnerable to resource development activities over the short and long term. The degree to which grizzly bear management objectives may be established as part of landscape unit planning processes remains uncertain.

### Land Use Plan

The *Grizzly Bear Management Strategy* (GBMS) developed by the Mackenzie LRMP addresses many of the concerns associated with grizzly bear survival and mortality risks. Overall, the Land Use Plan provides management direction necessary to maintain key grizzly bear habitats. In particular, the intent to identify and establish *Wildlife Habitat Areas* provides stand-level direction required to protect critical seasonal habitats (e.g., spring foraging areas, avalanche chutes). Also, the consideration to establish Grizzly Bear Management Areas (GBMAs) indicates there is a potential FPC *Higher Level Plan* recommendation made by the Land Use Plan if the need to create “no hunting” zones arises.

Although the Mackenzie GBMS does not explicitly provide FPC *Higher Level Plan* recommendations as outlined in the *Identified Wildlife Management Strategy* (IWMS) (e.g., seral stage objectives), it does recognize road access as a key risk factor to grizzly bears, and recommends access control points in some key RMZs (e.g., Akie).

The GIS area analysis indicated that the Plan reduces the risks to grizzly bears by allocating more habitat to lower risk RMZs. In particular, the Plan increases the amount of grizzly bear habitat (including critical spring habitat) allocated to PAs (6%) and *Special Management* RMZs (22%) which represents a modest increase compared to the Base Case (Table 7). In addition, another 22% of high suitability grizzly bear habitat is allocated to *Wildland* RMZs. Because these zones preclude commercial timber harvesting, they pose fewer cumulative industrial impacts. Despite these positive shifts in resource management emphasis, the Plan also increases the amount of high suitability grizzly bear habitat allocated to *Enhanced* RMZs to 18% from 4% in the Base Case and because these RMZs are concentrated in the southern portion of the Plan Area, grizzly bears will be at somewhat higher risk there. The GBMS, however, may partly mitigate the potential adverse effects of increased resource development in those southern RMZs.

In contrast, the distribution of *Special* RMZs together with the proposed *Northern Mackenzie Access Management Area* (NMAMA) as well as the large Frog-Gataga PPA suggests the risks to grizzly bears are relatively low in the northern RMZs. These RMZ designations suggest grizzly bear habitat will be maintained in a more natural condition and key mortality risk factors (e.g.,

roads, human-conflict) will be minimized. As such, the Land Use Plan is estimated to pose less risk (moderate) to grizzly bears compared to the Base Case (High) (Fig. 3).

**Table 7: Breakdown of High Suitability & Spring Grizzly Bear Habitat by RMZ Category**

Resource Management Zone Category	High Suitability Habitat			
	Base Case		Land Use Plan	
	% GLB	% THLB	% GLB	% THLB
Existing Protected Areas	2.7	0	2.7	0
Proposed Protected Areas	3.5	3.5	1.6	1.8
Frog-Gataga PPA			8.0	1.8
Wildland RMZs			22.3	5.3
Special RMZs	8.2	7.4	21.7	20.6
Caribou Management # 2/3	0	0	5.1	9.4
General RMZs	82.0	88.8	21.0	32.2
Enhanced RMZs/(Settlement)	3.6 (0.03)	0.4 (0.07)	17.7	28.7
Total High Habitat *	100	100	100	100

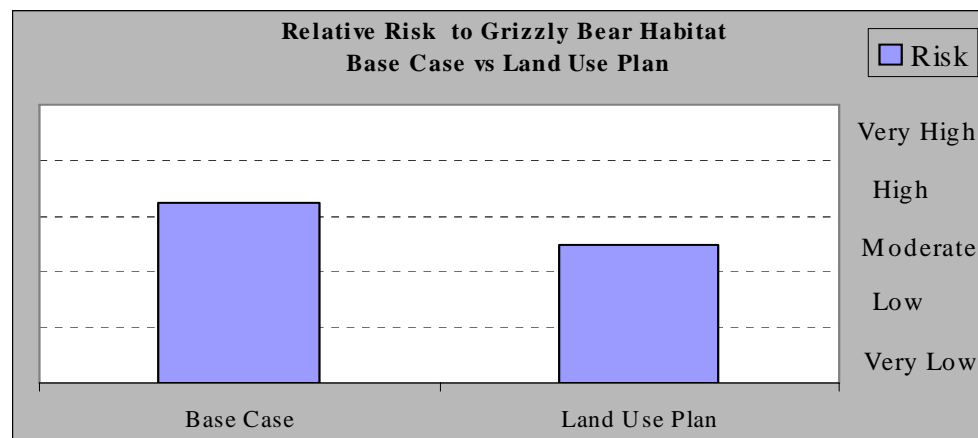
  

Resource Management Zone	Spring Habitat			
	Base Case		Land Use Plan	
	% GLB	% THLB	% GLB	% THLB
Existing Protected Areas	0	0	0	0
Proposed Protected Areas	12.0	9.7	13.2	9.7
Frog-Gataga PPA			8.6	4.6
Wildland RMZs			3.5	2.1
Special RMZs	12.0	7.6	23.5	17.1
Caribou Management # 2/3	0	0	1.3	2.2
General RMZs	64.8	70.1	12.7	18.0
Enhanced RMZs/(Settlement)	10.5 (0.6)	12.8 (0.5)	37.1	46.2
Total Spring Habitat*	100	100	100	100

Total high suitability grizzly bear habitat = 2,210,087 ha (GLB); 286,976 ha (THLB) THLB/GLB = 13%

\*Total spring grizzly bear habitat = 117,245 ha (GLB); 34,769 ha (THLB) THLB/GLB = 29.6%

**Fig. 3: Ranking of Base Case and Land Use Plan according to their relative risks to grizzly bears.**



### 4.3 Woodland Caribou

#### Base Case (i.e., without Land Use Plan)

The allocation of caribou habitat (Map 18) to predominately *General* and *Enhanced* RMZs as well as a lack of explicit management direction from an FPC *Higher Level Plan* are the primary reasons the Base Case poses high to very high risks to caribou. Although the RPAT proposed PAs and *Special* RMZs (total of 25%) provide adequate protection for portions of the Chase and Wolverine Herds, 75% of the high suitability caribou remain in *General* and *Enhanced* RMZs (Table 8), which are considered to pose relatively high risks primarily due to incompatible seral stage distributions. Furthermore, additional management direction is needed to adequately reduce the risks in critical low elevation winter ranges (e.g., Klawli early winter range).

**Table 8: Breakdown of High Suitability Caribou Habitat and Known Caribou Corridors by RMZ Category**

Resource Management Zone Category	High Suitability Caribou Habitat			
	Base Case		Land Use Plan	
	% GLB	% THLB	% GLB	% THLB
<i>Existing Protected Areas</i>	3.4	0	3.4	0.0
<i>Proposed Protected Areas</i>	13.9	21.3	11.0	15.3
<i>Frog-Gataga PPA</i>			0.5	0.1
<i>Wildland RMZs</i>	N/A	N/A	11.5	1.0
<i>Special RMZs</i>	7.3	19.2	34.0	19.3
<i>Caribou Management # 2</i>	0	0	2.7	4.0
<i>Caribou Management # 3</i>	0	0	3.2	5.5
<i>General RMZs</i>	34.6	48.0	14.2	30.6
<i>Enhanced RMZs/(Settlement)</i>	40.6 (0.14)	11.2 (0.3)	19.6	24.1
Total High Habitat	100	100	100	100
	<b>Caribou Corridors</b>			
Resource Management Zone Category	Base Case		Land Use Plan	
	% GLB	% THLB	% GLB	% THLB
<i>Existing Protected Areas</i>	0	0	0	0
<i>Proposed Protected Areas</i>	5.2	16.0	3.4	9.1
<i>Frog-Gataga PPA</i>			0.0	0.0
<i>Wildland RMZs</i>	N/A	N/A	65.9	12.1
<i>Special RMZs</i>	66.4	13.6	5.9	18.9
<i>Caribou Management # 2</i>	0	0	0.5	1.6
<i>Caribou Management # 3</i>	0	0	0.0	0.0
<i>General RMZs</i>	28.4	70.4	9.1	29.2
<i>Enhanced RMZs/(Settlement)</i>	0 (0.2)	0	15.2	29.2
Total Corridor Habitat	100	100	100	100

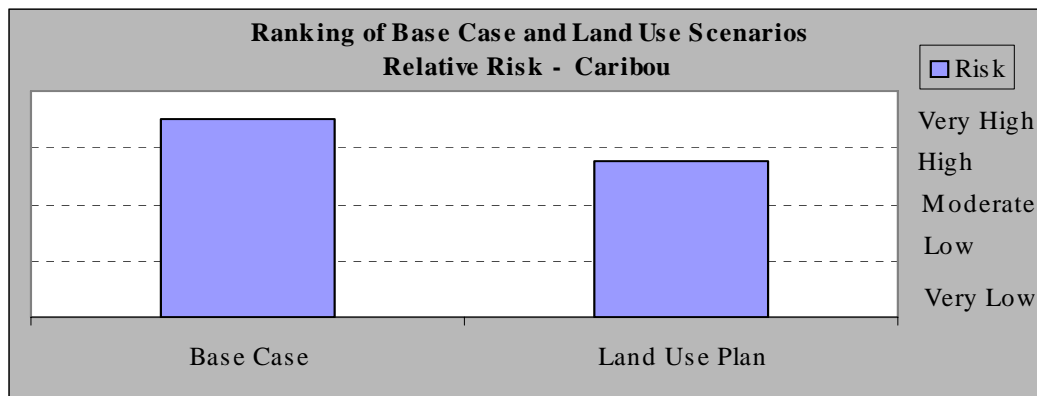
Total Caribou High habitat = 1,351,007 ha (GLB); total (THLB) = 151,159 ha; THLB/GLB = 151,159/1,351,007 = 11.2 %;  
 Total Corridor habitat = 39,295 ha; total (THLB) = 6 055 ha; THLB/GLB = 6055/39,295 ha = 15.4%

## Land Use Plan

The recommended Land Use Plan proposes to implement a *Caribou Management Strategy* (CMS) designed to maintain caribou populations throughout the Mackenzie Plan Area. The CMS was reviewed during the last assessment of scenarios (October 1999), which concluded that the strategies generally contained positive habitat protection measures required to integrate caribou habitat and forest development. However, the report also expressed concern regarding area specific Strategy # 1 (large patch) and a lack of explicit forest age class objectives. Because the CMS has not been revised, those concerns remain. In particular, designating the *Klawli* RMZ as *General* suggests increased risk to caribou in that area over the short and long term. To mitigate potential negative impacts, the recommended joint approval sub-zones in this RMZ (and others) as well as the establishment of the Caribou Biologists Technical Committee may provide new information and innovative solutions to this habitat supply issue.

The GIS area analysis also suggests some offsetting effects by implementing the Land Use Plan. Although the amount of Gross Land Base in the Plan Area allocated to *General* and *Enhanced* RMZs is reduced, the amount of caribou habitat that occurs on the THLB in these zones remains similar to the Base Case (54% vs 59% total, Table 8).

This is largely due to reallocating northern RMZs to *Special* and *Wildland Management* where mineral values are higher than forestry. The Land Use Plan also slightly reduces the amount of caribou habitat in PAs compared to the Base Case by reducing size of the *Chase* and *Omineca* PPAs. Overall, this reallocation of habitat reduces risks to caribou in the northern RMZs, but increases risks to caribou in the southern portions of the Plan Area (Chase and Wolverine Herds). Overall, the Land Use Plan is considered to pose moderate to high risks to caribou over the long term, which is somewhat of an improvement compared to the Base Case (high to very high).



**Fig. 5: Ranking of the Base Case and Land Use Plan according to their relative risks to caribou.**

## 5.0 Fisheries

### Base Case

Moderate impacts to fisheries values were anticipated under Base Case management. These impacts were largely associated with sensitive terrain and fish species (Arctic grayling, bull trout) sensitivity to resource development. About 8 (14%) of the 57 identified fish units were considered to be at moderately high risk under Base Case management due to the relatively large proportion (>75%) of these watersheds allocated to *Enhanced RMZs* (Trask 1999).

### Land Use Plan

#### *General Implications*

The Land Use Plan increases the number of Fish Units at high risk from 8 to 17 of 57 (30%). The fisheries resources within these Fish Units are considered at risk due to the large proportion (>75%) of watershed area allocated to *Enhanced RMZs*. These watersheds are at greater risk due to cumulative watershed impacts associated with intensive forestry practices and potential mining activities. Impacts to fisheries values within watersheds with >75% of the area in enhanced *Enhanced RMZs* may occur as a result of (i) high equivalent clearcut area,<sup>1</sup> (ii) extensive road development, and (iii) fewer opportunities for providing enhanced protection of fisheries values.

The relatively low terrain sensitivity, and limited occurrence of Arctic grayling and bull trout (i.e., Philip and Blackwater fish units) in watersheds within low elevation areas in the southwest portion of the Plan Area partially mitigates the potential negative effects of the extensive areas of *Enhanced RMZs*.

Moderate impacts to fisheries values are anticipated in the Osilinka River watershed, which is almost entirely zoned as an *Enhanced RMZ*.

The lower reaches of direct tributaries to Williston Lake largely occur within *Enhanced* or *General RMZs*, which increases the risk of impacts to spawning habitats of lake resident fish such as kokanee and rainbow trout.

Watersheds in the northern portion of the Plan Area are largely zoned for *Special*, *Wildland*, or are proposed Protected Areas, which should be adequate to conserve fisheries values. However there are concerns regarding the maintenance of fish passage and habitat values associated with resource development, particularly road development, within valley bottoms.

Potential road development could occur within several proposed Protected Areas, including the *Omineca* (almost 100% probability along Germansen Lake), *Finlay-Russel*, and *Frog-Gataga*. In addition to the identified *ELUA* corridor along the north side of the Finlay River within the *Finlay-Russel* PA, an additional corridor along Pelly Creek and a potential crossing of the Finlay River in the Cutoff Creek area have been identified. The section along Pelly Creek would involve numerous crossings of tributaries to Pelly Creek, and there is a greater risk of impacts to fish, particularly fish passage. Due to the mountainous terrain, a crossing of the Finlay River

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<sup>1</sup> Equivalent clearcut area refers to cut over areas that have not fully hydrologically recovered.

may be necessary to access timber in the Bower Creek area. The risk of impacts to fish habitat associated with the Finlay crossing are substantially less than the Pelly Creek route.

The identified *ELUA* corridors in the proposed *Frog-Gataga* PA extends across the valley bottoms of the Gataga and Kechika Rivers where there are potential impacts to spawning habitats and implications for fish passage associated with the construction and maintenance of a permanent road within the valley bottom. It is anticipated that more conservative road building practices would be employed within Protected Areas. Preliminary assessments of fish habitat along the proposed corridors may occur if LRMP strategies for red and blue-listed species are applied. This could at least partly mitigate potential negative effects through the identification of sensitive habitats and relocation of the road or development of appropriate mitigative strategies.

The proposed *ELUA* corridors associated with the proposed *Omineca* PA and associated sub-zones include an almost certain upgrade of the existing road along the north side of Germansen Lake to Forest Service Road hauling standards. The Germansen Lake route involves two crossings of major creeks and numerous smaller creeks, most of which are likely non-fish bearing due to natural barriers to fish associated with the steep south-facing slopes that extend to the lake. As it is likely that most substantial streams would be crossed using bridges, and that many smaller streams would be non-fish bearing, there are limited risks associated with maintaining fish passage. However, there are risks associated with increased fishing pressure at creek mouths as well as sedimentation of the lowermost portions of creeks between the road and the lake.

Regarding mineral tenures, in the Base Case, it is assumed that existing mineral tenures would not be grand-fathered in the RPAT proposed Protected Areas. However, there is no recommendation in the Plan about whether to allow some existing tenures that overlap with proposed PAs to continue and therefore these properties could be developed in the future subject to the usual probabilities and government decisions. Where mine development, including roads and infrastructure (e.g., Ecstall in *Frog-Gataga* and Jackaroo in *Omineca*) would be located within a surrounding PA, there is significantly greater risk to fisheries values in those recommended PAs, relative to the Base Case.

### ***Featured Species: Arctic Grayling***

With respect to Arctic grayling, the Upper Osilinka Fish Unit is more mountainous than the lower Osilinka and sustains less significant grayling habitat. The high terrain and fish species sensitivity, and anticipated cumulative and unmitigatable impacts associated with timber harvesting activities throughout the watershed has long term management concerns. The application of management objectives and strategies that lead to increased inventory and identification of important habitats may partially mitigate the long term effects of intensive resource development.

Most of the lower Mesilinka watershed and over half of the upper watershed are zoned as *Enhanced* RMZs and there are similar concerns for Arctic grayling as there are for the Osilinka watershed.

Although most (79%) of the Nation River Fish Unit, which encompasses the lower watershed, has been zoned as an *Enhanced* RMZ, the main river corridor has been zoned for *Special*

*Management*, which should provide adequate protection for Arctic grayling that are resident in the mainstem river.

Significant gaps in the present knowledge of grayling distribution and abundance in most systems within the Plan Area also increase the risks to grayling, although they cannot be quantified or reasonably estimated. However, considering that approximately 59% of the known grayling habitat is zoned as either *General* or *Enhanced* RMZs and only 13% is in Protected Areas, there are significant risks to grayling in the long term.

Within portions of watersheds zoned as *Enhanced* or *General*, the application of FPC regulations, including the maintenance of fish passage at stream crossings, and the potential for new and more restrictive requirements for stream crossing structures, will be important tools in maintaining fish habitat values.

### ***Featured Species: Bull Trout***

In general, moderate impacts are anticipated as a result of the occurrence of bull trout habitats in sensitive mountainous terrain in areas that are subject to sustained or increased resource development pressure, including primary road development (e.g., *ELUA* corridors).

In the Base Case, moderate impacts to fisheries values occur in 7 Fish Units where bull trout are a primary featured species and in 2 Fish Units where they are a secondary species. As the anticipated impacts are predominantly associated with enhanced resource development, it is likely that bull trout would be affected, particularly in the smaller rearing streams along valley walls.

In the Land Use Plan, significant impacts to fisheries values occur in 1 Fish Unit where bull trout are a secondary featured species, moderate impacts occur in 4 Fish Units where bull trout are a primary featured species and in 1 Fish Unit where they are a secondary species. The greater proportion of Wildland and Special Management RMZs improves the outlook for bull trout in the northern portion of the Plan Area but the trade-off is that there is a greater proportion of Enhanced RMZs in the southern component. Relevant General Management Direction and strategies with potential to mitigate impacts include conducting research, inventories and mapping in order to develop management strategies that could be applied at the watershed and operational levels with the goal of maintaining or enhancing populations of red-listed and blue-listed species. The potential effectiveness of management strategies are limited where terrain hazards are high and it is likely that some level of impacts will occur within many fish units featuring bull trout.

### ***Lake Fisheries***

Significant lake fisheries values within the Plan Area are associated with high quality angling and wilderness recreation opportunities. The target fish species are primarily rainbow trout, lake trout, bull trout and kokanee salmon. With respect to the assessment of potential impacts to lake fisheries values is difficult to achieve where fishing pressure generally has a greater overall impact on fish populations in lakes than adjacent land use activities.

Of the 13 lakes known to contain lake trout, four are readily accessible by vehicle. Over time, as access is provided to more lakes through block roads associated with timber harvesting adjacent

to lakes, fishing pressure increases and results in impacts to fish populations. Lake trout and bull trout are particularly sensitive to angling pressure and have a long recovery period relative to other species such as rainbow trout. In addition to lake trout, bull trout and Dolly Varden also occur in lakes and are susceptible to angling pressure. Of the 21 lakes are known to contain bull trout (reported on maps as Dolly Varden), 8 presently have direct road access to them.

Key lake fisheries values are recognized by designation as Class A lakes under the FPC. This classification should provide enhanced protection for fisheries by preventing direct access to these regionally important lakes (i.e., within 200 m due to riparian reserve zone) and providing a 50 m lakeshore management area. The LRMP recommends classification of 2 key lakes, specifically Weissener and Fox lakes, as Class A lakes for the purposes of managing lake trout, and Pelly Lake for Dolly Varden. In addition, access management direction includes deactivating all secondary roads, which may mitigate potential impacts to lake trout and bull trout in these lakes. In addition, access management planning proposed for specific RMZs (e.g., Fox) will also reduce risks to lake fisheries.

### ***Conclusions***

Baseline fish and fish habitat inventory work focused on identifying important Arctic grayling and bull trout habitats is needed in most watersheds to facilitate the management of these species. The Land Use Plan provides management direction that directs further habitat inventory for red and blue listed fish species (i.e., grayling and bull trout) and allocates many of these stream systems to *Special Management*, including many of the northern Fish Units (e.g., Thutade, Obo, Fox).

Overall, there is a trade-off between larger areas of *Enhanced* RMZs in the southern half of the Plan Area, and larger areas zoned as PAs, *Special Management*, and *Wildland* zones in the northern half. Correspondingly, it is anticipated that moderate impacts to fish and fish habitat will occur within watersheds with a significant (>75%) proportion of the area in *Enhanced* RMZs. The development of management strategies to mitigate these potential impacts will require additional fish and fish habitat inventory work noted previously. In summary, the Land Use Plan is estimated to pose moderate risks to fisheries as is the Base Case, although the spatial distribution of those impacts differs markedly between the two.

### **6.0 Access Related Issues**

The long term implication of new road development has the potential to pose relatively high risks to environmental values (e.g., habitat, water quality). Although the steep terrain in portions of the Mackenzie LRMP area may constrain the production of a large *road network* (i.e., limit road density) within a drainage, road alignment in narrow valleys is often limited to riparian valley bottoms that provide key seasonal habitats for some species (e.g., grizzly bears). In addition, mining roads can be built in very steep terrain (and not usable for logging) which provides increased access to subalpine and alpine habitats. Therefore, access management objectives and strategies need to be developed and effectively implemented to reduce potential negative impacts.

It is clear that both permanent primary and temporary secondary roads will increase over time to facilitate potential forestry and mineral development activities. However, the *General Management Direction* proposed by the Land Use Plan provides direction to deactivate

temporary secondary roads, but primary roads will remain intact. Because a number of watersheds that have very high wildlife values will undergo road and forest development in the near future (e.g., Pelly, Buffalohead and Lower Akie), the risks to wildlife associated with increased human disturbance will substantially increase. The *General Management Direction* and RMZ specific access management strategies have recommended deactivation of temporary roads as well access control points (e.g., pulling bridges, gates) at strategic locations (e.g., Del, Zygadene Creeks) which will help partly reduce the risks associated with increased road access in these areas.

In addition, the recommended Land Use Plan proposes the NORM-MAC area, which is assumed to be managed as per the adjacent area governed under the *Muskwa-Kechika Management Area Act* (approx. 1.4 million ha). Although the general intent and strategies outlined are positive, legislation and protocol outlined for the area as proposed by the LRMP provides increased certainty that effective coordinated access management (i.e. inter-agency) will be implemented. This reduces the inherent uncertainty associated with implementing recommendations that are only adopted as policy rather than law, and helps reduce the risks to fish and wildlife populations.

## **7.0 Overall Conclusions**

Overall, the *Mackenzie Recommended Land and Resource Management Plan* provides some positive management direction that will reduce risks to some components of biodiversity and certain environmental values (e.g., grizzly bear, water quality) in portions of the Plan Area. In addition, both the caribou and grizzly bear management strategies are positive initiatives that have the potential to reduce the risks to these higher level plan species. The *Objectives and Strategies* outlined in the GMD designed to manage road access including the *Northern Mackenzie Access Management Area* also suggest access management strategies will be developed and implemented as best as possible to minimize potential adverse effects to wilderness values as well as species sensitive to road development. Although these are all considered positive habitat protection measures, the relatively large proportion of the Plan Area allocated to *Enhanced RMZs* (30% Gross Land Base; 55% THLB) also suggests increased risks to biodiversity in the central and southern portions of the Plan Area.

## **8.0 References**

*Mackenzie Draft Recommended Land & Resource Management Plan (LRMP)*. June 2000.

*Mackenzie LRMP: Socio-economic and Environmental Base Case*. Final Report - September 1999. Ministry of Employment and Investment, Keystone Wildlife Research and Triton Environmental Ltd.

*Mackenzie LRMP: Socio-economic & Environmental Assessment of "Agreement in Principle" and Land Use Scenarios*. Draft Report - October 1999. Ministry of Employment and Investment, Keystone Wildlife Research and Triton Environmental Ltd.