**Interim Wood Supply for Southeast Yukon, Proposed Amendments and Additions Draft November 30, 2003**

Ken Kiemele*, Jan Adamczewski*, & Mike Gill**, (*YTG Environment, ** Environment Canada)

Members of the Interim Wood Supply Committee (IWSC), reporting to the Kaska Forest Resources Stewardship Council (KFRSC)

**A. Executive Summary**: The main Interim Wood Supply (IWS) area for Watson Lake under KFRSC planning was narrowed down to the lower East Hyland watershed, primarily the Cosh Creek area, by summer 2003. A draft plan for timber harvest in this area was set up under contract by Industrial Forestry Service (IFS) with YTG Forest Management Branch, and modified by the IWSC. At a meeting Oct. 29-31, the IWSC was unable to agree on whether the IWS plan to date had fully met key values and principles of ecosystem-based forest management planning. We offer this document and maps as a modified approach that we believe is clearly consistent with key values and principles of ecosystem-based forest management. The detailed stand information from IFS was instrumental to our modifications.

The areas where we have suggested improvement to the current draft IWS plan are:
(1) including land steward information and demonstrating its use in planned management;
(2) ensuring that the extent of existing and proposed forest removal from the Cosh Creek drainage is considered with respect to potential effects on water flow and fisheries, and on sensitive wildlife species like marten, goshawks and forest songbirds requiring unbroken older forests;
(3) ensuring that the Cosh Creek watershed FEN (Forest Ecological Network) includes an adequate representation of rare stands of 131-year or older, including birch-leading stands and fir-leading stands that have limited economic value;
(4) recognizing that the Cosh Creek watershed has an exceptionally old upland forest mosaic of complex terrain, species mix, and predominantly small patches of 50ha or less, and amending proposed cut-blocks to reflect this pattern;
(5) improving the consistency of the proposed logging plans with the 1999 Timber Harvest Planning and Operating Guidebook, a document based on extensive consultation and 3 years of work by a multi-agency team.

In developing this approach, we used thresholds based on terrestrial and aquatic ecological values and principles (e.g. connectivity) to reduce the extent of proposed forest removal in the Cosh Creek watershed, to set aside a greater proportion of the oldest forest stands, particularly fir-dominated ones, and to bring the plan, including cut-block sizes, into compliance with the 1999 Guidebook as much as possible. Initial public review indicates that larger clear-cuts would be controversial in the Yukon, as they have been elsewhere. Details of spatial analyses and amendments are provided in appendices. We estimate that the timber volume from this approach would be about 75,000$m^3$. This could be augmented with wood from Years 2 and 3 planned for the Cosh Creek area and other sources, depending on industry needs. As the first significant forest planning document from KFRSC, the IWS plan should clearly show that it properly addresses, in practice, the principles and values of ecosystem-based forest management.

**B. Introduction**:
At a meeting of the technical group (IWSC) Oct. 29-31, 2003, to review the draft Interim Wood Supply (IWS) plan for the East Hyland area, the group was unable to reach consensus on whether this plan was fully consistent with some key values and principles of ecosystem-based forest management. As a result, we were asked by the chair to put together a modified approach for KFRSC to consider. We offer this document and the associated map as our recommended approach for the main interim wood supply.

The process by which the main source for the Interim Wood Supply was narrowed down to the lower East Hyland area was sound. Given the need to make interim wood available for winter 2003-2004, it was practical to focus on an area that is relatively accessible and has proven stands of merchantable timber. This approach means that no new areas need be opened for timber on a short time-line, and more of the region's forests can be planned carefully during larger scale regional planning. We also accept that timber harvest anywhere in the region will have some environmental effects, both positive and negative.

The draft Interim Wood Supply plan for the Cosh Creek (East Hyland) area is based largely on work carried out by Industrial Forestry Service (IFS) under contract with YTG Forest Management Branch. IFS did an exceptional job of identifying and mapping natural features on their 1:5,000 maps. This detailed information was invaluable as it allowed us to make meaningful cut-block modifications that captured various natural features whilst avoiding, whenever possible, economically valuable stands. We found that this plan had some real strengths, particularly in identifying economically viable areas for timber harvest, and in setting aside the limited lowland forests from timber harvest. However, the draft plan did not adequately address a number of key social, economic and ecological values in upland forests. In part, this resulted from an operational need to make wood available for winter 2003-2004 on a short time-line, while definition and mapping of values and management strategies developed more slowly. Nevertheless, any plan endorsed by KFRSC, even for a limited time and area, must clearly demonstrate that it is ecosystem-based and that it addresses key values and principles. This is particularly true of timber harvest planned for an area with significant previous logging in the 1990's. All forests, even those given a timber harvest priority like Cosh Creek, must meet minimum standards of forest stewardship.

We recognize that our amendments to the draft plan will result in a reduced volume of wood for Year 1 from the Cosh Creek Planning area. We estimate the volume at about 75,000$m^3$. However, it is important to consider the following: 1) the Committee was tasked with finding up to 128,000$m^3$ for each of 3 years, from large landscape units Y02 and Y03, using ecosystem-based forest management; 2) there are two other planning areas within Y02 and Y03, that can provide some of the local timber supply to Watson Lake; 3) additional wood could be accessed from areas currently slated for Years 2 and 3 in the Cosh Creek area; and 4) a smaller volume may be sufficient to meet the current level of industry interest for Year 1. Timber harvest in Cosh Creek, a small watershed (35$km^2$) that has already had significant logging, should not proceed to the point at which key values and principles are compromised.

Section C details our concerns with the current draft IWS plan with respect to some key values and principles. For each point, we offer an alternative approach based on technical sources and consistent with the principles of ecosystem management. Wherever possible, we translated these strategies into a mapped spatial context. These strategies focus on a sub-set of the acknowledged values found within the area in question. However, we believe that applying strategies to maintain this sub-set of values (i.e. indicator species and thresholds) will provide adequate management for the maintenance of other recognized values in the area.

The final section (D) presents a number of principles and strategies that would be useful for the Interim Wood Supply plan and further planning documents. References follow section D, and four appendices complete the document. A large, detailed map showing proposed cut-blocks under our approach is presented separately. A smaller version of this map is included with the document.

## C. Critique of the current draft IWS Plan, with proposed improvements

1. **Land Steward Information** (Social, Economic and Ecological) – The importance of information from Kaska land stewards is emphasized in all documents relating to forest management planning under KFRSC, including the identification of interim wood supply areas and forest management in those areas. Unfortunately, this information was not available to the technical committee when drafting the plan because the Traditional Knowledge Protocol had not been signed. This has constrained our ability to come up with a comprehensive plan that makes use of all existing information. On this issue, we are not criticizing the current draft plan as our alternative also does not yet contain the Land Steward information. Rather, we are identifying it as an essential component that should be included before the plan is finalized.

2. **Cumulative forest removal effect on water flow and fisheries** (Ecological) – One of the recognized effects of clear-cut logging is increased surface run-off, reduced evapotranspiration, and altered water movement through the soil (Swanson et al. 1998). YTG Fisheries staff suggested that a maximum of 18% forest removal from a Class 2 watershed like Cosh Creek, over a period of approximately 10 years, would keep altered water flows (run-off) within an appropriate range. Simulations on re-growth in clearcuts in Alberta indicate that in conifer forests the annual water yield will be increased substantially for about 50 years post-harvest (Swanson et al. 1998). Cosh Creek is a fish-bearing stream with a known chubb population. GIS work shows that earlier cut-blocks from the 1990's add up to forest removal of 14% in the Cosh Creek drainage (see Appendix 1 for details). Regeneration in the Cosh Creek cut-blocks is variable, and in some areas is still at an early stage, with waist-high alder and birch and substantial open ground. Currently proposed cut-blocks would add a further 8.7% forest removal to Cosh Creek, for a total of 22.7%. In some of the sub-watersheds making up Cosh Creek, cumulative forest removal would reach 52.6%. Five of the 14 sub-watersheds making up Cosh Creek would have forest removal of at least 40%, and 4 of these 5 are adjacent to one another.

   **Cumulative forest removal effect on water flow and fisheries, Suggested Approach** - The 1998 Yukon Forest strategy's vision states (p. 3) *"Caution will be exercised when the consequences of actions in the forest are uncertain"*. A precautionary approach would include 1) managing the "ecological unit" (the Cosh Creek Drainage) on a sustainable basis by keeping forest cover removal to less than 18%; 2) reducing the planned forest removal in the class 1 drainages that would have the heaviest current-plus-planned cut-blocks, and 3) ensuring that the 1999 Guidebook's riparian provisions are applied.

   We have identified a number of blocks in the most heavily targeted class 1 drainages that should be reduced or at least deferred until regeneration is more advanced. This will reduce the level of impact on sub-watersheds and the class 2 Cosh Creek watershed. Overall forest removal for Cosh Creek would be 18.5 % under this approach. In addition, we also identified areas where intermittent draws should be protected and riparian management strategies should apply. These measures should help reduce siltation by interrupting direct water flow from cut-blocks into streams, and help regulate water temperature. Water-courses should be protected throughout their length, including head-waters.

3. **Impacts on marten as an indicator species** (Ecological, potentially Economic) – Marten were identified by the IWSC as a fragmentation-sensitive species associated with older forests, and have been used elsewhere (Ontario, New Brunswick) as an indicator species for other wildlife with similar habitat needs. Marten are also the most economically important species for trappers in the region. The effects of clear-cut logging on marten are well documented: marten densities in boreal clear-cuts 3-40 years old in Ontario were about 10% of those in nearby un-cut forests (Thompson 1994). We simulated the likely effects of existing and proposed cut-blocks on marten in the Cosh Creek area, based on recent technical papers that link the degree of forest removal in marten habitat to the capacity of the forest to support breeding marten. Details are provided in Appendix 2.

   Planning units for the GIS simulation in the Cosh Creek area were hexagons of 4 $km^2$, the average size of a female marten territory in the Yukon (Archibald and Jessup 1984). Chapin et al. (1998) suggested using marten home ranges as planning units, as these are the minimum areas that can sustain a breeding marten. Male marten home ranges usually are non-overlapping, adjacent blocks of forest, normally with a

slightly smaller female home range contained in each male territory (Archibald and Jessup 1984). Hargis et al. (1999) used 9km$^2$ blocks and Potvin et al. (2000) used 10km$^2$ blocks; the analyses would likely yield similar results (same areas, same % forest removal), but the resolution would be poorer.

Where the degree of forest removal exceeds 20-30% of a planning unit, breeding marten are unlikely to be present (Bissonette et al. 1997, Chapin et al 1998, Hargis et al. 1999, Potvin et al. 2000). Simulated territories were grouped as Little/Not Affected (91-100% forested), Somewhat Affected (81-90% forested), Marginal (71-80% forested) and Unsuitable (0-70% forested).

The Cosh Creek watershed is small (about 35 km$^2$) and would contain about 9 female marten territories. We bracketed the Cosh Creek drainage with additional territories and included a portion of the Contact Creek watershed to the east, for a total of 25 territories. For existing cut-blocks, 14 were Little/Not Affected, 6 were Somewhat Affected, 5 were Marginal, and 0 were Unsuitable for marten (Table 1).

Under the currently proposed harvest, the main expected change was in 5 territories becoming Unsuitable in the central part of the watershed (Table 1). These results suggest that the additional logging proposed under the draft IWS plan could have significant localized impacts on the sustainable marten population in the Cosh Creek watershed, and by extension on other species with similar habitat needs.

**Impacts on marten as an indicator species, Suggested Approach** – We found that the most heavily impacted marten territories corresponded to the sub-watersheds in the Cosh Creek drainage that would have excessive forest removal when evaluated for watershed/fisheries effects on run-off. However, although the degree of forest removal was reduced for several territories (see Appendix 2), the effects of our approach made only a small difference to the estimated effects on marten territories (Table 1). These results indicate that there can be prolonged environmental costs to species like marten in areas where timber harvest is given a priority and forest removal is substantial. The central portion of the Cosh Creek would have a low capacity to support breeding marten for an estimated 30-40 years or more. Avian species requiring mature forest-interior habitat would also likely be scarce in this area. Fortunately, the effects of logging on marten do not extend far past the edges of cut-blocks (Thompson 1994, Chapin et al. 1998, Potvin et al. 2000). These results underscore the importance of defining some areas where non-timber values are given a high priority, to offset at a larger scale the localized impacts likely to occur in timber-priority zones. This simulation approach could be useful as one way to estimate the impacts of past and proposed logging and to set limits depending on KFRSC objectives for planning areas at various scales.

**Table 1. Totals of simulated marten territories in categories of likely impact by existing, existing+currently proposed and existing+proposed modified logging**

| | Existing cut-blocks | | Existing+currently proposed cut-blocks | | Existing+proposed modified cut-blocks | |
|---|---|---|---|---|---|---|
| Category of effect | Number of territories | Percentage of total | Number of territories | Percentage of total | Number of territories | Percentage of total |
| Little/Not Affected (91-100% forested) | 14 | 56 | 14 | 56 | 14 | 56 |
| Somewhat affected (81-90% forested) | 6 | 24 | 4 | 16 | 4 | 16 |
| Marginal (71-80% forested | 5 | 20 | 2 | 8 | 3 | 12 |
| Unsuitable (0-70% forested) | 0 | 0 | 5 | 20 | 4 | 16 |

4. **Use of forest patch sizes appropriate to the Cosh Creek forest mosaic** (Ecological) – Emulation of natural disturbance is a useful tool in forest management planning. However, fire and logging differ in many respects – effects on soil, regeneration, resumption of use by displaced wildlife, sizes of disturbed areas, intervals between events, and creation of access to remote regions (McRae et al 2001). Application of fire emulation must also be tempered by social desires and recognition that natural disturbances like fire will

continue to shape the forested landscape. Most Canadian jurisdictions limit clear-cut sizes to 40-50 ha (McRae et al. 2001).

Not all of the forests in the southeast Yukon burn in the large, landscape-scale fires found elsewhere in the Hyland watershed. Some forests tend to burn in smaller, more frequent, stand-maintaining fires (AEM 1998 a, b). The Cosh Creek watershed shows a similar trend, with 69% of the patches less than 50 ha in size. The presence of exceptionally old stands in the area does not necessarily mean that the Cosh Creek watershed will burn in a catastrophic, large scale fire. "*There is no evidence of an increasing or decreasing probability of burning with age*" (Johnson 1998). In addition, site visits show that the complex terrain and mix of tree species is typical of upland complex forests, not upland simple forests. The IFS document notes (p. 10) *"hectare for hectare, the complex zone should have greater retention, smaller openings, more irregular opening shapes, and more openings than the uniform zone*".

Given these patterns, it is difficult to justify larger cut-blocks of up to 180 ha, when these would clearly be at odds with the watershed's natural forest mosaic. The 1999 Guidebook suggests maximum 40 ha openings in upland complex forests and 60 ha openings in upland simple forests. While these limits need not be applied exactly, we see little justification for larger clear-cuts in the Cosh Creek area. Large clear-cuts also have a highly negative image with the Canadian public; initial public review of an earlier draft IWS plan indicates that this would be equally controversial in the Yukon.

**Use of forest patch sizes appropriate to the Cosh Creek forest mosaic, Suggested Approach** – The suggested amendments, together, incorporate a patch size distribution more appropriate to the watershed's natural forest mosaic. Managing closer to the 1999 Guidebook rules for block sizes is more in keeping with the attributes we presently see within the Cosh Creek area. We recognize that there are two large existing fire disturbances in the larger East Hyland area, but do not seek to mimic their attributes because they are not appropriate to this watershed. Smaller cut-blocks are also less likely to provoke controversy during public review.

5. **Rare & old upland forest representation and forest age class objectives** (Ecological) – The IFS report indicates that less than one percent of the stands within the larger East Hyland area are greater than 140 years old. The Cosh Creek area has a substantial component of these old, complex upland forests, some of them estimated at up to 180 years old. If succession is defined as the replacement of the post-fire cohort with the under-story cohort, then the Cosh Creek area is the result of a longer than normal fire cycle.

   A well established concept of ecosystem-based forest management is to over-represent rare and old stands within watersheds. In this regard, the 1999 Guidebook proposes forest age-class targets to ensure that a representative portion of mature and old forest is left on the landscape after logging. To be truly representative, this should include some of the better sites with merchantable timber, so that the forest left after logging is not composed only of un-merchantable stands. In much of the Yukon, where specific knowledge of distribution and abundance of wildlife is minimal, this measure is of particular importance. If a good representation of all habitats, especially the rare ones, is left on the landscape, then the habitat needs of sensitive wildlife species requiring these habitats are likely to be met. Older merchantable stands are important habitat for some forest songbirds, as they contain large diameter trees, high internal stand structure and a complex under-story. Some of these species (Red-breasted Nuthatch, Blue-headed Vireo, Three-toed Woodpecker and Golden-crowned Kinglet) were identified by the technical team as values that the interim wood supply plan would address. These birds are negatively impacted by even-aged harvesting techniques, being intolerant of forest openings (Derleth et al. 1989; Drolet et al. 1999; Sallabanks, 1994, 1995).

   The current proposed harvest targets these old stands with 76% of the timber types in the proposed blocks 120 years or older and 25% 160 years or older. Table 5 of the IFS report states that this harvest will result in a 50% reduction (from 495 ha to 248 ha) in 131+ year old forest stands within the East Hyland Planning Unit (not including the old stands that have already been removed by previous harvesting). Removing this proportion of these rare, old age stands is inconsistent with ecosystem-based forest management. The

IFS-proposed FEN (Forest Ecological Network) is based largely in lowland forests and contains few old upland stands. The current proposed harvest also includes some rare birch leading stands.

**Rare & old upland forest representation and forest age class objectives, Suggested Approach** – To ensure adequate representation of old and rare habitats and still allow opportunities for harvest, we modified the proposed blocks so that more old forest habitat was retained. One strategy was to reduce the amount of fir and birch leading stands for harvest, since they are of limited market value (see below). Including some of these stands in the FEN would help to improve the representation of old and rare forest habitats while minimizing the impact on economic values. As noted elsewhere in this document, setting aside an ecologically equivalent area as a control that can be compared to Cosh Creek, with its intensive logging, is a desirable outcome and required under adaptive management. However, areas like Cosh Creek appear to have exceptionally old upland stands and we do not know of another area with a substantial 160-year-plus representation of large fir-leading stands. This increases the importance of adequate representation of these stand types within the Forest Ecological Network for Cosh Creek. The suggested block modifications would result in more of this important habitat being retained, with an estimated 24% reduction (from 495 ha to 380 ha) in the existing 131+ year old stands.

6. **Substantial sub-alpine fir component in proposed timber block** (Economic) – A number of the proposed new cut-blocks at Cosh Creek have a large alpine fir component. Considering the ecological desirability of conserving some of the exceptionally old forest stands in the area (see above), reducing the number of fir-leading old stands in the planned timber blocks would serve both economic and ecological purposes.

   **Substantial sub-alpine fir component in proposed timber blocks, Suggested Approach** – There are a number of opportunities to retain old stand types and more specifically those that contain a high percentage of fir. As all of the proposed blocks contain fir to some degree, it is therefore really a question of which stand retention configuration would provide the most value or gain the most multiple values, (i.e., enhance riparian zones, improve connectivity, manage for focus species, provide interior forest conditions, etc). In terms of logging, there are stands that are least desirable. An example of the multiple values approach is to defer or delete most of block 7 - it is difficult to log, is located at the head-waters of several streams and contributes to a heavy harvest within a number of small class 1 watersheds. We worked through all the stand assessments and made adjustments to reduce the fir component in proposed cut-blocks.

7. **Connectivity of wildlife habitat** (Ecological) **–** Connectivity of wildlife habitat is required at two levels - the landscape, and the stand. In the current draft plan, the FEN (Forest Ecological Network) provides the landscape connectivity in the lowland and riparian forests, but it does not effectively capture and link upland habitats or provide ridge and valley-to-valley corridors. The current plan relies heavily on in-block retention to provide the stand level connectivity - movement corridors and linkages within the upland forests and to points beyond. The Guidebook recommends at least 15% retention for cut-blocks over 10 ha in upland complex forests. A range of 5-20% should generally meet wildlife tree and bio-diversity objectives (Steventon 1994).

   There is less urgency for stand-level retention when very little of a landscape is to be developed or there is a substantial use of reserves (Coates and Steventon 1994). In this case, Cosh Creek will sustain a relatively intensive timber harvest, hence stand-level retention has greater significance. Adjacency rules for removal of leave patches between cut-blocks require that regenerating stands be at least 3m in mean tree height (based on 1998 Yukon Timber Supply Analysis) before leave areas can be cut. Most regeneration in existing Cosh Creek cut-blocks is below this average height.

   Given these considerations, identification of upland corridors, adequate stand-level retention, and large patch retention are of high importance in logging planned for the Cosh Creek watershed.

   **Connectivity of wildlife habitat, Suggested Approach** – Our suggested approach enhances 3 main east-west corridors within the area of interest by broadening them and using existing terrain, vegetation and drainage features. In addition, this approach increases the in-block retention to encourage more rapid

resumption of use by wildlife. The proposed new cut-blocks keep opening sizes of new-plus-existing openings closer to the 40 ha Guidebook limit, lessening concerns over adjacency. In addition, we added forested corridors linking wildlife tree patches to surrounding uncut forests, to provide for species like marten that rarely cross large, open areas.

8. **Maximum straight-line distances across cut-blocks of 400m for moose** (Ecological) – Moose were identified as a key game species in the area. Moose prefer a good mix of old forests for cover and openings for forage. An upper limit on the maximum edge-to-edge distance to cover for moose was identified as 400 m in the 1999 Guidebook and at 300 m based on moose studies in the Liard basin. Some of the larger cut-blocks in the current draft plan exceed these distances, with distances of 1000m or more. As well, the provision for cover within the large blocks is minimal. Hiding cover for moose should be in patches 3-5 hectares or greater, with a minimum width of 200 m. Large retention patches will also benefit other wildlife.

   **Maximum straight-line distances across cut-blocks of 400m for moose, Suggested Approach.** The proposed block modifications ensure that proposed cut-blocks do not exceed 400m distances edge-to-edge and that the provisions for cover are applied. In several cases, we linked wildlife tree patches to adjacent un-cut forests to encourage their use by moose and other wildlife.

## D. Other approaches & principles for the IWS plan and further plans.

1. **Identification of an un-logged set-aside area** – The technical committee appeared to be in general agreement with the concept of setting aside an area of similar size and forest type to the Cosh Creek area. This would serve both to offset the relatively heavy timber harvest in the Cosh Creek area and as a control for monitoring of the ecological effects of timber harvest. However, a set-aside lasting three years, the duration of the Interim Wood Supply plan, has little ecological meaning. This concept is better addressed during larger regional planning, when longer-term strategies can be defined. A set-aside area should be identified and deferred from logging at least until a larger regional plan is in place. Adaptive management was identified as one of the guiding principles for KFRSC forest management planning; carrying out adaptive management in the lower east Hyland should include ecological monitoring of Cosh Creek, with a comparison to a similar un-logged area. Initial monitoring of the Cosh Creek area and an un-logged area northeast of Blind Lake will be underway in winter 2003-2004: trapper Ted Neufeld will carry out track counts that provide an index of abundance of marten and other medium-sized mammals, under contract with YTG Fish and Wildlife Branch.

2. **Use of watersheds as appropriate spatial scales for forest management** – The issue of appropriate spatial scales came up often during the IWS committee's meetings. A group of cut-blocks appears to have major impacts on a small area, but when a much larger landscape is considered, the same cut-blocks appear to be a minor disturbance. Watersheds offer a natural hierarchy of spatial scales for forest management. As an example, Cosh Creek was identified by Fisheries staff as a class 2 stream and its boundaries (heights of land) could readily be identified as an ecological unit in terms of a fish population. Concerns over altered hydrology are best assessed within a unit like this. Within this watershed, smaller creeks flowing into Cosh Creek could also be mapped. Larger planning units identified for KFRSC regional planning are already tentatively identified as watersheds; our work here shows the utility of smaller watersheds as useful planning area boundaries.

3. **Strategy of concentrating timber harvest in some areas and for a limited time** – There appeared to be general agreement within the committee with the idea of identifying zones where timber harvest would be a priority, while other areas would either be set aside or harvested lightly (this concept is related to point 1 above). In general terms, development-sensitive wildlife habitat (for such species as marten, fisher, northern goshawk, and some forest owls) is best left in large, contiguous blocks, and benefits little from widely scattered disturbances unless those occur at a very low intensity (25% or less of a home range, Steventon 2000). If the disturbance associated with logging can also be limited in time, then problems arising from prolonged access to previously remote areas can be minimized. These concepts are difficult to address in a short-term plan, and are most appropriate to larger regional plans. We caution, however, that even in areas identified as having a priority for timber harvest, forest management must still meet a set of social, economic and social non-timber values to be considered ecosystem-based forest management.

4. **Lack of clarity on in-block and between-block retention of merchantable stands** – The IFS plan emphasizes the ecological importance of residual retention in cut-blocks. Substantial retention within cut-blocks can indeed mitigate the effects of timber harvest on sensitive wildlife. However, we found it difficult to identify what forested areas were merchantable and what exactly was being retained between and within blocks. In our experience, merchantable stands of timber generally include some smaller trees and groups of trees. IFS-identified blocks of merchantable timber also did not always coincide with previously mapped merchantable wood blocks from Forest Management maps. This may, in part, reflect the changing assessments of merchantability from fieldwork. Merchantable and non-merchantable stands should be identified and shown clearly, and then in-block and between block retention is readily apparent. We recognize that current forest inventory has its limits.

5. **Stand-level management recommendations** – As noted by McRae et al. (2001), one of the main reasons that burned areas often return more quickly to good value for wildlife habitat is that most fires leave the majority of the tree trunks in place. These then have value as snags and as they fall and decompose, they provide nutrients and habitat suitable within a few years for small mammals, which then encourage the return of predators like marten, owls and hawks. Clear-cutting generally leaves much less of these structures in place. The more woody material and the more non-merchantable trees left within cut-blocks, the greater the likelihood

that the cut-block will return to good value for wildlife needing these features. We suggest the following, recognizing that there may be practical constraints and safety considerations to these “best practices”:

a) All tops and limbs of trees should remain on site, and should not be burned as slash.
b) Non-merchantable trees should be left standing, preferably in groups.
c) Wildlife tree patches should be 3 ha or more (minimum size to provide one songbird territory), connected to surrounding uncut forest by unbroken forested corridors, and should be representative of the forest being harvested. An unbroken corridor would encourage use of the patch by species like marten that will not cross large, open spaces.
d) The edges of all cut-blocks should be windfirm and should follow natural contours, to approximate the appearance of natural forest openings.
e) Snags 25cm dbh or greater should be retained within a clump of standing trees to improve their wind-firm attributes. This is the minimum size to be used by some cavity-nesting bird species.
f) Block boundaries should be modified to incorporate any active or inactive Northern Goshawk nests within a patch of un-harvested forest at least 24ha in size.

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**Appendix 1. Evaluation of forest removal in the Cosh Creek watershed, in relation to a threshold based on altered run-off following logging.**

The Department of Environment's Water Resources and Fisheries sections were asked to provide advice regarding forest harvesting in the Cosh Creek watershed. Fisheries responded with a series of mitigative measures to be applied at the ecological unit level, Class 1 and Class 2 drainage level and the point source impact level. Our amendments to the current plan integrated these concepts and practices to sustain the Cosh Creek aquatic system. A watershed map is provided.

| Watershed Name | Sub basin Number | Subbasin Area (ha) | Existing Cut Area (ha) | % of Subbasin (existing cut) | Current Proposed Harvest Area (ha) | % of Subbasin (current proposed harvest) | Total Cut (ha) (existing + current proposed harvest) | % of Subbasin (existing + current proposed harvest) | Total Cut (ha) (existing + modified harvest plan) | % of Subbasin (existing + modified harvest plan) |
|---|---|---|---|---|---|---|---|---|---|---|
| Contact Creek | 1 | 1538.92 | 62.45 | 4.06 | 0.00 | 0.00 | 62.45 | 4.06 | 62.44 | 4.06 |
| Contact Creek | 2 | 207.62 | 26.14 | 12.59 | 0.00 | 0.00 | 26.14 | 12.59 | 26.14 | 12.59 |
| Contact Creek | 3 | 471.03 | 57.84 | 12.28 | 67.72 | 14.38 | 125.56 | 26.66 | 90.75 | 19.27 |
| Contact Creek | 4 | 656.88 | 40.47 | 6.16 | 64.89 | 9.88 | 105.36 | 16.04 | 73.31 | 11.16 |
| Contact Creek | 5 | 314.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 6 | 633.36 | 72.23 | 11.40 | 97.90 | 15.46 | 170.13 | 26.86 | 115.96 | 18.31 |
| Contact Creek | 7 | 650.21 | 86.82 | 13.35 | 38.01 | 0.00 | 124.83 | 19.20 | 120.02 | 18.46 |
| Contact Creek | 8 | 62.57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 9 | 106.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 10 | 384.84 | 6.28 | 1.63 | 0.00 | 0.00 | 6.28 | 1.63 | 6.28 | 1.63 |
| Contact Creek | 11 | 388.45 | 2.41 | 0.62 | 0.00 | 0.00 | 2.41 | 0.62 | 2.41 | 0.62 |
| Contact Creek | 12 | 478.47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 13 | 733.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 14 | 862.31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 15 | 455.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 16 | 292.83 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 17 | 260.38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 18 | 212.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 19 | 448.92 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 20 | 1169.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 21 | 175.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 22 | 219.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 23 | 105.84 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 24 | 649.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Contact Creek | 25 | 662.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Total for Watershed** | | **12140.15** | **354.64** | **2.92** | **268.52** | **2.21** | **623.16** | **5.13** | **497.31** | **4.10** |
| Cosh Creek | 1 | 527.41 | 54.69 | 10.37 | 0.00 | 0.00 | 54.69 | 10.37 | 54.69 | 10.37 |
| Cosh Creek | 2 | 312.06 | 82.78 | 26.53 | 0.00 | 0.00 | 82.78 | 26.53 | 82.78 | 26.53 |
| Cosh Creek | 3 | 269.51 | 37.20 | 13.80 | 0.00 | 0.00 | 37.20 | 13.80 | 37.19 | 13.80 |
| Cosh Creek | 4 | 124.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cosh Creek | 5 | 247.27 | 21.41 | 8.66 | 0.00 | 0.00 | 21.41 | 8.66 | 21.41 | 8.66 |
| Cosh Creek | 6 | 446.80 | 29.26 | 6.55 | 0.00 | 0.00 | 29.26 | 6.55 | 29.26 | 6.55 |
| Cosh Creek | 7 | 263.66 | 49.50 | 18.77 | 80.09 | 30.38 | 129.59 | 49.15 | 74.98 | 28.44 |
| Cosh Creek | 8 | 176.66 | 6.14 | 3.48 | 13.88 | 7.86 | 20.02 | 11.33 | 18.20 | 10.30 |
| Cosh Creek | 9 | 166.50 | 55.48 | 33.32 | 32.02 | 19.23 | 87.51 | 52.55 | 62.01 | 37.24 |
| Cosh Creek | 10 | 162.84 | 29.04 | 17.83 | 47.12 | 28.93 | 76.16 | 46.77 | 57.77 | 35.48 |
| Cosh Creek | 11 | 316.96 | 87.07 | 27.47 | 62.90 | 19.85 | 149.97 | 47.32 | 111.37 | 35.14 |
| Cosh Creek | 12 | 287.31 | 54.64 | 19.02 | 62.21 | 21.65 | 116.85 | 40.67 | 101.78 | 35.42 |
| Cosh Creek | 13 | 192.99 | 3.53 | 1.83 | 23.83 | 12.35 | 27.36 | 14.18 | 27.56 | 14.28 |
| Cosh Creek | 14 | 214.38 | 8.13 | 3.79 | 0.00 | 0.00 | 8.13 | 3.79 | 8.13 | 3.79 |
| **Total For Watershed** | | **3709.16** | **518.87** | **13.99** | **322.06** | **8.68** | **840.93** | **22.67** | **687.13** | **18.53** |

**Appendix 2. Simulated effect of existing and proposed logging on female marten home ranges in the Cosh Creek area, Southeast Yukon**

**1. Introduction**: The purpose of this analysis is to provide an index of likely impacts of logging on marten from existing cut-blocks and proposed new ones in the Cosh Creek area in the lower Hyland watershed. This class 2 watershed had some logging, mostly by patch cuts (small clear-cuts usually 5-20 ha in size) in the 1990's. Additional cut-blocks have been proposed for an interim wood supply for timber harvest, under forest management planning under the Kaska Forest Resources Stewardship Council.

Marten are used here as an indicator species for other old forest-associated wildlife such as woodpeckers, goshawks and boreal owls. Ontario and New Brunswick have provincial logging guidelines that use marten as an indicator species.

Marten are territorial animals; resident or territorial adult marten breed, while juvenile marten rarely breed. Home ranges (territories) vary from < 1km$^2$ to 30-50km$^2$; Yukon marten home ranges are 4km$^2$ for females, 6 km$^2$ in Nisutlin drainage (Archibald and Jessup 1984).

**2. Logging - effects on marten – key points**:

(a) Spruce-fir-hardwood forest in Maine, 50% clear-cutting, 25% partial cutting:
un-logged reserve had 3 times more marten tracks per km of trail than cut-blocks (Soutiere 1979).
(b) Regenerating clear-cuts 3-40 years old, boreal forests in Ontario (Thompson 1994) :
Cut-blocks had 1/10 marten tracks/km compared to un-cut forest, younger marten, lower productivity, higher overall mortality, higher trapping mortality.
(c) Industrial forest in Maine, 44% young stands: marten density 2.8 times higher, density of lactating females 3 times higher, in unlogged forest (Payer & Harrison 1999).
(d) Marten use of regenerating clear-cuts, Quebec, boreal forest (Potvin et al. 2000):
"*maximum amount of clear-cuts that the American marten can tolerate in its home range is about 30%*";
recommend < 30% of 10km$^2$ landscape blocks clear-cut over 30 yrs.
(e) Utah mountain forests, 18 study sites, each 9 km$^2$, live-trapped marten; (Hargis et al. 1999): "*marten were nearly absent from landscapes having > 25% in clear-cuts and natural openings*"; recommend that for 9km$^2$ blocks, <25% be in natural openings and cut-blocks.
(f) Industrial forest, Maine, analysis of 27 home ranges of marten (Chapin et al. 1998);
"*Males and females tolerated a median of only 20% regenerating clear-cuts in their home ranges*";
recommended using spatial needs of breeding adults as basis of management; each home range had a single patch of unbroken forest making up on average 58%.

In addition, 3 photocopied figures are attached.

Fig. 15.1 shows relationships between marten population density and proportion of mature forest removed, from Bissonette et al. (1997). Actual data sets from Maine and Utah suggest marten will be at very low densities or absent at >30% forest removal.

Fig. 6 shows 3 landscape configurations for cut-blocks in marten habitat, each with 20% forest removal, from Hargis et al. 1999. Maximal retention of uncut marten habitat in large blocks suggests that aggregated small blocks and larger cut-blocks are preferred to many scattered blocks.

Fig. 1 shows 1188 locations (dots) of territorial adult marten in an industrial forest in Maine, from Chapin et al. (2000). Territorial marten used larger blocks of uncut forest, rarely used cut-blocks, and made little use of small leave patches or heavily fragmented areas.

**3. Methods and Results**: The simulation approach is based on 3 studies of the landscape-scale impacts of logging on marten (d,e,f) above. The simulation assumes that all forested habitat in the mature (80-120 yr) and old (at least 120 yr) classes is marten habitat and that all forested areas have equal habitat value. Field reconnaissance suggests that the Cosh Creek forests generally should be high quality marten habitat, given the

old age, structural complexity, varied terrain, and mix of tree species throughout the stands. The focus is on female marten territories because a sustainable marten population must have breeding female marten with home ranges of sufficient quality to produce young. Poorer habitat may support juvenile, non-breeding marten (Thompson 1994), but is unlikely to support breeding adults.

The 3 studies defined blocks of 9km$^2$, 10km$^2$, and marten home ranges of 2.6km$^2$ (females) and 4.5km$^2$ (males). Chapin et al. (1998) suggested using territories of male and female breeding marten as planning units, as these are the minimum areas that can sustain a breeding marten. We used hexagon-shaped simulated female marten territories of 400 ha or 4 km$^2$, as those are the average female home ranges in the Yukon (Archibald and Jessup 1984). Male marten home ranges usually are non-overlapping, adjacent blocks of forest, normally with a slightly smaller female home range contained in each male territory (6 km$^2$, Archibald and Jessup 1984). The evaluations could be run with 9 or 10 km$^2$ blocks; the analyses would likely yield similar results (same areas, same % forest removal), but the resolution would be poorer.

A grid of 400 ha hexagons was overlaid on the Cosh Creek area. For each simulated territory, the proportion of the 400 ha in recent cut-blocks was calculated. The evaluation was repeated for recent-plus-currently proposed cut-blocks, and again for recent-plus-proposed modified cut-blocks. Results are listed in Table 2a and 2b. The study area in hexagons bracketed the Cosh Creek watershed (Map 1). Based on the technical papers described above, simulated marten territories were mapped as unsuitable for marten (0-70% forested), marginal (71-80% forested), somewhat affected (81-90%) and minimally affected or unaffected (91-100% forested).

The Cosh Creek watershed is small (ca. 35 km$^2$) so would likely support about 9 breeding female marten territories if they average 4km$^2$. If Cosh Creek and portions of Contact Creek with significant logging are included, then the total number of simulated territories is 25 (see Map).

Logging carried out to date would mean that 14 territories are little/unaffected, 6 home ranges are somewhat affected, 5 are marginal, and none are unsuitable for marten (Table 2). The central portions of the Cosh Creek watershed show most of the effects and the peripheral portions are largely unaffected.

Under the current proposed harvest, the 14 little/unaffected territories would largely remain the same, 4 would be somewhat affected, 2 would be marginal, and 5 would be unsuitable for marten.

Under our proposed modified harvest, the category totals are similar: 14 little/unaffected, 4 somewhat affected, 3 marginal and 4 unsuitable. The central portions of the Cosh Creek would be heavily affected by both harvest options, while more peripheral home ranges would remain largely unchanged.

**4. Management implications:** Some impact of intensive logging on sensitive wildlife species like marten is unavoidable. The effects could last for at least 30-40 years (based on Chapin et al 2000 and Thompson 1994). Over a short period, the impacts appear small and localized. However, the analysis here does not include years 2 and 3 of the interim wood supply, and additional logging over the next 40 years could affected neighbouring watersheds in a cumulative manner, long before the central Cosh Creek habitat again supports breeding marten. The resumption of substantial use of cut-blocks by marten would best be based on track counts showing that marten are using these areas significantly, rather than on an elapsed period of years.

It may be useful to use the type of assessment presented here as one of a number of approaches to defining limits on timber harvest at various scales. Thresholds of the allowable impact on marten, as an indicator species, could be defined for (a) large watershed units that can include timber harvest-priority and non-timber priority portions, (b) smaller watershed units where timber harvest is given priority but minimum standards of ecosystem-based management must still be met, and (c) areas where there is active marten trapping and economic losses for trappers could be significant. KFRSC might want to consider defining such thresholds for larger regional planning.

This approach could be used to evaluate a number of timber harvest plans before logging occurs, and may assist in evaluating possible compensation to trappers for likely losses of marten fur.

The simulations carried out here rely on marten habitat use studies from widely separated areas in North America. The similarity of the measured patterns suggests that these thresholds apply in many types of forests, including northern boreal forests. Track counts planned for the Cosh Creek area and an unlogged area in the Hyland watershed by Yukon Fish & Wildlife for winter 2003-2004 should provide actual (empirical) information on marten abundance in logged and unlogged forests.

**Table 2a. Effects of existing, existing+currently proposed cut-blocks, and existing+proposed modified cut-blocks in the Cosh Creek and western Contact Creek watersheds on simulated female marten territories**

Status of marten territory: Little/Not Affected (91-100% forested); Somewhat Affected (81-90% forested); Marginal (71-80% forested); Unsuitable (0-70% forested). Analysis does not include effects of proposed Year 2 and Year 3 cut-blocks at Cosh Creek.

| Marten territory | Existing cut-blocks | | Existing + currently proposed cut-blocks | | Existing + proposed modified cut-blocks | |
|---|---|---|---|---|---|---|
| | % forested | Status | % forested | Status | % forested | Status |
| 3 | 89 | Somewhat Affected | 89 | Somewhat Affected | 89 | Somewhat Affected |
| 4 | 87 | Somewhat Affected | 87 | Somewhat Affected | 87 | Somewhat Affected |
| 5 | 97 | Little/Not Affected | 97 | Little/Not Affected | 97 | Little/Not Affected |
| 6 | 100 | Little/Not Affected | 100 | Little/Not Affected | 100 | Little/Not Affected |
| 8 | 73 | Marginal | 73 | Marginal | 73 | Marginal |
| 9 | 84 | Somewhat Affected | 66 | Unsuitable | 69 | Unsuitable |
| 10 | 100 | Little/Not Affected | 99 | Little/Not Affected | 98 | Little/Not Affected |
| 11 | 99 | Little/Not Affected | 99 | Little/Not Affected | 99 | Little/Not Affected |
| 14 | 91 | Little/Not Affected | 91 | Little/Not Affected | 91 | Little/Not Affected |
| 15 | 89 | Somewhat Affected | 89 | Somewhat Affected | 89 | Somewhat Affected |
| 16 | 71 | Marginal | 45 | Unsuitable | 58 | Unsuitable |
| 17 | 89 | Somewhat Affected | 69 | Unsuitable | 79 | Marginal |
| 21 | 92 | Little/Not Affected | 92 | Little/Not Affected | 92 | Little/Not Affected |
| 22 | 96 | Little/Not Affected | 96 | Little/Not Affected | 96 | Little/Not Affected |
| 23 | 77 | Marginal | 53 | Unsuitable | 67 | Unsuitable |
| 24 | 91 | Little/Not Affected | 75 | Little/Not Affected | 81 | Little/Not Affected |
| 29 | 97 | Little/Not Affected | 97 | Little/Not Affected | 97 | Little/Not Affected |
| 30 | 81 | Marginal | 80 | Marginal | 81 | Marginal |
| 31 | 77 | Marginal | 50 | Unsuitable | 58 | Unsuitable |
| 32 | 98 | Little/Not Affected | 98 | Little/Not Affected | 98 | Little/Not Affected |
| 34 | 94 | Little/Not Affected | 94 | Little/Not Affected | 94 | Little/Not Affected |
| 35 | 93 | Little/Not Affected | 93 | Little/Not Affected | 93 | Little/Not Affected |
| 36 | 91 | Little/Not Affected | 91 | Little/Not Affected | 91 | Little/Not Affected |
| 39 | 87 | Somewhat Affected | 87 | Somewhat Affected | 87 | Somewhat Affected |
| 40 | 100 | Little/Not Affected | 100 | Little/Not Affected | 100 | Little/Not Affected |

**Table 2b. Totals of simulated marten territories in categories of likely impact by existing, existing+currently proposed and existing+proposed modified harvest**

| | Existing cut-blocks | | Existing+currently proposed cut-blocks | | Existing+proposed modified cut-blocks | |
|---|---|---|---|---|---|---|
| Category of effect | Number of territories | Percentage of total | Number of territories | Percentage of total | Number of territories | Percentage of total |
| Little/Not Affected (91-100% forested) | 14 | 56 | 14 | 56 | 14 | 56 |
| Somewhat affected (81-90% forested) | 6 | 24 | 4 | 16 | 4 | 16 |
| Marginal (71-80% forested | 5 | 20 | 2 | 8 | 3 | 12 |
| Unsuitable (0-70% forested) | 0 | 0 | 5 | 20 | 4 | 16 |

**Appendix 3. Block-specific net-downs and other changes proposed for the Interim Wood Supply in the Cosh Creek area.**

The purpose of this Block Summary is to ensure that the desired actions or management decisions are identified with a rational and clear direction to be taken at the block level.

The linkages between management scales 'forest, stand and block' are important to the management of various values, particularly when the desire is to maintain those values over meaningful time within ecosystem based parameters.

The detailed block maps are attached. They will be useful when reviewing the following block summary and the volume estimates.

## IWS Summary of Block Modifications

| Block | Value and Issue | Management/Action |
|---|---|---|
| 4 | • Connectivity corridor between block - stand type III (SbSw)<br>• Representative retention patch (low volume stand/operability constraint)<br>• WTP and NP areas to the SE<br>• Block may be visible from Alaska Highway | • Specific (Blk - 4A): Improve the corridor through block 4 by widening the zone; include adverse slopes and types II and III.<br>• Specific (Blk - 4A): Expand existing WTP to include NP areas to SE<br>• Specific (Blk - 4B): Include merchantable types to offset corridor increase.<br>• Increase dispersed retention to mitigate visuals. |
| 5 | • Class 4 stream and RMZ along north and south boundary - creek appears to flow through existing cutblocks, therefore there is some effect from past logging.<br>• Remnant corridors - potential WL corridor along north and south boundary - drainage and riparian setbacks<br>• Central wet area and drainage through block running north to south<br>• Rock outcrops and old slumps<br>• VIA (visual impact assessment)<br>• Located in two small sub-watershed with 41% and 47% percent cut forest cover removal. | • Specific (Blk - 5A ): Apply RMZ to class 4 streams along north side of this block 5 (unit 1 and unit 2)<br>• Specific (Blk - 5B): Remove from harvest type I stands Fir/Birch along the draw to maintain a corridor between existing block to the north and between Blk 5 unit 2 and unit 3. This will provide separation and a buffer between old and new block; reduce sight-distances, provide cover and movement corridor as well as capture old stands.<br>• Specific (Blk - 5C): Provide a functional north/south corridor and eliminate un-merchantable fir stand (90m3 ha) and also 165 year old type I stand. |

| | | |
|---|---|---|
| 6 | • Identified 'Old growth Fir stand' types in the central and east portion of the block.<br>• All stands contain some Fir from 10% to 70%<br>• Class 4 Creeks and riparian management<br>• Game trails along north boundary associated with Birch stand. Birch leading stand are productive and rare on the landscape.<br>• Operability and riparian management constraints on east portion of the block.<br>• BFP stand type IV, IMM stand type V and adjacent Type III fir stands can be used to reduce block size, provide effective corridor between old and new cutblock, improve merchantability species mix and retain old growth fir component.<br>• Leading Birch stands are considered rare on the landscape and some are identified at 80m3/ha. | • Specific (Blk6-A): Utilize BFP stand type IV, IMM stand type V and adjacent Type III fir stands to reduce block size, provide effective corridor between old and new cutblock, improve merchantability species mix and retain old growth fir component.<br>• Specific (Blk6-B): Defer/delete the SE portion of this block to retain effective buffer between the two previously harvest blocks, retain 180 year old PF stand type III, reduce blocks edge to edge distances from the 550-700m range to 350-500m. Also contains Birch leading type (type IV) imbedded this provision.<br>• Specific (Blk6-C): Include a windfirm buffer on game trail located on the north boundary of block and apply the riparian management zone to the creek (east portion of block); remove the BFP stand from harvest. This stand (type IV) is estimated at 80m3/ha, and the stand itself is a rare type. These types are believed to be rare over the landscape.<br>• Specific (Blk6-D):. Include the small water hole located in the west side of the proposed block in the riparian/reserve to ensure that an affective corridor (100-200M) exists between the block and the previously harvested cutblock located to the west. It is expected that this corridor will correspond (link) to the RMZ on the creek located to the SE of this location. |
| 7 | • A north/south ridge that separates this block<br>• Harvest will remove residual stands at headwaters and contribute to forest cover removal in two sub-watersheds already affected by past harvesting. This action will result in a large cutblock.<br>• The harvest of block 7 would result in a total of 47% forest cover removal in Coch Creeks sub-watershed 7.<br>• Removal of existing cover/corridor between previous cutblocks.<br>• Significant portion of the central and northern most components of block 7 contain Fir leading stands > 165 years and Sb > 170 years (stand type III and VI)<br>• East/west connectivity corridor<br>• Block has operability constraints<br>• Pine Marten box. | • Specific (Blk 7 A and B): Remove this block from the IWS Plan to reduce the amount of forest cover removal, reduce and conserve old stands 150-170 years, improve corridor and connectivity options, reduce watershed effects, minimize logging impact and costs (this is a difficult block to log).<br><br>Note: the IWSC has agreed to removing block 7 from the plan.<br><br>• Specific ( Blk 7 C): Include this unit as a harvest block with a modification to west boundary. Provide a 100m corridor between Blk 7 C and the previously harvested cutblock to the west.<br><br>Blk 7 C is isolated from the other block components, is close to the main haul road. |

| | | |
|---|---|---|
| 8 | • Stream or draw flowing from WTP. The draw feature appears to bisect the block.<br>• Class 4 streams to the north and south of the block<br>• Old stand types (150-170 years, one stand 80 years) | • General Provision: Apply RMZ (RZ and MZ) to the stream north of this block. This action will capture, some but not all of the old F/P/B stands as the MZ will extend into this block. Detail RMZ plan to maintain reserve zone and wet Sb types should be submitted for approval during the timber permit process.<br>• Specific (Blk8-A): Extend the linear WTP and riparian enhancement area west to the previously harvested cutblock. Include the adjacent type III stand immediately to the north of the existing WTP. This action will protect the stream or draw that flows easterly from the WTP; eliminate the need to harvest a F, Sb stand (type III) that has been identified as a low volume, young stand <80, presently under recommended harvest age and merchantability standards; and improve the WTP. This forest type will provide the Fir/P- mature conifer cover in the future (about 80 years from now.<br>• Specific (Blk8-B): Apply the RMZ guidelines to the stream located along the south boundary. Be sure to include the type III stand (80year old F/P stand) as it is presently unmerchantable. |
| 9 | • Multiple games trails (south and east side of block<br>• Steep, unstable and wet areas (NE portion of block)<br>• Ridge line running east to west through block<br>• Headwater draws/creeks drain the west side of block; a dry drain flowing from east side of block.<br>• Small (3ha patches) WTP and long sight-distances provide a poor environment for moose.<br>• Proposed block abuts previous cutblock; edge to edge and edge to cover distances (moose)<br>• Major corridor immediately north of block 9.<br>• High Fir/Sb component (140-150 years - types I and IV)<br>• Drainage in the West portion of the block associated with F/Sb types<br>• Den site near NE portion of the block | • Specific (Blk9-A): Increase den buffer to approximately 200 m (THP&OG) by including adjacent fir type I (low volume old stand). This will also provide an irregular shape to the block and follow type lines.<br>• Specific (Blk9-B): Link the game trail, WTP and dry drain into a larger treed patch. This area contains low volume F, P, SB type I stands, therefore will improve merchantable mix (Sw, Pl and F)<br>• Specific (Blk9-C): End the proposed block boundary just north of the game trail that is located in the southern portion of the block 9. This action will also provide a sizable WTP (hiding cover) in the old cutblock immediately south of the proposed block.<br>• Specific (Blk9-D): Defer harvest in the west end of block 9 to capture F,P,Sb stand type greater than 140 year; provide separation between old and new blocks; added protection for small drainage; and reduce fir content. |
| 10 | • Mature Block (estimate 115years)<br>• Reserves for wildlife and operability - steep terrain and low volume timber<br>• Several dry drains with steep slopes (60-80%) running north/south through this block. The flow is north/south, the block layout is east/ west<br>• Wildlife Den (present buffer 25m)<br>• Game trail east of den running N/S.<br>• Ridges and drains running through the block in a north/south direction and the block is orientated east/west<br>• West portion of block 10 is located in sub-watershed (7) which has the potential for 49% forest cover removal. Reducing the amount of year 1 harvest will reduce the impact on the small watershed (264 ha). | • General provision: Link reserves and drains to provide hiding cover and reduce the line-of-sight within block<br>• Specific (Blk10-A): Buffer den 200M (THP&OG) and delete most westerly portion of the proposed block to provide den buffer and effective corridor (estimate 150 - 300m) between previous and new harvest. Follow type lines and keep to the block boundary to the east of dry draw located SE of the den. The slopes are 55-60% in this area. This action will maintain the N/S game trail as well.<br>• Specific (Blk10-B): Retention on steep ridge slopes to provide soil/slope protection, wildlife patches, separate old and new cut blocks and reduce fir component. Concentrate this action on type I (F,P,SB stand). These action will result in a smaller blocks with reduced sight-distances and distances to cover and also stimulate re-growth (regeneration) and re-use by wildlife.<br>• Specific (Blk10-C): Provide north/south link through the block for wildlife by retaining a treed reserve along dry |

| | | |
|---|---|---|
| 10 | • Large block (91 ha - not considering previously harvested cutblocks); the 500m-950 m widths | drains (200-300m in width). Drainage at this point in the block appears to flow both north and south. The drain to the south has inoperable slopes (60-80%). These action will provide moose hiding cover, break the block at its center (reducing block size), provide corridor, and improve water/riparian conditions in sub-watershed.<br>• Specific ( Blk 10-D): Link the WTPs to provide separation between Blk 10 units. |
| 11 | • Mature stand (120 years)<br>• Class 4 streams<br>• Wet Sb type SW with drainage into from the proposed and existing cutblock.<br>• Marten Box<br>• Operability constraints | • Specific (Blk11-A and B ): Apply RMZ (RZ and MZ) - the MZ will extend into this block. Provide a detailed RMZ plan to maintain reserve zone and wet Sb types.<br>• Specific (Blk11-C): Remove the steep slopes from the proposed block. This will provide some separation between new and old cutblocks. |
| 12 | • Landscape Level Connectivity (east/west) - FEN component<br>• Forest composition - Old Growth (190 year Pl and Sw leading Types)<br>• Located in class 2 watersheds (9 and 10) potential harvest impact of 53% and 47% forest cover removal.<br>• Class 4 streams - up to 6 creeks and drain affect this block and block 11 to the south<br>• FEN - connection of Cosh Creek to Contact Creek Watersheds<br>• Marten box<br>• Game trails up and down creek and between blocks (existing blocks) . Retain much of the stands between blocks to minimize effect. | • General Provision: Apply RMZ (RZ and MZ) to all streams and apply a no harvest policy in the RMZ for the creek/drains that are associated with the major landscape corridor running east/west through block 12.<br>• Specific (Blk12-A): Enhance major landscape corridor by linking old stands (type I and III) through block 12 to the RMZ. Delete Blk 12-A from the harvest plan. This action will enhance corridor and maintain existing buffer, retain old growth stands type I and III, respect marten trapping opportunity.<br>• Specific (Blk12-B): Retain WTP near road junction to provide in-block retention. The edge to edge distance will be 350-400 across the old cutblock and the proposed block.<br>• Specific (Blk12-C): Defer harvest in the type I stand (P, Sb 190 years) and enhance landscape corridor and provide larger leave patch of MFC for other values. Ensures that the major corridor is linked to the FEN.<br>• Specific (Blk12-D): Reduce harvest in the east to enhance protection of drains and corridor (slopes and terrain?); marten box?<br>• Specific (Blk12-E): large riparian/ reserve patch central to the proposed block(existing and proposed). There are two drainages noted plus some linear stand typing indicates a pattern to the south and west through this patch. This action will reduce sight distances, view from the main haul road and provide a large reserve patch within existing and proposed cuts (10 plus ha.) |
| 13 | • Landscape Level Corridor - FEN component | • Provide a large scale corridor, utilize birch type and some adjacent SPF types to link FEN to the west.<br>• Provide a link through or between existing cutblock and proposed blocks 13 and 10. The adjustments need to be made on Block 10 (see block 10) |

**Appendix 4. Estimated Modified Block Volumes Based on IFS Data.**

The Block changes were reviewed in relation to the data found in the Yukon Energy Mines and Resources Timber Reconnaissance Summary table provided for each block by IFS. We assumed this data to be the best available to use to calculate volumes for the modified blocks.

The results indicate that our approach would provide 74,942 $m^3$ for year 1 from blocks 4,5,6,7,8,9,10, 11 and 12. This analysis did not consider Block 13 as there was no information available for this block.

## Estimated Block Volumes Based on IFS Data

| Block Number | Block Unit | M3/ha. |
|---|---|---|
| Block 4 | Area 1 | 250 |
| | Area 2 | 260 |
| Block 5 | Area 1 | 300 |
| | Area 2 | 290 |
| | Area 3 | 270 |
| | Area 4 | 250 |
| Block 6 | Area 1 | 275 |
| | Area 2 | 250 (plot notes) |
| | Area 3 | 250 (plot notes) |
| Block 7 | Area 1 | 125 |
| Bock 8 | Area 1 | 200 |
| | Area 2 | 200 |
| Block 9 | Area 1 | 125 |
| | Area 2 | 125 |
| Block 10 | Area 1 | 225 |
| | Area 2 | 250 |
| | Area 3 | 200 |
| | Area 4 | 215 |
| Block 11 | Area 1 | 260 |
| Block 12 | Area 1 | 275 |
| | Area 2 | 250 |
| | Area 3 | 275 |

| MODIFIED BLOCK VOLUMES | | | | | |
|---|---|---|---|---|---|
| | **Block** | **Unit** | **Area** | **Vol/Ha** | **Block volume** |
| | 4 | 1 | 19.67 | 250 | 4917.50 |
| | 4 | 2 | 20.70 | 260 | 5382.00 |
| | 5 | 1 | 4.23 | 300 | 1269.00 |
| | 5 | 2 | 18.29 | 290 | 5304.10 |
| | 5 | 3 | 23.09 | 270 | 6234.30 |
| | 5 | 4 | 16.76 | 250 | 4190.00 |
| | 6 | 1 | 11.63 | 275 | 3198.25 |
| | 6 | 2 | 15.66 | 250 | 3915.00 |
| | 6 | 3 | 13.32 | 250 | 3330.00 |
| | 7 | 1 | 7.95 | 125 | 993.75 |
| | 8 | 1 | 8.01 | 200 | 1602.00 |
| | 8 | 2 | 3.49 | 200 | 698.00 |
| | 9 | 1 | 30.37 | 125 | 3796.25 |
| | 9 | 2 | 3.91 | 125 | 488.75 |
| | 10 | 1 | 15.06 | 225 | 3388.50 |
| | 10 | 2 | 17.57 | 250 | 4392.50 |
| | 10 | 3 | 18.77 | 200 | 3754.00 |
| | 10 | 4 | 23.13 | 215 | 4972.95 |
| | 11 | 1 | 11.78 | 260 | 3062.80 |
| | 12 | 1 | 18.27 | 275 | 5024.25 |
| | 12 | 2 | 10.08 | 250 | 2520.00 |
| | 12 | 3 | 9.12 | 275 | 2508.00 |
| | | | | | |
| Total Volume | | | | | 74941.90 |