Ecosystem Based Management Implementation in the Great Bear Rainforest

LANDSCAPE RESERVE DESIGN METHODOLOGY

July 18, 2016

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1 Scope

This document revises and replaces the Strategic Landscape Reserve Design Process from 2010. It provides guidance on the spatial application of Part 1, Division 3, Sections 4 to 7 of the 2016 Great Bear Rainforest Land Use Order (GBR LUO). These sections outline objectives for ecological representation, objectives for Managed Forest and Natural Forest and objectives for Restoration Zones and Restoration Landscape Units, as well as a process to achieve these objectives via the establishment of Landscape Reserve Designs (LRDs). The primary purposes of the LRDs are:

1) To identify spatially over time, the minimum and long term representation targets specified in the objectives for ecological representation while maintaining the areas of Managed and Natural Forest.
2) To the extent reasonably practicable, simultaneously contribute to the protection and stewardship of:
    (i) Aboriginal Heritage Features, Aboriginal Forest Resources, and Cultural Cedar Use; and
    (ii) Red-Listed and Blue-Listed Plant Communities, habitat important for species at risk, ungulate winter range, and habitat for regionally important wildlife, including, but not limited to mountain goats, grizzly bears, Northern Goshawks, tailed frogs, and Marbled Murrelets.

This document outlines primarily the technical approach to Landscape Reserve Design (LRD) pursuant to the GBR LUO; it does not deal with the planning and review processes that are critical to include in any reserve planning process. These processes are contained in the document "A Framework for Landscape Reserve Design in the Great Bear Rainforest". Technical design cannot be undertaken in isolation from planning (seeking input, review, discussion etc.). Licensees of tenures with an allowable annual cut less than 20,000 m3 per year are exempt from having to complete a LRD. It is expected that they will work with and/or provide information to the LRD Working Group to assist in developing the LRD for their operating area, or follow the one developed for their area if choosing not to participate.

Each of the following sections is organized as follows:

- a DISCUSSION of considerations and/or issues pertaining to the step or topic being addressed; and
- a brief statement of the STEP(s) required in the design process.

LRD is of course only one tool to achieve conservation and land management goals. LRD needs to be considered in the broader context along with other measures such as age-class distribution, rate of cut, as well as stand- and site-level measures, etc. The designer should note when a value of particular concern will not be included in an LRD but rather dealt with by another management tool. Some examples of this could be a Government Actions Regulation Order for a resource feature such as karst or a recreation area, or an UWR that allows harvesting with timing and cover restrictions. In those cases, values are being managed by another tool that is not part of the LRD process.

Keeping track of these values and recording how on-the-ground management may address concerns related to them may be important, particularly for some First Nations' values (e.g., hunting or berry picking opportunities that benefit from a range of age classes). Being explicit about the extent to which

values are captured through LRD versus how it is anticipated they will be addressed through future operational management at the stand level is important. If First Nations interests and values are not captured through LRD, their extent and spatial distribution should inform operational planning and the operational constraint assumptions used in subsequent timber supply analysis and during the delineation of Managed and Natural Forest. Furthermore, this will allow presentations to affected First Nations and to non-industry stakeholders to indicate how all the important values will be managed, thereby placing the LRD into an overall management context.

This methodology document describes the steps involved in undertaking a Landscape Reserve Design. The amount of time spent on any of the steps will be subject to the scale and availability of data and resources, characteristics of the Landscape Unit, and contributions of interested stakeholders.

2 Data Requirements

The data needed for LRD includes both datasets common to all LUs across the Order Area and specific datasets from First Nations and stakeholders within the LU under consideration. Input from First Nations and identified stakeholders needs to be solicited and consideration given to how (and if) their information fits within the scope of Landscape Reserve Design pursuant to the GBR LUO. Examples of identified stakeholders could include non-forest sector operators such as tourism lodges, eco-tourism companies, community groups, and tenure holders for tourism, mining and independent power producers. Data layers can best be utilized for design when viewed as an overlay on a satellite image, LIDAR, seamless orthophoto base or similar imagery. Quality imagery can be very useful for appreciating site and stand characteristics that are important for design but are not otherwise available, such as structural attributes of stands and site variability within TEM/PEM polygons. Distribution of proprietary data is at the discretion of the owner for use by the lead professional in preparation of the LRD.

The Order Area-wide data includes a seamless TEM/PEM/forest cover layer that contains a wide range of basic attributes, and several habitat-related datasets. The habitat-related datasets have will be compiled in groups of LUs (typically 5-6 LUs per LU Group). These data sets will be available at ftp://ftp.geobc.gov.bc.ca/publish/Regional/Nanaimo/CoastImplementation/EBMDataCentre/LRD/ Password: “poolEy3@”.

LU-specific datasets may include the following:

- From First Nations: - spatial data from traditional use and occupancy studies (sites of habitation, food- and transportation-related resources, hunting and trapping areas, etc.), areas of economic activity (bear viewing, accommodation, etc.), reserved areas identified in Detailed Strategic Plans and FN Land/Resource Use Plans (where completed, including any Marine plans); any archaeological sites not included in the Provincial registered archaeological sites database; and the spatial polygons representing the area required to protect and steward these values, features, and interests.
- From licensees: - spatial data relevant to operations/forest management in the LU, including harvested cutblocks, cutblocks under Cutting Permit; engineered, declared, planned and projected cutblocks; priority areas or areas of interest based on total chance or other long-range planning, and roads. Inquire of licensees regarding any data quality issues (e.g. operability lines) or particular strategic concerns related to forest management (e.g. critical access, log dump locations).

- From interested stakeholders: - areas of local recreational use, ecological interest and economic use as appropriate.

LRD planning is a "strategic" planning approach – and is intended to use 'strategic' generally available data. However, in many landscape units, finer-scale information is available, which may be helpful to inform placement of reserves.

STEP 1: Obtain the current version of datasets common to all LUs across the Order Area (i.e. items listed under points 1 and 2 of Appendix I).

STEP 2: Obtain datasets specific to the LU under consideration (i.e. items listed under points 3 and 4 of Appendix I).

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3 Design Process

The first steps in the design process are defining the area of interest, understanding the values in the LU, and determining the targets to be achieved. After these initial steps (sections 3.1-3.3), then a foundation layer for design can be generated (section 3.4), a series of draft versions of an LRD can be developed and then assessed (section 3.5) so that iterative improvements and perhaps flexibility (section3.6) can be used to refine the design to a "First Iteration" suitable for review by First Nations and stakeholders that are not participating in the LRD Technical Team.

3.1 Area of Interest

The GBR LUO focuses on planning at both a total "Order Area" level and at the landscape unit (LU) level. Although LRDs are to be designed for individual LUs, the actual ***area of interest*** to which they apply is often somewhat smaller than the extent encompassed by the entire LU since the area of interest comprises *only* the Provincial Crown lands within an LU (with minor exceptions noted below). Private (fee-simple) lands and First Nations reserves (IRs) are excluded from the area of interest unless the private lands are part of fee-simple Schedule A lands in a Tree Farm License (TFL). Lands under federal jurisdiction other than IRs, such as lands managed by the Prince Rupert Port Authority, are also excluded from the area of interest (although National Parks or other federal reserves would contribute to representation targets, there are no National Parks or National Park Reserves within the Order Area). Provincial Crown lands excluded from the area of interest include Woodlot Licenses (excluded by the woodlot license planning and practices regulation), community forest agreements and four deciduous Forest Licenses (A49542, A49543, A34862 and A88640).

In most LUs, the area of interest does not differ greatly from the gross LU area. However, in some LUs, the location of such exempted lands (e.g. valley bottom, estuaries) can significantly constrain LRD options.

STEP 3: Define the area of interest within the LU by excluding private lands (unless otherwise requested), woodlot licenses, community forests, four deciduous Forest Licenses, First Nations reserves and other lands under federal jurisdiction.

To facilitate GIS processing, it is advisable to clip all the GIS datasets to the area of interest.

STEP 4: Ensure all GIS data is clipped to the area of interest.

3.2 Evaluate the Character of the LU undergoing design

The Order Area includes approximately 145 LUs, with similarities and unique characteristics in each. Since EBM fundamentally aims to maintain both the integrity of ecosystems (EI) while providing for human well-being (HWB), it is very useful to compile a comprehensive checklist of EI and HWB values at the outset of reserve design. Completing the checklist provided in Appendix 2 provides a snap-shot of the biodiversity, ecological, cultural and other values to be conserved within the LU.

The checklist (Appendix 2) first enumerates values to be conserved pursuant to the GBR LUO; this will invariably include site series group (SSG) representation (per Schedules F and G, this will be summarized in hectares in "Landscape Unit Targets Tables" on the GBR website https://www.for.gov.bc.ca/tasb/slrp/plan17.html), areas of Grizzly Bear habitat (Schedule D) and specified areas in the Kimsquit River, Klinaklini River and Viner Creek Reserve Zones (Schedule P). Second, it lists values present in the LU including Aboriginal Heritage Features, Aboriginal Forest Resources and Cultural Cedar Use (including monumental cedar); Red- and Blue-listed Plant Communities; habitat important for species at risk, wildlife habitat areas (WHA) and ungulate winter ranges (UWR) and habitat important for regionally important wildlife extant within the LU, including, but not limited to mountain goats, grizzly bears, Northern Goshawks, tailed frogs and Marbled Murrelets. The checklist also itemizes additional values to be considered for landscape-level reserves, including areas of First Nations interest, archaeological sites, exceptional and rare old-growth stands, special ecosystems such as karst, black bear habitat elements and larger riparian and/or active fluvial complexes.

The quality of the THLB and economic logging chance are key considerations for the economic status of the LU and thereby are part of the overall goal of meeting the Managed Forest (MF) target in the GBR LUO and so contributes to the overarching goal of HWB. The checklist should be used to note the anticipated area of Managed Forest on a LU basis (provided in "Landscape Unit Targets Tables"). Notes should also be made in the checklist regarding available licensee data (cutblocks, operability refinements etc.) and the accuracy of the Timber Harvesting Landbase (THLB) and Non-contributing (NC) layer.

The checklist also provides a place to summarize other input from First Nations, licensees and any other affected stakeholders. Last, the checklist suggests a number of strategic level questions be considered before embarking on reserve design. Comments pertaining to the quality or limitations of the available data should be noted in the checklist. When designing reserves, keep the quality/confidence of the various datasets in mind, for example, modeled habitats/values should always be subordinate to actual inventory data.

STEP 5: Compile and complete the checklist of values to be considered in Landscape Reserve Design (Appendix 2) which encompasses Human Well-being (HWB) and Ecological Integrity (EI) values to be considered during the design process.

3.3 Determine Targets for the Area of Interest

The GBR LUO establishes two types of targets to maintain ecological integrity: - the Old Forest Representation Target and the Minimum Old Forest Retention Level – these are subsequently referred to in this document as 'representation targets' and 'minimum old levels'. Targets have been derived after consideration of the range of natural variation (RONV), which ranges from 60% to 97% for the forested biogeoclimatic variants. Usually the minimum old level is set at 30% but in some special cases where there is limited old forest remaining in the LU, then minimum old levels are set at 20% or at the level specified in Schedule F. Order Area targets are specified (Schedule G) for all SSGs *as a percentage* of SSGs. Required representation is based on the dominant SSG in forest cover polygons, which is generalized from up to three components/deciles in the original TEM polygon attribute data. The representation target is the long-term goal for old-growth forest which at the present can be comprised of a mix of early, mid, mature and old seral stages. This mix must include (or exceed) the required minimum old level. To avoid any ambiguity and ensure consistent application of the Order, both targets will be calculated *in hectares for all LUs* and provided in "Landscape Unit Targets Tables" as well as the percentage from which the hectare target has been derived. These LU-specific targets are not legal targets, but rather intended as input to the design process. Attaining these LU targets will ensure adequate distribution of reserves throughout all variants across the entire Order Area. These targets have already incorporated a drawdown to 20% or to levels specified in Schedule F that has utilized the 18,650 hectare allowance in the LUO see section 3.6. Any alterations to the targets and allocations of drawdowns are part of the flexibility discussion (section 3.6).

The GBR LUO also provides for 3,108,876 hectares of Natural Forest and 550,032 hectares of Managed Forest across the Order Area. Although the legal target for Managed Forest is specified for the Order Area as a whole, the anticipated/projected distribution of the Managed Forest among individual LUs will be apportioned and is presented along with representation targets and minimum old levels in the Landscape Unit Targets Tables which will be available on the Great Bear Rainforest website https://www.for.gov.bc.ca/tasb/slrp/plan17.html .

The split between Natural Forest and Managed Forest plus the attainment of the two targets (representation targets and minimum old levels) will achieve 70% retention of all ecosystems across the Order Area, with only minor exceptions.

The Landscape Unit Targets Tables will be housed and managed in a centralized repository rather than being appended to this methodology so that they can be easily revised as better available TEM (and other) information becomes available. Alterations of landscape unit targets within trading groups that continue to meet the legal requirements when rolled up are the prerogative of the Operational Planning Implementation Committee (OPIC). Approval to alter targets where the alteration will move target hectares between trading groups will rest with the Government to Government tables (G2G); maintenance of the tables will be done by the (OPIC).

Currently, 56% of the Order Area is covered by terrestrial ecosystem mapping (TEM) and 83% of the Managed Forest is covered by TEM. Another 500,000 ha of TEM is scheduled to be completed in 2016. The remainder of the Order Area is classified and mapped by a predictive ecosystem mapping scheme (PEM), with a correspondingly lower confidence in this data. For the PEM portion of LUs, designers can utilize some flexibility, such that LU non-legal SSG targets in the LU target tables are considered to be met if the design meets 90% or more of the target for individual SSGs while meeting

the overall target for the variant. This is merely a time-limited flexibility applicable until the PEM is upgraded to TEM; the designer must document their rationale and demonstrate how they have used other better available information (e.g. imagery) to improve data confidence until TEM is available. Once TEM becomes available, the LRD will be updated as necessary to meet the original SSG target amounts for each SSG. Consequently, the SSG targets for the Order Area do not change when PEM flexibility is used, the Order Area targets will be realized as soon as improved data becomes available.

STEP 6: From the Landscape Unit Targets Tables, obtain the LRD hectares required to meet the representation targets, the minimum old levels and the projected Managed Forest area.

3.3.2 Allowances for Anticipated Aspatial Portions of Targets

The Managed Forest includes areas that will eventually be set aside as reserves during more detailed site-level/operational planning and layout, but these areas are not yet/cannot yet be spatially defined because of inventory data/scale limitations. The modelling of impacts of LRD to timber supply and the setting of targets assumed this aspatial netdown in the THLB to account for such small areas of future NC. For example, larger Wildlife Tree Retention (WTP) patches in planned cutblocks could be suitable for and ultimately contribute to LRDs but cannot be identified in the LRD before those cutblocks are designed. These "average operational landbase netdown" (AOLN) areas can be calculated from the current dataset by reference to the inclusion factor attribute ("INCL"). For any particular inventory polygon, its aspatial area is calculates as: Aspatial ha = (Polygon ha) * (1.0 – INCL).

These aspatial allowances ('aspatial hectares') are anticipated eventually to become non-contributing. They are presently included as part of the SSG targets, which need to be defined spatially in the LRD. This creates a problem because the data available now is insufficient to define them spatially. In addition, not all of these aspatial hectares/future NC areas will add useful areas to LRDs; some will be too small to contribute effectively to an LRD (which by definition is, after all, 'landscape-level'). In consideration of such scale limitations, it is initially estimated that only 75% of the aspatial hectares will ultimately contribute to LRDs and thus the SSG targets should be revised downwards by that amount. The actual proportion of the aspatial areas that prove to be appropriate for LRD will only become apparent over time; hence this is a topic for monitoring and adaptive change. It should be noted that the aspatial hectares are invariably small in comparison with the target hectares.

STEP 7: Reduce the representation target hectares obtained in Step 6 by 75% of the operational landbase netdown to obtain the purely spatial SSG targets to be met within LRD.

Example:

SSG Target: 1000ha
Operational landbase netdown = SSG Sum of (all inventory polygons * [1 - inclusion factor]) = SSG operational landbase netdown: e.g. 10 ha

Suitable for LRD: 75% of the SSG operational landbase netdown = 7.5 ha
Spatial Target: 1000 ha – 7.5 ha = 992.5 ha

Ultimately reserved at both landscape and site-levels: = 1000 ha (7.5 site level ha (to be added to LRD in future) + 992.5 LRD ha (identified during initial LRD)

(i.e., another 2.5 ha of currently aspatial netdown is expected to be identified over time as stand- level reserves but is not expected to be useful for LRD).

The aspatial adjustment reduces only the amount of the old forest representation target to be spatialized in the near term, not the minimum old level required.

3.4 A Starting Point for Design

Once all necessary data have been collected, the area of interest has been determined, values in the LU have been explored, and targets refined for aspatial amounts (i.e., after the above steps), then the actual reserve design can begin.

3.4.1 Assess to what extent NC can fulfill targets

Before starting the design it is useful to identify the SSGs where 1) NC includes more than enough old to meet minimum old levels and representation targets or 2) where the NC only just meets targets and 3) where NC is insufficient and operable areas will be needed to meet minimum old levels or representation targets.

These basic calculations will give the designer a general appreciation regarding which SSGs operable areas will need to be chosen for inclusion in LRD. Those operable areas should be areas that also provide co-location with as many other values as possible (as much benefit as possible from putting operable areas in reserve). The actual amount of NC chosen in the design will likely vary from the amount of NC actually available (for a variety of reasons see section 3.4.2 below), and hence this first assessment of NC is only a preliminary planning step to provide some general context.

3.4.2 Building a starting point

All LUs include areas that are clearly unavailable or unlikely to be available for timber production, which already encompass a variety of ecosystems (SSGs) in various seral stages. Such areas (that have for the most part been enumerated in the checklist), range from larger, landscape-level reserves to small site-level reserves and features. These include the following:

- Clearly unavailable landscape-level entities including all existing (and in-process) parks, conservancies, class 1 grizzly polygons (per Schedule D), ecological reserves, BMTAs, UWRs and WHAs (all species), plus the reserves mandated by the GBR LUO Schedule P (Kimsquit River, Klinaklini River and its tributaries, and the lower portion of Viner Creek). These are often considered as ‘hard’ reserves.
- Otherwise partially constrained areas including: unstable terrain; occurrences of red-listed plant communities; archaeological sites; First Nations’ sites and traditional use areas; historic sites; recreation sites and features; larger riparian reserves and high value fish habitat (HVFH) polygons along rivers, streams, lakeshores and marine shores; small islands; non-WHA reserves for Northern Goshawk (and other species).
- Uncommon to rare or otherwise special ecosystems such as various non-forested to sparsely forested wetlands (including forested swamps and some specific SSGs [31 and 32 but not in

hypermaritime]), SSGs having 100% Representation Targets and SSGs where all old seral is needed to meet the minimum old level.

- Mapped inoperable and alienated areas (i.e. made inaccessible by other constraints), and ESAs.
- Non-contributing (NC) areas based on the available base TSR dataset.
- Some site level features such as riparian reserves, in-block retention, culturally modified trees, WTPs; small occurrences of red-listed plant communities or forested swamps etc.
- Stand level features that are not intended for future harvesting can form part of the LRD. Those features need to be greater than 1 ha in most LUs and bigger in restoration LUs (i.e., ≥ 7 hectares in size; or ≥ 3 hectares in size and ≤ 1.5 tree lengths from a cutblock edge within a Type 1 Restoration LU)
- Note that the LRD should not necessarily include all these potential site-level features. We advise against including, for example, WTPs and in-block retention that is small and disconnected from larger reserves. In addition, many of these features are not yet known at this time, and cannot be adequately defined at a 1:20,000 planning scale. Such small site-level reserves comprise, or are analogous to, the 25% of the aspatial allowance per SSG target that is considered to be unsuited to landscape-level LRDs.
- Note that the LRD should not necessarily include all these site-level features. We advise against including, for example, WTPs and in-block retention that is small and disconnected from larger reserves. In addition, many of these features are not yet known at this time, and cannot be adequately defined at a 1:20,000 planning scale. Such small site-level reserves comprise, or are analogous to, the 25% of the aspatial allowance per SSG target that is considered to be unsuited to landscape-level LRDs.
- Where class V terrain-stability units are mapped, and where this is supported either by satellite imagery (i.e. unstable areas are indicated and can be delineated by natural slide scars) or by local knowledge; there may be an opportunity to place inoperable class V terrain into landscape reserves without having a real impact against the Managed Forest. However, note that stability class V terrain is not invariably excluded from the operable land base. In some cases, there are % netdowns applied to a forest cover polygon that do not coincide with a unit of unstable terrain (e.g. only part of a forest cover polygon is class V).

Typically, a good starting point for design can be made by various combinations of the above listed constrained areas. In addition, since the degree of confidence in their 'unavailability' varies (more or less decreasing confidence in the order listed above); the designer must exercise judgment based on local knowledge in order to compile an initial LRD layer in GIS. Optionally, this can be a one-step or multi-step process depending on the character of the LU. While it may be instructive to explore how the various constraints contribute to representation targets, it is likely most efficient to include as much as confidence allows in the initial (starting point) design.

In most cases, considerable NC will be included in the initial starting point. Often, including all NC would lead to excessive over-representation. Over-representation, even if in areas now considered NC, is not desired because portions of NC may well be eventually found to be operable. From a design process standpoint, experience has shown that it is much more difficult to trim back than to make additions to satisfy representation while simultaneously adhering to good design principles, so including only clearly useful NC is the best starting point. Not including all of the NC as a starting point can also be considered where constraints other than NC are already meeting or close to meeting targets (e.g. an LU with a high proportion of park or

conservancy), as this would also avoid over-representation. NC is normally reserved to meet targets prior to taking areas in the THLB. Not selecting available NC to meet a SSG target that leads to selecting more in the THLB than is required to meet the representation target means the additional impact will have to be offset elsewhere in the LU or in a to be determined trading group depending upon the flexibility provision utilized.

Depending on the distribution of the inoperable, it may be advisable not to include small isolated fragments of inoperable, at least in this starting point for design. What constitutes "small" will vary by LU, and is guided by consideration of the natural pattern of SSG polygon sizes within the LU. For example, the distribution of matrix SSGs in many CWH variants is relatively continuous, with the typically three matrix SSGs occurring in broad swaths across valley slopes such that the natural pattern has substantial forest interior condition and relatively little edge. Contrast this with hypermaritime variants where the pattern of matrix SSGs is complex and frequently interrupted by poorly drained bog forests and wetlands (bogs) so that there is naturally far more edge and less interior condition. The choice of an appropriate minimum polygon size for a particular LU needs to suit its inherent ecosystem (SSG) pattern; a consistent arbitrary cut-off does not make ecological sense.

It is important to note that the modelling assumptions used all inventory polygons greater than 1.0 hectares in assessing the NC available to meet targets and in determining the extent of the Managed Forest. Not selecting inoperable polygons down to one hectare in SSGs that do not have surplus inoperable to meet targets may impact the Managed Forest - impact that would have to be balanced off elsewhere (see "Maintaining the Area of Managed Forest").

Permanent roads (i.e. existing roads other than those purposefully rehabilitated) are routinely incorporated within LRs; and future roads through LRs are permitted by the GBR LUO in a number of circumstances (e.g. safety, unavoidable access). Although some of these roads will recover to become productive site (however usually not the former SSG), some (mainlines, major branch roads) will not recover and represent a purposeful change of use from the original SSG. Ideally, although they should be considered part of the Managed Forest, they should be mapped and classified as Non Productive (as with rock, water etc.) so that their area would not contribute to meeting representation targets nor should their inclusion in the LRD be considered a managed forest impact. Where the available data quality/precision does not facilitate tracking roads; it should be documented by the designer and subsequently addressed in future data updates and LRD revisions. (Note: evaluation of this issue during pilots revealed the areas involved are not large [pers. comm. Laversee]).

STEP 8: Compile a foundation for LRD (a V1-0 GIS layer) which includes all existing constrained areas that are considered clearly suitable for inclusion within a LRD**.**

STEP 9: Explore the implications of adding all NC to the foundation design (a V1-1) since all NC was not incorporated in step 8.

STEP 10: From steps 8 and 9, develop a starting point for design that incorporates an LU-appropriate amount of NC.

3.5 Developing a first working draft of a LRD

The starting point for design (step 10) includes only inoperable areas judged to be appropriate for inclusion in an LRD. It does *not yet* include any consideration of ecological values, additions to meet representation targets, First Nations values or reserve design principles using the process outlined in the document *A Framework for Landscape Reserve Design in the Great Bear Rainforest*. These considerations are all taken into account in a subsequent, iterative, step by step process that produces a first working draft of a LRD. This 'first working draft' is the first design that is getting close to meeting representation and minimum old targets while incorporating any exceptional concentrations of values into the design and adhering to the apportioned Managed Forest area.

Three considerations in developing this first working draft are:
1. The application of good design principles;
2. Consideration of a values-first vs. a representation-first approach to design; and
3. Getting close to targets whilst minimizing any impact on the anticipated Managed Forest area.

Before embarking on a first working draft, the designer needs:
1. to understand and evaluate the implications of all three of these considerations; and
2. to evaluate the extent to which the starting point contributes to targets.

3.5.1 The Elements of Good Design:

Good design includes aspects of both geometry and content. The geometric elements of good design include considerations of size, configuration, distribution, connection and landscape fit.

- Size: Larger reserves are more ecologically valuable than smaller reserves because they include a greater amount of habitat, have more forest interior compared to edge habitat and have greater long-term integrity. The Order Area already contains some very large, entirely protected watersheds and conservancies in the order of 1000's of hectares. Within an individual LU, 'large' would be in the order of 100's of hectares. However, having only a few large reserves in an LU would mean they would tend to be isolated from one another and it would be difficult to achieve all the desired values and representation targets and difficult to capture a variety of areas of high ecological or cultural value. Small reserves can often be useful for special, uncommon to rare sites and communities that by their nature are inherently small (e.g. small wetlands). The representation target for the LU at the lower levels e.g. 30% can make it difficult to have both reserves spread out over the LU and have larger reserves. In these cases, a judgment needs to be made to find a balance between smaller representing reserves over the whole LU or having larger reserves that are less connected.
- Configuration: Highly irregular boundaries, protruding peninsular shapes and narrow linear/curvilinear polygons have a high proportion of edge and provide little forest interior (recall that a circle is the optimum shape for minimal edge and maximal interior condition). Polygons with less edge and more interior conditions are more ecologically valuable than shapes with high edge to area ratios. Nonetheless, some ecologically important areas are typically long and narrow (such as riparian areas or cliff bands) and not be able to be widened into larger reserves, so long narrow reserves are sometimes appropriate.
- Distribution: Reserves should capture a range of elevations in the LU from valley bottom to ridge-tops and be geographically dispersed throughout the LU rather than concentrated in one area.
- Connection: Connecting reserves by means of spatial continuity both across-valley and along-

valley facilitates the movement and migration of both animals and plants, and likely increases resilience in the face of climate change. Spatial connections are also supplemented by the functional connections afforded by a permeable Managed Forest matrix outside of reserves comprised of WTPs, in-block retention and riparian and other site-level reserves. Linkages to adjacent LUs (e.g. through low passes) and other protected areas further facilitate migration.

- Reserve boundaries should 'fit the landscape' wherever feasible using boundaries that follow natural breaks (e.g. ridge-lines, basin boundaries, the edge of floodplains, the back of terraces and the active portion of fans). Seral stage boundaries are often not useful, but they can make sense for some values (e.g. MAMU habitat).

In addition to achieving SSG targets, a good design should also incorporate the following elements of diversity:

- Red- and blue-listed plant association occurrences should be included as per Appendix VI. These plant associations are generally considered to be appropriate SSGs associated with forests over 200 years of age, or with younger forests with complex stand structure and a veteran tree layer. 100% of red-listed and 70% of blue-listed plant associations are required to be protected but not all of these need be protected by LRD. Both size and location of an occurrence determine whether a red- or blue-listed plant association would be managed as a stand level feature or incorporated into LRD.
  Some listed plant communities can be identified by TEM in combination with stand age or imagery that reveals forest structure, but others will only be identified during site-level layout and thus not be feasible for inclusion in the initial LRD, but may be included in future LRD amendment.

- Stand level features that are not intended for future harvesting (e.g. resource features, red-listed ecosystems) that meet the following occurrence size and location contribute to meeting representation targets and minimum old levels and form part of the LRD when they are:
  - Within a Type 1 Restoration LU:
    - ≥ 7 hectares in size; or
    - ≥ 3 hectares in size and ≤ 1.5 tree lengths from a cutblock edge; and
  - Within all other areas:
    - ≥ 1 hectare and capable of being mapped

- Designers should include avalanche SSGs (SSGs numbered in the 50's) in reserve where they are adjacent to or form part of important habitat (e.g. Schedule 2 grizzly bear habitat) and/or where they occur in a vegetation mosaic with reserved forested SSGs, particularly if those coincide with lower capability/suitability grizzly habitat.
- For the representation for the alpine SSGs (CMA and equivalent). It is preferred to place this representation in 2-3 relatively large LRD polygons, preferably continuously and substantially linked down through mountain hemlock parkland and forest, montane and submontane variants to yield a reserve polygon that encompasses the full elevational range within the LU. We have recommended that representation of alpine area be at the variant level rather than by SSG, but the present Order requires representation by SSG wherever they have been mapped.
- SSGs are a grouping of site series and thereby include a range of site productivity and site capability, and a mix of leading species/stand composition. Site series also have a range in productivity/capability and stand composition although to a lesser extent than in a SSG. Since

encompassing the full range of productivity/capability and the diversity of leading species/stand types is a design consideration, the designer should keep this variability within SS and SSGs in mind when selecting areas of SSG/SS to include in reserves.

- Note that the '00' SSGs include a diversity of miscellaneous land types (e.g. rock outcrop, bare soil, talus) as well as a wide range of non-forested to only sparsely forested (wooded) ecosystems with many occurring at parkland to alpine elevations. This grab-bag at times also has nonsensical seral attributes (likely carried over from nearby forested SSGs?). Although there are targets for 00 SSGs it has been recommended that these be dropped. Currently the targets for these SSGs remain in the Order so must be included in the design, the designer should be watchful for 00 polygons that encompass wetlands (other than the extensive open bogs of hyper maritime variants); these should be included in reserves where adjacent to included forested SSGs in order to capture the full range of ecosystems on the landscape. Small wetlands contain particularly valuable elements of biodiversity, floristic complexity and habitat, especially in drier variants.

Apply, at the LU level, the results of the occurrence analysis/risk assessment (undertaken at the Order Area level). This analysis is available in excel format at ftp://ftp.geobc.gov.bc.ca/publish/Regional/Nanaimo/CoastImplementation/EBMDataCentre/LRD/ Password: poolEy3@

- The intention is to track and then ensure adequate representation of Site Series where red or blue listed and non-listed site series are in an SSG i.e. any site series that are mostly found in the 2nd and 3rd decile rather than the first decile that are determined to be at risk of under-representation because of their tendency to occur in second and third deciles of TEM mapping. Appendix IX explains how to alter targets based on the occurrence analysis. If the goal for Minor Component Site Series cannot be met as set out in the Minor Component SSGs risk table, the SSG will be flagged by the designer for operational staff to identify and manage at the field level.

While LRDs *must* meet representation targets *and* achieve the desired Managed Forest area across the Order Area, a good LRD design *should also* co-locate regionally important species habitat and First Nations' and other HWB values to the extent practicable.

Consideration for First Nations' values will include items enumerated in the checklist and will depend on input from local Nations (regarding importance and order of inclusion in LRD). The same is true for licenses and other tenure holders or interested parties – a good design will include the values in the checklist as far as possible. It is of course not possible to maximize value capture within the context of having to meet the representation and Managed Forest targets. Each must be addressed as best as possible within the required targets either at the LU level or at the 'to be determined (TBD)' trading group level (see steps below and also the flexibility section 3.6).

Considerations specific to individual regionally important species include:

- Grizzly bear: All class 1 grizzly bear habitat is included in reserve. As well, 50% of class 2 is required in reserve in the Central and North Coast Area, and optional in the South Central Area. Throughout the CWH, priority class 2 grizzly habitats to reserve are spring (early and late) habitats at lower elevations (<500 meters elevation) and in valley bottoms. Class 2 habitats of floodplain ecosystems or associated with wetlands and estuaries are particularly important. In hypermaritime variants, all class 2 grizzly habitats should be considered for

reserve.

- Marbled Murrelet: When using models to identify MAMU habitat, contiguous rank 1 and 2 MAMU habitats should be merged (to reflect moderate and high habitat) and where the merged polygons are <40 ha, additional rank 3 habitat should be added where possible to provide polygons in excess of 40 ha in order to control the extent of edge/edge predation. 40 ha is a small polygon for MAMU - ideally, areas for MAMU should be greater than 200 ha so that if all the adjacent forest is harvested there is still enough forest interior to reduce predation.
- Northern Goshawk: Focus reserves on high and moderate nesting habitat since nesting habitat is relatively more important than foraging habitat and because most high/moderate habitat will also be high to moderate foraging habitat. Keep in mind the territorial requirements of this species by aiming for a distribution of potential nesting areas of about 200 ha (plus additional foraging habitat) closely associated with foraging habitat spaced about 7km apart along valleys or similarly spaced throughout more subdued topography.
- Tailed frog: Above known tailed frog stream reaches, consider protection up to and including headwater areas. Reserve class 2 reaches situated upstream of class 1 reaches in preference to class 2 reaches alone.

3.5.2 Values-first or representation-first approach?

As specified in the GBR LUO, objectives for Landscape Reserve Designs must address meeting the targets for representation and the Managed Forest. In addition, to the extent practicable, LRDs should simultaneously contribute to the protection and stewardship of a wide range of other values: Aboriginal Heritage Features, Aboriginal Forest Resources and Aboriginal Tree Use; Red- and Blue-listed plant communities (including the area of blue-listed plant communities to be conserved in the long term that may or may not be included in LRD); habitat important for species at risk, ungulate winter ranges and habitat important for regionally important wildlife, including, but not limited to mountain goats, grizzly bears, Northern Goshawks, tailed frogs and Marbled Murrelets. (See discussion of values in 3.5.1 above)

The co-location of representation and values engenders two potential approaches to building LRDs: a representation-first approach and a values-first approach. Although the GBR LUO directs a representation-first approach, experience gained in past pilot and problem-solving trials indicates that a values-first approach for some portions of some LUs will more likely achieve the overarching objective of maximizing ecological integrity and human well-being within an LRD.

The appropriate balance between the two approaches very much depends on the nature of the specific LU(s), which should have become clear by completing the checklist (step 5). In LUs without substantial concentrations of values, a representation-first approach is indicated, and indeed this is probably the norm. However, designers should be alert for situations where exceptional concentrations of values are found and where additional flexibility may be required. The two following situations serve to illustrate:

- Aggregations of important First Nations values: This would include permanent or seasonal village sites and associated resource (land, fresh and salt waters) use areas – salmon streams, clam beds, fish traps, monumental cedar, bark-stripped CMTs, food and medicinal plant harvesting areas. Reserves should incorporate cohesive areas containing these concentrations of values.
- Concentrations of biodiversity and habitat: These concentrations are most often located on the

floodplains and valley flats flanking major rivers that penetrate the Coast Mountains, specifically, the LUs of the Pacific Ranges and Kitimat Range ecosections. Cohesive low-elevation, valley-bottom reserve polygons extending from an estuary for some distance up-valley should be delineated to encompass combinations of estuarine, riparian, floodplain, active fluvial, listed plant communities, forested swamps and habitats for several regionally important species (typically grizzly bear, Marbled Murrelet and important salmonid spawning and rearing habitat). LUs comprised of large glaciated valleys containing such diversity include the Green, Kiltuish, Lower Klinaklini, Phillips and Stafford, etc. Several similar valleys have been entirely set aside as conservancies where this diversity is of particular concern to various First Nations (i.e. Khutze, Klekane-Aaltanhash and Koeye Conservancies). In areas with limited examples, or exceptional examples of old forest, consider building a design around these elements, to maximize the overall ecological values gained from inclusion of these elements.

Note that often these concentrations of values are already constrained with substantial overlap of several constraints (e.g., floodplains and active fluvial, grizzly habitat, forested swamps, listed plant communities, WHAs for Murrelet and Goshawks, etc.). Sometimes, however, reserving these high value areas would impact otherwise unconstrained THLB and thus would add to the impact on the Managed Forest for the LU. In this situation, a decision must be made to either use flexibility by offsetting with Managed Forest in other LUs in to be determined trading groups, or to not capture all of the concentration of values in the LRD (see making Trade-offs, 3.5.4).

STEP 11: If the LU under consideration has areas with exceptional concentrations of values, consider a values-first approach for that portion of the LU; otherwise use a representation-first approach.

3.5.3 Beginning to add to the starting design for Representation or Values First Approaches

For both values-first and representation-first approaches, it is first necessary to evaluate the extent to which the starting point contributes to both representation targets and minimum old levels. This makes clear the areas of SSGs needed to be added to the LRD to meet targets.

STEP 12: Evaluate the extent to which the starting point for design (from step 10) contributes to both the representation targets and minimum old levels.

Following this evaluation, the following steps are required:

Filling of gaps to attain minimum old levels and representation targets should be guided by selection rules that will minimize any impact on the Managed Forest, as follows:

- Fill gaps in minimum old levels before gaps in representation targets (any added minimum old will also contribute to representation targets)
- For minimum old gaps, fill with inoperable (NC) before operable (THLB)
- If using operable to fill gaps, give preference to most/more constrained operable
- Then, for representation target gaps, fill with inoperable (NC) before operable (THLB)
- If using operable to fill gaps, give preference to most/more constrained operable.

A good design not only requires that an LRD must meet representation targets, avoid impacting the Managed Forest and follow design principles, but should also co-locate habitat and First

Nations' values to the extent practicable. Fortunately, at relatively high levels of representation, substantial areas of habitat tend to be included by default. Conversely for the relatively low levels of representation (30% or <30% old) it can be more difficult to include substantial areas of habitat. The following steps are not necessarily sequential, rather they outline a number of processes/considerations that need to be kept in mind and more or less simultaneously integrated (and/or balanced) as best as possible.

STEP 13: Add to the starting point design to fill representation gaps and value gaps by adding to the foundation polygons (i.e. Step 10 existing protected and constrained areas) thereby increasing forest interior habitat and controlling the extent of edge.

STEP 14: Co-locate with areas of First Nations values/concerns as much as possible when adding to meet representation targets.

STEP 15: Co-locate with areas of regionally important species habitats/values as much as possible when adding to meet representation targets.

3.5.4 Making Trade-offs

Landscape-level reserve design commonly requires the designer to make trade-offs between various values. Considerations in making such trade-offs include:

- What is the rarity/replicability of the values being considered (i.e. would ecological integrity of the LRD still be strong if the value was captured in reserve in other areas of the LU? Could it be captured in reserves in other LUs?).
- What are the differences in economic impacts among choices for reserve location to accommodate an ecological value (i.e. if both areas have similar ecological value and are in operable areas, then assess if the logging chance/productivity of one area is higher than the other, then choose the area of least impact).
- Does the LU have a concentration of a particular value that is unusual for the Order Area? For example, a particular LU may have a concentration of First Nations values and thus have more reserve focused on those values than an LU with fewer First Nations values.
- If all habitat values cannot adequately be accommodated in the LU, then apply local knowledge to give higher priority to certain habitats in certain LUs. For example, LUs in the hypermaritime generally provide poorer quality habitat and support lower densities of MAMU and Grizzly than do LUs in the more incised valleys. Similarly, island-dominated LUs may be less suitable for MAMU than mainland LUs, but both might be equally suitable for NOGO.
- Where a concentration of values significantly impacts the Managed Forest, then a decision might be made to use additional flexibility (i.e. by trading Managed Forest between LUs of the same trading group (these groups have not yet been determined – see section 3.6.2).

3.5.5 Using recruitment

The minimum old levels specified for the GBR Order Area or for each LU (see target discussion in section 3.3) must be met with old forest if available, with the exceptions of some flexibility provisions in the Order (see section 3.6.2 to 5 below). Where there is a shortfall in old to meet the minimum old forest levels or long term representation targets at the order level

or the LU level, non-old areas of recruitment will be used to meet the target. The choice of non-old to place in the LRD will depend on long-term considerations of geographic distribution, Managed Forest integrity and habitats, in part guided by Appendix IV. In some instances, designing the most ecologically appropriate LRD with useful Managed Forest areas will involve recruiting areas of mid-seral or even early-seral that eventually will increasingly become useful components of the reserve network (e.g. an early seral fluvial site might be preferred to a mid-seral or mature zonal site).

STEP 16: Fill minimum old and/or long term representation targets using recruitment so as to produce a reserve design with a high degree of ecological integrity within 250 years (by the year 2264).

Once the LRD has met representation targets and included as much of the regionally important species, First Nations and HWB values as possible, then the design elements should be assessed.

STEP 17: Assess the distribution and configuration of polygons at this stage of design.

Ideally there will be a range of patch sizes that avoid having excessive edge caused by polygons with highly irregular boundaries. The LRD polygons should be well distributed throughout the LU having boundaries that fit the landscape wherever possible. Some reserves should be large, consistent with natural large patches in the LU. Small reserves should be used only for small special places or if unavoidable to meet expected Managed Forest levels. (See section 3.5.1 for more information on principles of good design).
The reserve should include areas for important values as far as possible. Those that impact Managed Forest should be identified for further consideration and to assess if elements of flexibility will allow for their inclusion.

STEP 18: Track (flag) reserve polygons impacting the Managed Forest that were included to conserve exceptional concentrations of values (so that these can be further assessed during subsequent steps and during use of flexibility).

3.5.6 Maintaining the Area of Managed Forest:

The Managed Forest target is legally established at the Order Area level and projected Managed Forest areas in the LU target tables are not legally established, but are apportioned so that they roll up to the Order Area Managed Forest legal objective. While this ensures a distribution of representation across the entire Order area, it also engenders a limited amount of flexibility in the Managed Forest area for individual LUs, i.e. Managed Forest area within an individual LU may be somewhat lower or higher than the allocated area. In recognition and respect of First Nations territories and licensee operating areas, “trading groups” of LUs will be determined and approved by the G2G forums. Within these trading groups, the Managed Forest aggregate area should be met. Appendix VIII contains a list of draft trading groups.

If the first working draft impacts the projected Managed Forest area, then the designer can first

look for possible trade-offs within the LU, by simply looking for NC areas rather than operable areas. However, if some values are deemed of high enough value, then aspects of target flexibility within the LU should be explored (see flexibility section 3.6.3 to 5). This flexibility within the LU is related to SSG targets – for example, perhaps there are options to use NC in one SSG while reducing the operable used in another. If those elements of flexibility are insufficient to maintain values while meeting the projected Managed Forest area, then flexibility within the LU trading groups can be explored (see flexibility section 3.6.2). It might also be possible to trade outside of a trading group but this will require consent of the G2G forums.

3.5.7 Maintaining the Utility of Managed Forest:

It is important to the success of EBM that the integrity of the Managed Forest be maintained; this not only requires attaining the Managed Forest area required by the GBR LUO but also ensuring that the Managed Forest is located in operationally useable/useful areas. This means that while still meeting the representation requirements of the LUO, as much as possible the reserves should attempt to create un-fragmented, operationally useful (i.e. reasonably efficient) areas of productive forest land.

SSG targets typically are met as much as possible within the inoperable land base based on the best available inventory information. However, since THLB/NC categorizations in TSR data sets are of variable quality and by no means certain, more detailed local knowledge can be applied by consultation with operational personnel as necessary to refine inoperable and operable polygons. Any polygons selected as LRD that are operable in the inventory but considered inoperable by operational personnel should be documented. These areas would not count as Managed Forest when selected for the LRD. Conversely, some inoperable (i.e. classified as NC) polygons can purposefully be left out of the design if they are considered operable based on licensee input. These should also be documented and not counted as available inoperable forest to meet representation targets but rather count towards achieving the Managed Forest for the landscape unit. The Managed and Natural Forest data will be tracked by OPIC and housed in the EBM Data Centre. This will allow a method to update and track the Managed and Natural forest areas for the Order Area in a consistent manner. Where reserving significant areas of operable forest to meet LU level representation targets is unavoidable and/or ecologically desirable, seek input/local knowledge from operational personnel to minimize the actual operational impact.

Seek to create practical operational units and, as far as possible, avoid fragmenting the operable land base. As far as possible, while simultaneously considering other design considerations, design reserves so that the areas of Managed Forest build onto areas currently of high interest for timber harvest and future production in the context of meeting the representation targets for the LU.

Stability class V terrain is not invariably excluded from the operable land base. In some cases, there are percentage netdowns applied to a forest cover polygon that do not coincide with a unit of unstable terrain (e.g. only part of a forest cover polygon is class V). Where class V terrain-stability units are mapped, and where this is supported either by satellite imagery (i.e. unstable areas are indicated and can be delineated by natural slide scars) or by local knowledge; there may be an opportunity to place inoperable class V terrain into landscape reserves without having a real impact against the Managed Forest. As noted above there may be a discrepancy between field assessments of LRD polygons and their base classification in the inventory used for planning LRDs. See Appendix V, Tracking the Managed Forest, for detail on tracking field vs inventory

data as it pertains to Managed Forest hectares.

STEP 19: Attempt to maintain operationally realistic areas of Managed Forest across the Order Area through avoiding impacts on the operable land base where possible and by managing to meet the projected area of Managed Forest at the LU level or trading group (TBD) level.

3.5.8 Restoration Zones and Temporary Old Forest Reserves:

Nine landscape units within the GBR are identified as Type 1 Restoration LUs (Thurlow, Gray, Fulmore, Estero, Knight-East, Stafford, Gilford, Lull-Sallie, and Whalen); four are identified as Type 2 Restoration LUs (Lower Klinaklini, Huaskin, Snowdrift and Miriam). These LUs have a prolonged harvesting history and relatively little remaining old forest. Short and long-term targets for conservation are lower in these landscape units because of their current condition, and because of their substantial contribution to long-term timber supply within the GBR. In addition, Restoration Landscape Units have a relatively high proportion of red- or blue-listed plant communities in comparison to the remainder of the Order Area. Apart from different timing requirements for design, both Type 1 and Type 2 Restoration LUs require the design of Restoration Zones.

The objective within Restoration Landscape Units is to "restore landscape level biodiversity in LUs with extensive past forest development activity". The required Restoration Zones are a special case or a subset of landscape-level reserves elsewhere in the Order Area. They are to be comprised of "a minimum of 30% of each SSG", however several elements of flexibility can be applied to facilitate achieving this target (see section 3.6). In addition, in order to expedite the restoration of old-growth structural attributes, thinning and silvicultural activities may also occur within Restoration Zones (see Section 4 re Modification and Management of LRDs). Appendix VII outlines how additional, more precise inventories of old forest or old forest attributes, as they are undertaken, can help identify areas desirable for LRD in restoration zones. Some of the attributes of old forest noted in Appendix VII although not present in current inventories may be visible from the imagery (orthophotos, Lidar etc.) that is used during LRD design, and thus some attributes can be used to identify areas with old forest attributes useful in reserve. If not available at the time of initial LRD design, such information would be considered under future modifications of LRDs (see Section 4). As always, inclusion of these areas needs to be balanced against Managed Forest impacts.

Restoration zones will be comprised largely of non-old forest to be recruited to old at some time prior to 2264, apart from small fragments of old forest that wherever feasible are included and surrounded by the more extensive non-old of the Restoration Zones.

Much of the remaining old forest in Restoration LUs exists as small fragments of old-growth forest scattered across a landscape dominated by second-growth forests. Since these small patches are an important element of present-day biodiversity, and their reservation is required to meet minimum old levels, they must be reserved in some way in the short to intermediate term. However, in the long term, many of these fragments would not contribute greatly to the Restoration Zones because of their size and distribution. Those judged not to be ecologically very useful or those not feasible to encompass within a Restoration Zone are therefore designated as and included in Temporary Old Forest Reserves. Consequently, Temporary Old Forest Reserves contribute both to attaining minimum old levels in the short term, and to the area of Managed

Forest in the long term (i.e. when no longer required, they will be available for harvesting).

Because of the additional spatial challenges involved in designing Restoration Zones within the four highly modified landscapes of the southern LUs, one additional element of target flexibility is available to designers within the Type 2? Restoration LUs (see Section 3.6).

STEP 20: Within Restoration LUs, design and designate Restoration Zones and Temporary Old Forest Reserves.

3.5.9 Assess the first working draft at this stage

Use the standard reporting template (Appendix III), to summarize and report representation, minimum old levels, the area of Managed Forest and the amounts of habitat, cultural and other values reserved in the LRD at this stage. Then consider the adequacy of habitat and other values, using the EBM adequacy assessment (note this is still in development with G to G as part of the Quality Assurance process) as a guide.

STEP 21: After designing the first working draft, analyze for: the adequacy of SSG representation and minimum old levels, meeting the projected area of Managed Forest, and the coverage of regionally important species habitats, cultural and other values.

3.6 Developing a Design sufficient for Stakeholder Review – the First Iteration

3.6.1 Refining the working draft to a First Iteration

Based on deficiencies identified in step 21, modify the design, re-analyze and reconsider the adequacy of design until such time as the point of diminishing returns has been achieved. During these subsequent versions, attempt to trim any excessive over-representation of SSGs from edges of reserves and especially near operable areas or areas that could be operable in the future. We suggest not spending excessive time/effort about over-representation in clearly non-operable areas such as steep-slope, higher elevation montane to subalpine forest. Subsequent review by industry/operations personnel should focus on finding and deleting from the LRD over-represented SSG areas that could be operationally useful (i.e. likely operable).

Undertake design revisions (steps 22 and higher) ideally until the required minimum old levels, the old forest representation target and the anticipated Managed Forest area in the LU target tables are achieved and improvement of co-location with respect to other values is optimized. Invariably, a point of diminishing returns is reached after several iterations.

STEP 22: Modify the design based on deficiencies identified in step 21, re-analyze and reconsider the adequacy of design until such time as the point of diminishing returns has been achieved.

If minimum old levels, representation targets or anticipated Managed Forest in the LU cannot be attained by this iterative approach, then apply the various available elements of flexibility afforded by the Order, as outlined in the following section. Often the need for flexibility occurs when designers would like to capture more of some SSG and less of others to capture certain values or

improve design; but sometimes the flexibility is needed simply because there is not enough old forest available in polygons of reasonable size or location to use in a reasonable design.

Four flexibilities are available with respect to minimum old levels, representation targets and Managed Forest areas (see sections 3.6.2 to 3.6.5). Most of these flexibilities apply within a LU but there is also flexibility to trade among LUs and within LU Trading Groups (to be determined) for both representation targets and Managed Forest area (see Section 3.6.2). Not all flexibilities apply to all landscape units.

STEP 23: Proceed to applying one or more of the four available elements of flexibility if minimum old levels, representation target hectares and Managed Forest hectares are not attained at this point.

3.6.2 Applying Target and Managed Forest flexibility within or across LU Trading Groups (TBD):

Because the GBR LUO sets legal targets for representation and Managed forest at the Order Area, there are no legal targets at the LU level; rather, the LU targets tables are calculated levels that should be in each LU to achieve targets over the Order Area. The Order thus provides flexibility to trade targets for representation or Managed Forest among LUs across the Order Area while still meeting the Order Area targets (Div 3, Section (4)1(a) and 1(b) in the Order). Each LU will be assigned to a TBD "trading group" of LUs, an amalgamation of several LUs in a geographic area that as much as possible respects First Nations territories and management units, and to some extent ecological differences. These trading groups are not specified by the LUO but will be initially developed and approved by the G2G EBM forums (See draft list in Appendix VIII). Within these trading groups, a designer can redistribute representation and/or Managed Forest in order to adequately capture ecological values and attain the aggregate area of representation and Managed Forest for the combined TBD trading group of LUs. Clearly, it would be easier and more efficient to undertake design for entire TBD trading groups of LUs more or less at the same time. Consequently, integrating LRDs for all the LUs in a trading group is advisable. Trading between groups might also be available but requires explicit G to G approval.

3.6.3 Flexibility in old forest levels used to meet the 30% minimum by SSG within a landscape unit (GBRO 4(1) c)

Generally minimally 30% of each SSG is required to be reserved in an old forest condition. There is, however, some flexibility in the projected minimum old levels for SSGs in each LU. These flexibilities in minimum old levels will not often be used, but they allow targets to be changed to allow some harvesting in some circumstances.

This flexibility allows a reduction in minimum old levels projected for the LU (GBR 4(1) (c)) to allow for some harvest of old forest below 30% total forested by SSG (see GBR Div 3; Section 4 (2)):

- Where there is more than 30% old forest in the SSG in the LU then old forest in reserve can be drawn down to 30%. In a LU, for SSGs that already have less than 30% old forest, some harvesting can occur down to 20% of the total forest area (for that SSG) or to levels specified in Schedule F.

Note that in aggregate harvesting and or drawdowns to 20% as shown in the LU target tables cannot exceed 18,650 ha over the Order Area. As well, there must be enough old forest recruited by 2264 to meet the 30% total old forest landscape unit minimum old forest representation targets.

Both the GBRO Order Area Minimum Old Levels and the minimum old forest retention levels found in the LU Target Table already allocate the entire 18,650 hectares of drawdowns to the 20% total forest area or the minimum old levels in Schedule F. A planner can choose to re-allocate those apportioned drawdowns, but that requires adjusting drawdowns to compensate for that re-allocation elsewhere. Hence, for the most part, this 'flexibility' is already taken into account in target setting and adjustments to those allocations will not likely often be used in typical LRD planning.

3.6.4 Applying Flexibility for Minimum Old Levels (within LUs)

There are two flexibility provisions in the GBR Order that apply to minimum old levels <u>within</u> LUs.

1) The first flexibility in minimum old applies to all LUs and allows using old forest in higher productivity matrix SSGs to improve ecological outcome. Specifically, 5% of the minimum old target of an SSG can be added to the reserve in a SSG of higher level (productivity) within the same variant. This flexibility applies only to matrix ecosystems (see Schedule L) and applies to all LUs. Note that the targets might have already been adjusted using the flexibility identified above in 3.6.2 and 3.6.3).

   An example of utilization of this flexibility (Div 3, section 4(5) of Order):

   - SSG A in Schedule L has a minimum old forest requirement of 30% which is (for example) 100 hectares.
   - This provision allows 5% of the area (5 hectares) to be in a higher level SSG in the same variant but contribute to the minimum requirement for SSG A.
   - This means the minimum old requirement for SSG A is made up of 95 hectares of old forest in SSG A and 5 hectares of old forest in a higher level SSG in the same variant.

2) Minimum Old Flexibility for matrix SSGs within **specific** LUs (Div. 3, Section 4(3) of Order):

   The second type of flexibility in minimum old levels is more specific and applies only to the matrix SSGs (listed in Schedule L) within nine Schedule K LUs (Thurlow, Gray, Fulmore, Estero, Knight-East, Stafford, Gilford, Lull-Sallie, and Whalen). This flexibility allows **5% of the minimum old levels to be met by forests that are not presently old**, but only if this results in an **improved ecological outcome**. In other words, the minimum old level must be met with old forest where it is available with the exception that a limited amount of younger forest can be used if it improves the overall ecological outcome.

   <u>Guidance on improved ecological outcome</u>

   An improved ecological outcome can be achieved by improving one or more of the following aspects of ecological integrity:

   - Capture of rare old growth site series

- Increased proportion/hectares of interior forest
- Improved connectivity
- Capture of riparian areas and values
- Capture of habitat for regionally important species
- Capture of habitat for other wildlife species
- Inclusion of Red- and Blue-listed plant communities

As an example:

- If the minimum old target (in an applicable LU) was 30% of 100 ha, then 28.5 hectares of the 30 hectares of old forest required would be old and 1.5 hectares could be non-old forest.

Note that if the drawdown in section 4(2)(a)(ii) of the Order was utilized reducing the old forest requirement to 20 hectares then 19 hectares would have to be old forest and 1 hectare could be non-old forest where this resulted in an improved ecological outcome.

STEP 24: Apply minimum old level flexibility within LUs as needed/as appropriate.

Note that the flexibilities in minimum old levels can overlap. For example, an SSG occurring in Schedule L and is in one of the Landscape Units listed in Schedule K this SSG could utilize multiple flexibilities. As an example, if the initial old forest requirement was 30 hectares (30% of 100) this could be reduced to 20 hectares (20%, see 3.6.3 above). The 20 hectares could include 1 hectare of non-old forest under Div. 3, Section 4(3) if this resulted in an improved ecological outcome and 1.0 hectare of old forest from a higher level SSG in the same variant under Section 4(5).

3.6.5 Matrix Flexibility for Representation Targets across Variants and LUs (Div. 3, Section 4(6)

Flexibility to 'trade' **representation targets** - is restricted to four restoration landscape units - Thurlow, Fulmore, Gray and Estero - and only involves attaining the targets for the matrix SSGs within the CWHxm2, CWHdm and CWHmm1 variants. In these limited circumstances, up to 5% of the combined representation target (i.e. 5% of the representation target for and SSG summed over all four LUs) can be offset in an equal or higher level matrix SSG (as identified in Schedule M) within any of the three variants either within one of the LUs or among all four LUs.

These four southern LUs are highly operable with very little remaining old growth at lower elevations (i.e. within the sub montane variants). The CWHxm2, dm and mm1 occur along an ecotone defined by subtle differences in growing-season precipitation. In addition, there are multiple First Nations and community interests in these LUs and this additional flexibility is designed to provide the opportunity to optimize the design while meeting the many interests.

An example of this flexibility:

- Assuming the combined target area of the 01/03 SSG in the CWHxm2 variant for the 4 LUs is 2,000 hectares. Hence 5% flexibility allows up to a 100-hectare

shortfall in 01/03.

- Consequently, these 100 hectares could be met with equivalent or higher level matrix LUs in any combination of variants and the four LUs, such as:
    - 100 ha of CWHdm SSG 0103 (‘equal’) distributed across the 4 LUs; or
    - 100 ha of CWHdm SSG 05/07 (‘higher-level’) distributed across the 4 LUs; or
    - 50 ha of CWHdm SSG 05/07 and 50 ha CWHmm1 SSG01/06 in 1-4 of the LUs; or
    - etc.

STEP 25: Within Restoration LUs, apply matrix representation target flexibility within LUs first and across LUs as needed.

STEP 26: Use LU group trading of representation and Managed Forest in accordance with OpIC and G2G processes.

This iterative design process and application of flexibility measures ultimately produces the First Iteration LRD. Further revisions to the design are anticipated based on the consultation and planning process outlined in “A Framework for Landscape Reserve Design in the Great Bear Rainforest”.

3.7 Subsequent Iterations

The First Iteration should be sent out for review by key interested parties. After that review, further iterations may be needed to address comments and further refine the reserve design.

3.8 Quality Assurance

A Quality Assurance process for LRDs is to be developed. The details on this process and supporting quality checklist documents are in preparation by G to G and stakeholders. Completion is expected later in 2016.

4 Future Modifications to the Reserve

Modifications to LRDs are anticipated to be made over time for various reasons. Both modifications to LRD boundaries and physical modifications within LRs are provided for. The items enumerated below are not exhaustive, but merely intended to provide a sense of anticipated LRD modifications and management.

Modifications to LRD boundaries will most often occur to improve reserves as new or better information becomes available, including:

1) When and where TEM replaces PEM or where TEM is refined based on more precise data.
2) Where inventories of old forest provide information to delineate better reserve areas (see Appendix VII on old forest attributes/definitions).
3) Where a high-value area or habitat is found and traded for an area initially included strictly for

representation with little or no co-location value (i.e., an improved ecological outcome).

4) Where Natural Forest and Managed Forest areas are exchanged based on improved definition and inventory of THLB and NC, providing that allows improved delineation of the Managed Forest as well as maintains a high quality LRDs.
5) Where areas reserved in the future to fulfill other objectives (e.g. areas set aside under SARA) can be integrated into LRDs and thereby control impact on the Managed Forest.
6) Where needed to address safety concerns.

Physical modifications within LRs are allowed to a limited extent to address an operational access, infrastructure or safety issue and there is no practicable alternative, to address new information and spatial planning related to Aboriginal Heritage Features, Aboriginal Forest Resources, and Aboriginal Tree Use or for silvicultural activities to hasten the onset of old forest attributes.

Specific guidance on allowable modification depends on whether or not the LU is in a restoration zone.

4.1 Amendment Criteria for LRDs not in restoration zones

A Landscape Reserve Design may be altered or modified by a qualified professional to address new information provided that the revised LRD continues to:

1) Address the Minimum Old Forest Retention Levels, the Old Forest Representation Targets and the Managed Forest area, including aspatial adjustments.
2) Contribute, as much as practicable, to the protection and stewardship of:
    i. Aboriginal Heritage Features, Aboriginal Forest Resources, and Aboriginal Tree Use; and
    ii. Red-Listed Plant Communities, Blue-Listed Plant Communities, habitat important for species at risk, ungulate winter range, and habitat for regionally important wildlife including, but not limited to, mountain goats, grizzly bears, Northern Goshawks, tailed frogs, and Marbled Murrelets.

Any area removed from the Landscape Reserve must be replaced with an equivalent area of forest in the same SSG and same seral stage or has similar stand structural characteristics or be consistent with the flexibilities discussed in Section 3.6.

4.2 Amendment criteria for LRDs in a restoration zone

The boundaries of a Restoration Zone may be altered or modified by a qualified professional to address new information, provided that:

1) The alteration or modification is required to address an operational access, infrastructure or safety issue and there is no practicable alternative or to address new information and spatial planning related to Aboriginal Heritage Features, Aboriginal Forest Resources, and Aboriginal Tree Use.
3) The alteration or modification maintains or improves ecological outcomes
4) Any boundary alteration for an individual Restoration Zone cannot exceed 10 hectares in an

LU in a calendar year without a documented rationale.

Any area removed from the Restoration Zone must be replaced with an equivalent area of forest in the same SSG and same seral stage or has similar stand structural characteristics; or be replaced with forest areas consistent with the flexibility provisions allowed in the restoration LU (4(3), 4(5) and 4(6)).

Areas removed for safety reasons that do not also maintain or improve ecological outcomes must be replaced with an equivalent area of forest, consistent with the flexibility provisions in sections 4(3), 4(5) and 4(6).

5 Guidance on Accelerating Restoration of Old Growth Structural Attributes

The GBR objectives allow for the application of silviculture treatments to expedite restoration of old forest attributes within LRDs. This would be particularly valuable in Restoration LUs. Such silviculture treatments are intended and designed to increase the rate at which as a recruitment stand develops old growth characteristics. Generally, restoration aims to increase structural diversity by accelerating the development of:

- large trees with large crown and large diameter branches;
- large dead trees (snags);
- large fallen logs to increase coarse woody debris in a variety of sizes and stages of decay; and
- a deep, complex multi-layered canopy occupied by trees of varying species, ages and sizes in varying horizontal and vertical arrangement, including a regeneration, shrub and herbaceous layer.

Many papers shave been written on approaches to restoring of old forest attributes, some key references are included below; anyone considering treatments should explore the topic in more detail than the brief summary provided in the following paragraphs.

The most effective methods to restore old forest attributes typically involve spacing and thinning from below in stands less than 50 years old (thinning is generally less effective in the later stages of stand development (i.e., after age 80) due to crown lift and density dependent mortality resulting from crown closure). One or more thinnings can create a variety of densities within a stand increasing structural and biological diversity. Areas of lower stem density have increased available light to promote a greater richness and cover of understory trees, shrubs and other understory plant cover. Thinning also creates structural diversity in the overstory by concentrating growth on fewer trees resulting in larger diameter trees with larger crowns more rapidly than in unthinned stands. Thus the thinning(s) will accelerate development of some old-growth characteristics, perhaps by decades (compared to stand development without the thinning). Variable density thinning would allow retention of pockets of unthinned trees can maintain areas of dense canopy cover useful for light and snow interception.

There are specific forest health factors to consider when planning thinning in the GBR Order area. Western hemlock is very susceptible to mistletoe and also on poorly drained sites on the outer coast (CWHvh); thinning and partial cutting can increase levels of mistletoe infections. This may not necessarily be an impediment for creation of old growth attributes. For example, large witch’s brooms may be suitable for nesting and perching and for development of arboreal plant and animal communities. Western hemlock, balsam and Sitka spruce are also highly susceptible to root disease (e.g., Annosus root disease) which can be reduced or exacerbated by thinning depending on the trees removed.

Other restoration activities (besides thinning) are also possible but are less commonly implemented. For example, creating snags through killing of large trees (e.g., girdling, or inoculating with a root disease fungus), adding large pieces of coarse woody debris when necessary, and under planting with several tree species, especially shade-tolerant conifers (where they are absent), can increase the vertical and horizontal complexity typical of old-growth forests.

Old-growth forests are highly variable and typically develop along many different pathways. Approaches to restoration should likewise use a variety of options – no one prescription (such as heavy thinning, across the landscape) should be carried out over large areas. Principles of adaptive management should be considered to observe how forests respond to management to facilitate learning from the results.

6 References for silviculture to create old forest characteristics:

BC Biodiversity guidebook, chapter 4.

Negrave, R and D. Stewart 2010. Silvicultural practices for enhancing old forest stand structures in red- and blue-listed plant communities in the CDFmm Interim document version2.0

Park, A. and L. McCulloch. 1993. Guidelines for maintaining biodiversity during juvenile spacing. FRDA publication ISSN 0–7726–1941–7, 1993. https://www.for.gov.bc.ca/hfd/pubs/docs/sil/sil233.pdf

Powellson, A and P. Martin. 2001. Spacing to increase diversity within stands. BC government publication. https://www.for.gov.bc.ca/hfp/publications/00167/Sp_Div.pdf

Voller, J and S. Harrison. 1998. Conservation biology Principles for Forested Landscapes. UBC Press.

Appendices

APPENDIX I: Datasets to support LRD planning

GIS data is to be supplied in a uniform format – i.e. as geodatabase or shape files, Albers projection.

1) Version 2 JSP dataset, including:

- Seamless TEM_PEM_ver2d
- HrdRes_Patchworks_v1_Dissolve
- THLB_w_MidCoast_Update_used_v2d_and_up
- TPv2d1_w_PPA_Grizz_UWR_WHA_Age_Prod_LdSp

The following datasets are assembled in "data packages" for groups of Landscape Units throughout the planning area. These datasets are available from the EBM Data Centre upon a user initiated request. Specific file names as used on the designated FTP site are attached to each of these items the data catalogue with all the latest file names is located at (insert FTP site link) as these names will change the data catalogue structure is shown below check off layers used in this LRD. All GBR order schedule data is available as a Geodatabase or compiled shapefiles at http://www.for.gov.bc.ca/tasb/SLRP/plan17.html under the Spatial Data files header of the GBR webpage.

Dataset	LU Group Clipped Layer Name
Landscape Units	LU
Ministerial Order Boundaries	n/a
BEC Variants	BEC
Protected Areas - Parks, ERs, PAs, RAs	ParksER
Protected Areas - Conservancies	Conservancies
BMTAs	BMTA
SFMAs	TBD
WHAs	WHA
UWRs	UWR
Proposed WHAs - MAMU (NC)	WHAProposed
Proposed WHAs – NOGO	
Proposed WHAs - TAFR (MCSC)	
Proposed WHAs - TAFR (MC)	
Proposed WHAs – SACR	
Proposed UWRs - Goat (NCMC)	UWRProposed
Proposed UWRs - Goat (NCMC)	
Proposed UWRs - Goat (NCMC)	
Proposed UWRs - Elk (MC)	
Proposed UWRs - Moose (NC)	
Excluded lands (Private, IR, Woodlots, CFAs)	PrivIRWoodlotCFA

Dataset	LU Group Clipped Layer Name
Other excluded: hardwood lic, TFL 43	
TFLs	TFL
Forest Licenses	FL
THLB - TSR2	
THLB - Kingcome TSR3	
THLB - Mid-Coast TSR3	THLB
THLB - North Coast TSR3	
Data sets available as geodatabase or shapefiles from https://www.for.gov.bc.ca/tasb/SLRP/plan17.html under the Spatial Data files header of the GBR webpage. Schedules D to R	
GBRSchD_GB	
GBRSchE_IFW	GBRSchE_IFW
GBRSchP_Kimsquit	GBRSchP_Kimsquit
GBRSchQ_CSA_	GBRSchQ_CSA
GBRSchR_Kermode	GBRSchR_Kermode
GBRSchP_Klinaklini	GBRSchP_Klinaklini
GBRSchP_Viner	GBRSchP_Viner
GBSchQ-CSA	
GBRSchR-Kermode	
HVFH/Type 1 aquatic habitat	HVFH/Type 1 aquatic habitat
VQOs	EVQO
TEM	TEM
PEM	
Regionally important Species	EBMDataCentre\WildlifeDataMar2010
MAMU:	
MAMU Habitat (Air Photo Interpreted)	MAMU_API
SCC Habitat Low-level	MAMU_HablowLev
Goshawk:	
NOGO Habitat – 2012 Version	NOGO_ForHab NOGO_NestHab
Grizzly:	
LUO Sched 2 (Grizzly Bear) - Class 2	GB_Class2_CCNC
Goat:	
SCC GWR (grid)	Goat_HabClass1_SCC
Tailed Frog:	
Proposed WHAs - TAFR (MCSC)	TAFRHabTier1
Frog Suitable Habitat (buffers)	

2) The following datasets are available on the EBM Data Centre. These are not included in the "data packages" for groups of Landscape Units.

Datasets	
Economic Operability	Frog WHA - Prop (MC)
MAMU:	Grizzly Habitat
MAMU WHAs	Moose amended areas UWR
Goshawk:	Moose combined
NOGO Nests	Moose UWRs (MC)
Specified Areas (prop)	Frog basins CC field-verified
NOGO WHAs	Frog WS (SC)
Grizzly:	TWHA?
LUO Sched 2 (Grizzly Bear) - Class 2	UWR Suit Capability
Grizzly WHAs	
GB Class 1-6 (SCMC)	
GB Suitability (all)	
Goat:	
Goat UWRs	
NC Goat Waypoints	
NC GWR	
Tailed Frog:	
Frog Locations	
Frog WHAs Proposed	
Frog Streams	
Frog Basins	
Frog Sub-Basins	
Frog Sub-basins w/o buffers	
Frog sub-basins with buffers	
Other:	
Black Bear (CC)	
Crane - Prop WHAs	
Deer habitat grid (NC)	
Deer habitat rating	
Deer suit model (SC)	
Deer WR (MC)	
Elk - Prop UWRs (MC)	
Moose (NC)	
Moose (NC)	
Proposed DWRs	
In TBD:	
Deer WR (SCC)	

3) The following datasets may provide useful landscape unit specific information to inform strategic and detailed planning, but are not currently available on the EBM Data Centre or the Geographic Data Warehouse. Information is also available at the Integrated Land and Resource Registry http://geobc.gov.bc.ca/?pl=mt-maps-geobc

Dataset
FN Traditional Territories
Arch Sites
Traditional Use and Occupancy Areas
CMTs and other sites
Development areas - IPP, LNG etc.
Satellite Imagery

APPENDIX II: Example Checklist of Data used during Landscape Reserve Design: LU: e.g. KNIGHT EAST

VALUE		Y/N check	COMMENTS
Excluded from LU Order Area			
Private & IR		Y	IR in Glendale Cove area only.
Existing Legal Reserves (and other areas treated as existing legal):			
Protected Areas (Park, ER, Conservancy etc.)		Y	Hunwadi/Ahnuhati-Bald Conservancy (3647 ha, middle of LU); Wahkash Point (189 ha farther north in LU). Both adjacent to coast.
Proposed Conservancy		N	Name
BMTA		Y	Adeane Point - 1900 ha
Recreation Sites		Y	Glendale Cove grizzly viewing
UWR		Y	Deer & Goat; goat UWR is larger than deer UWR.
Proposed UWR		N	None that we know of
WHA		N	None that we know of
Proposed WHA Moose, Crane, Frog, MAMU, NOGO,		N	None that we know of
Schedule D areas -Grizzly Bear		Y	Mostly in northern part of LU.
Schedule R areas		N	
BCTS Cultural Heritage		?	Housed NON GENUS SDE, don't have it yet? We think this is arch site data. Will email Darren.
Riparian S1 and S2 Reserve		N	No major rivers here so probably no S1, S2 but no polygon data or line work to confirm.

VALUE		Y/N check	COMMENTS
Visual Quality (Preservation)		N	No preservation but some retention around Glendale and far west point
OGMA		N	None that we know of
Proposed OGMA		N	None that we know of
First Nations data:	GIS	Y	Some shape files -including two polygons for high importance cultural cedar. Also a creek mouth.
	pdf or other		Three pdf's which provide some information. Pdf's show important visual areas; important fish watersheds, and cultural areas. Unclear what cultural areas need in terms of protection – some shoreline association noted.
DSP designations			The pdfs above came from DSP but DSP information did not seem to include the categories listed below
	CWRecArea	N/A	
	Food	N/A	
	Inter-tidal & estuary (e.g. clam beds)	N/A	
	Lowlands Final	N/A	
	Monumental cedar	N/A	
	Visual	N/A	
Lodges, Resorts, Viewing sites		Y	Glendale Cove, as noted above in private land
Hardwood licences		N	None that we know of
Other Stakeholders	Note type	N	No local population

VALUE		Y/N check	COMMENTS
			No other stakeholders such as guide-outfitters, tourism operators that we know of.
Regionally important Species:			
Grizzly Bear Note where incremental to Schedule 2	Class 1	Y	Based on Schedule D
	Class 2 high quality, field verified		There is updated grizzly bear work, but we don't have it yet from John Sunde. Our class 2 is not broken down by high quality versus non-priority or by field-verified or not. We can assign priority based on attributes of the polygons and the Appendix III of old LRD template (guidance for priority regionally important species habitat). Class 2 can usually be added into reserve with little THLB impact.
	Class 2 high quality, not field verified		See above
	Class 2 non priority, not field verified		See above
	Classes 3-6 Inventory		Not considered for reserve
MAMU Note air photo vs. low-level aerial inventory	Known locations (nests and occupied detections)	N	
	Rank 1 and 2	Y	Air photo interpreted information. A scatter of

VALUE		Y/N check	COMMENTS
			watersheds – one to the south near Glendale Cover, one middle and one north. Northern one seems to overlap same general areas as grizzly and important fish watershed from first nation area. Smaller areas between those main watersheds.
	Rank 3	Y	Air photo interpretation information
	Rank 4 - 6	Y	Not considered for reserve
	Historic MAMU	N	Not considered here. Quite general information. Air photo current habitat more useful.
Tailed Frog Note inventory	Tier 1	Y	Many streams; strictly from model, not field verified
	Field verified (Tier 1)	N	No field work here.
	Class 1 (stream reaches)	N	Don't have these as GIS layers
	Class 2 (stream reaches)	N	Don't have these as GIS layers
NOGO	Field verified nests		Non that we know of
	Nesting High	Y	Using 2014 data from Cortex. Nhab - 3 is best and 0 is worst. We used option where age 90 is best habitat, both current condition and capability. SARA direction is under review and will be directing how goshawk is accommodated on the coast.
	Nesting Moderate	Y	Same files and comments as above
	Foraging	Y	Same files and comments as above

VALUE		Y/N check	COMMENTS
	Territories approximated	N	
Other Values:			
Exceptional and/or rare old growth stands	Added from schedule K	N	N
Known Monumental Cedar stands		Y	See First Nation GIS files
Known Red-listed plant communities		N	No red-listed based on available TEM
Known Blue listed plant communities		Y	We have TEM for everything (some fringes of PEM at edges that amount to 40 ha), so have ability to look for red and blue
Non-TEM communities - wetlands, estuaries etc.			We have TEM (a piece of PEM somewhere), so have ability to look for special ecosystems
Deer habitat		N	We have knowledge of useful WR characteristics and will keep in mind
Goat habitat		Y	Yes we have modeled habitat. Also have knowledge of useful WR characteristics and will keep in mind
Active Fluvial/Large Riparian		N	None known here
Karst		N	None known here
Stability class V		Y	Not mapped everywhere (have BCTS), but can be a useful building block in some areas (consider for goat areas)
High value Fish habitat	Schedule 3 HVFH layer (old from Sunde data package)	Y	High fisheries watershed at back end of Glendale Cover (schedule 3 important fisheries watershed. That overlaps one of the watershed identified by First Nation's DSP. Also we have a HVFH layer

VALUE		Y/N check	COMMENTS
			which also includes that same drainage and many other riparian zones in larger watershed in Knight East.
Licensee data – cutblocks (permitted, planned, etc.); wildlife point & polygon, archaeology data, stream classification		Y	Not much detail (no permitted or planned blocks as such) but do have 'areas of interest' from Interfor and BCTS - limited in extent. Interfor for example mainly in Glacier Bay area, which is harvested, now early seral; some old in valley to the South. BCTS has some areas in southern half, again limited in extent. Should be able to avoid, we'll see. Also have several small priority harvest areas from Capacity Forest Management. Don't have a roads layer
THLB/NC Reviewed?		Y	Recent data set, recently updated. THLB is limited.
Other?			
Earlier Work Considered:			
LRD		Y	by Interfor (Darrin Finnerty; March 14, 2011)
QA Consider file		Y	Terry and Laurie did QA and so are familiar with Knight East issues

Overarching Strategic design considerations:

STRATEGIC DESIGN CONSIDERATIONS	COMMENTS
Look at general distribution of layers: distribution of high quality regionally important species habitat, Company interest, First Nation interest, etc. and see patterns and possibilities	See if regionally important species habitat has possibilities of overlapping or adding to current protected area. Also, how does it seem to relate to THLB?
Distribution of Hard reserves? Existing protected areas - potential to link	Conservancy in middle, BMTA to south of that; smaller conservancy in the north.
Distribution of Old (and Mature)? - geographic & elevation (variants) - fragmentation	Considerable natural mature and little old in northern part of LU – this is driest part of CWHvm hence more fire history? Old broken up with non-forest. Low at lower elevation fragmented by mature (natural) and young and non-forest. Young in valley bottom and shoreline. Even conservancies have mix of old and mature – just the natural pattern. Large piece of old at high elevation above Glacier Bay
Potential of NC to provide representation? - adequate distribution (or most in 1 situation) - Stability class V provides good representation? - THLB but highly fragmented	Areas of priority tend to be in areas already developed. One new watershed
Any variant sliver issues?	Not likely, but we'll see for sure during analyses
Patterns to be represented - as used in Kingcome TSA	Mix of mature and old is a natural pattern that should be considered in patch and interior calculations
Habitats/values concentrated or localized?	Large UWR in north (goat), Grizzly in same area; some lower elevation deer UWR.
Co-location potential	Large UWR in north (goat), Grizzly in same area; some lower elevation deer UWR. May look at Marxan's co-location layer to check where hotspots are after we've done our best to find them based on individual species needs.

APPENDIX III. Standardized LRD Reporting Template

(this is available as an Excel spreadsheet at https://www.for.gov.bc.ca/tasb/SLRP/plan17.html)

SSGs in LUs

LU	SSG

Rationale Summary

This information is intended to provide a broad overview of key factors that affected reserve design selection across the Landscape Unit. These general rationales should not be directly linked to polygons or spatial information.

1. Describe primary considerations for selection of managed forest in reserves above the amount required to meet representation targets. - E.g. High Co-location values or other exceptional values and marginal managed forest
2. Describe primary considerations for non-selection of areas with high co-location values. Some examples: - Not operationally NC high probability of being harvestable and not a significant impact on overall value capture. - Significant economic interests either for the forest sector or other industries - Would isolate operable timber.

3. A general summary noting that information was received from FNs (list which ones) that affected reserve selection. In order to protect FN interests no specific geographic reference relative to these will be documented in the reporting out template. This confidential information is to aid the plan preparer in considering FN values up front in the reserve design.
4. Describe other factors not obvious in the standard dataset that influenced reserve selection (HVFH/Type 1 aquatic habitat, Alluvial streams, FRPA constraints etc.)

LU - REPRESENTATION - LRD - Version/Date:

All figures in ha (except %)

Forested SSG	Total forested SSG in LU	long term target (ha)	minimum Target ha	Current Old inoperable	current old operable	old inoperable in LRD	TOGFRs ha total	old operable in LRD	total old contribution to minimum	Non-old inoperable	Non-old operable	inoperable non-old in LRD to meet minimum flexibility utilization	inoperable non-old to meet minimum recruitment	operable non-old in LRD to meet minimum flexibility utilization	operable non-old to meet minimum recruitment	total non-old to meet minimum target	minimum operable impact to meet minimum	actual operable impact to meet minimum	managed forest surplus/Deficit to meet minimum	inoperable old in LRD for long term	operable old for long term	total old for long term	inoperable non-old in LRD for long term	operable non-old for long term	minimum non-old operable impact to meet long term	actual non-old operable impact to meet long term	Total non-old Reserved	Total Reserved	Old Surplus / Deficit	Total Surplus / Deficit	Total managed forest Impact	managed forest Surplus/Deficit
list SSGs in LU	1,000.0	700	300	250.0	50.0	250.0	10.0	40.0	300.0	250.0	450.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	250.0	150.0	150.0	150.0	400.0	700.0	**0.0**	**0.0**	200.0	0.0
Total SSG																																

LU - VALUES SUMMARY - LRD (includes Existing Legal)

All figures in ha
(except %)

VALUE	Habitat Class	Total amount in LU (IF KNOWN)	Total in existing legal reserves	Reserved in LRD	Natural Forest in LRD	Managed Forest in LRD	% Reserved in LRD	% of Combined Habitat*	% of habitat in LU relative to subregional total for MAMUMAMU and NOGO**	% of habitat in LU for MAMUMAMU and NOGO relative to entire GBR
AHFs										
AFRs										
ATU VALUES										
Monumental Cedar										
Red Cedar										
Yellow Cedar										
Other Species										
CMTs										
CCMTs										
HCMTs										
Grizzly Bear	1									
	2									
Marbled Murrelet	1									
	2									
	3									

VALUE	Habitat Class	Total amount in LU (IF KNOWN)	Total in existing legal reserves	Reserved in LRD	Natural Forest in LRD	Managed Forest in LRD	% Reserved in LRD	% of Combined Habitat*	% of habitat in LU relative to subregional total for MAMUMAMU and NOGO**	% of habitat in LU for MAMUMAMU and NOGO relative to entire GBR
Northern Goshawk	N1									
	N2									
	F1									
	F2									
Coastal Tailed Frog	1									
	2									
Mountain Goat	UWR									
Red-listed Plant Community										
Blue-listed Plant Community										
Black Bear Dens										
Grizzly Bear Dens										

*combined habitat is all classes added together for a given species
**For consistency with the conservation Gap Analysis the same 3 sub-regions South, Central and North will be the sub-regional total against which the LU contribution is compared as well as for the GBR as a whole

FROM THE GBR LUO: to the extent practicable simultaneously contributes to the protection and stewardship of:
(i) Aboriginal Heritage Features, Aboriginal Forest Resources, and Aboriginal Tree Use; and (ii) Red-Listed and Blue-Listed Plant Communities, habitat important for species at risk, ungulate winter range, and habitat for regionally important wildlife, including, but not limited to mountain goats, grizzly bears, northern goshawks, tailed frogs, and marbled murrelets.

LU - OTHER INCLUDED VALUES SUMMARY - LRD (includes Existing Legal)

All figures in ha (except %)

Area and % of Value are optional for strategic level reporting

Value	Was this value considered/does it apply?	Area of Value Reserved	% of Value Reserved	Comments
	Checklist (Y/N or N/A)			
Existing legal (incl. in-process legal):				
Protected Areas (Park, Conservancy, Ecological Reserve etc.)				
In-process Conservancy				
BMTA/SFMA				
Recreation Sites				
UWR				
In-process UWR				
WHA				
In-process WHA				
OGMA				
In-process OGMA				
Schedule 2 (grizzly) of Legal Orders				
Schedule 7 of Legal Orders				
Other Species:				
Deer				
Sandhill crane				
Other Ecological:				
Karst				
Riparian S1 and S2 Reserve (TRIM watercourses)				

Value	Was this value considered/does it apply?	Area of Value Reserved	% of Value Reserved	Comments
	Checklist (Y/N or N/A)			
minor occurrence SSGs (rare Site Series)				
Visual (VQO = Preservation & Retention)				
DSP - area designations:				
CWRecArea				
Food				
Mon_Cedar				
Visual				
Other				
First Nations traditional use areas:				
habitation				
food/transportation harvest areas				
other				
First Nations Economic areas:				
bear viewing areas (incl. buffer)				
tourism sites (accommodation etc.)				
other				
Other Values:				
could be any human well-eing values				

Managed and Natural Forest field assessments summary

Polygon ID	MF to NF field verified (ha)	NF to MF field verified (ha)
23	5	0
36	0	10
12	5	0
totals	10	10

Flexibility summary

LU	SSG	4(3) non-old ha used	4(5) Higher Level SSG	4(5) Ha of HLSSG	4(6)equal or HLSSG	4(6) ha in equal or higher

APPENDIX IV. Guidance for Recruitment

Once the minimum target has been filled then old or non-old forest can be selected to fill the long term target. Professional judgement will be used to select the best places for recruitment in the context of the overall management of Managed Forest impacts for the LU/trading group (TBD). If operational information shows that a given polygon is misclassified in terms of age or operability, use the operational information to fulfill the target and document the change and the supporting information. This is part of the continuous improvement strategy for LRDs. The goal is to capture the actual values on the landbase in the representation targets while also meeting the Managed Forest target. In aggregate the LRDs need to meet both the representation targets and the Managed Forest hectares.

The intent of the recruitment in all operability categories is (1) to restore old-growth forest, and (2) to achieve a reserve system that over the long term has a good geographic distribution of representation, habitat and capture of the other values listed in the objectives.

Considerations of ecological utility:

- Age of the stand: older stands will develop old growth structure sooner.
- Stands that have developed structural diversity relatively early as a result of disturbances (i.e. physical disturbances, insects or disease). Age class alone can be a poor measure of old-growth attributes; it is the attributes and structures associated with old forests that are of primary interest (i.e., structural stage 6 or 7.)
- More productive sites within a SSG, since these are more likely to develop structural and habitat diversity quickly. If TEM mapping is available, it can be used to select the relatively more productive sites within a SSG Areas having values specified in the GBR LUO, particularly where multiple values are co-located.
- Sites that will potentially develop red- or blue-listed plant communities over time. Low elevation, valley-bottom fluvial sites are especially important where earlier logging has impacted such sites.
- Areas with known human well-being values, which benefit by inclusion in reserves.
- Areas with biologically significant stands (e.g. riparian and older deciduous forest -mid and early seral deciduous stands commonly have high biodiversity values [e.g. soft or decayed wood suited to cavity nesting at a relatively young age]).
- Areas that increase forest interior within reserves, areas that improve connections among reserves and/or improve geographic or elevational distribution within a LU.
- Sites that maximize carbon sequestration.
- Areas that are unlikely to be disturbed through time by either natural disturbances [avalanches, slides] or development [mining, power or other].
- Areas that have the potential to develop into regionally important species habitat particularly in consideration of the overall amount of habitat for a given regionally important species in the GBR (e.g., if there is a shortfall of the desired amount of habitat for a regionally important species then stands with potential to develop habitat for that species could be targeted for recruitment).

Economic Considerations:

In addition to the Managed Forest considerations discussed in this document also consider any other economic opportunities when locating areas for recruitment such as:

1. Areas that do not create access impediments to Managed Forest elsewhere in the LU
2. Areas that minimize the impact on logging chance and economic operability
3. Areas that minimize impact on wood quality
4. Areas that minimize the impact on other economic opportunities
5. Areas where economic opportunity would be enhanced by SRLD location e.g. a view scape for a tourism lodge.

APPENDIX V. Annual Reporting and Data Updates and Refinements

This appendix deals with annual reporting, data refinements and updates, and tracking the managed forest natural forest and productive forest landbase.

I. Annual Reporting

There are a number of elements that require annual reporting which will be discussed and refined as part of the monitoring framework. Annual reporting will include, but is not limited to the following:

1) Previous years harvesting
2) Revisions to LRDs
3) Ecosystem mapping updates.
4) Managed forest and Natural forest totals
5) Plan area targets
6) Western Yew retention areas and Grizzly and Black Bear Dens.

Some of these reporting topics will be the subject of updates and are discussed further below

II. Data Updates and Refinements:

1) There are two categories of updates to the "Risk Allocation Data Set" that will encountered during the ongoing implementation of EBM namely:

    a. Those required to reflect/incorporate new data sets (e.g. those associated with large data changes associated with the incorporation of new TEM data (e.g. the new data set in the process of being finalized by the Province that will replace approximately 1,000,000 ha of SSPEM with new TEM data) or updates to VRI mapsheets; and
    b. Those required to reflect/incorporate data refinements/resolution improvements to be applied to data sets existing at any given point in time for new inventories (i.e. forest cover inventory data (VRI) and the ecosystem mapping (TEM/PEM) that may result from new inventory work.

2) As a part of ongoing LRD implementation, the updates described above will occur as follows:

    Ecosystem Inventory

    Differences noted in the field from the ecosystem mapping will be tracked in a derived data layer separate from the Ecosystem Inventory as LRDs are refined. Updates to ecosystem mapping will be done as described below:

    a. Updated Map based system - Similar to the above only using updated TEM data based on increased survey intensity using RISC standards (usually a combination of air photo interpretation and field verified sample plots). Area by SSG and subsequent targets will be refined as map polygons are refined.

b. Field verifications will inform inventory sampling and may be used as part of the sample set for an inventory update. Field based operational surveys will be used to continually update a derived version of the TEM or PEM dataset. This includes field verification of VRI age and SSGs. This will inform and may be used to update inventories. The mapped inventory will be used to measure against targets in the order.
c. Area by SSG and subsequent old forest representation targets and minimum old levels will be incorporated as part of planned periodic inventory changes to the data sets for target determination.

Forest Cover Inventory (VRI)

Field assessments of seral stage and stand structure information will be tracked in a derived data layer separate from the VRI as LRDs are refined and field level information is gathered. When changes to forest cover attributes are found in field reviews, a rationale produced by a qualified professional will be kept on file to document the field information. VRI resolution updates will be reported annually and incorporated into the implementation dataset as per standards to be described in the EBM ILC data standards document (to be developed). Field assessments will inform and may be used as sample data for VRI updates. Minimum old levels may be revised depending on the effect of inventory changes.

III. Accounting for Managed and Natural Forest in the Order Area Over Time

1) "Managed forest" means the area of productive forest that is or will be available for timber harvest. The Managed Forest was initially defined as the area identified as the Timber Harvesting Landbase (THLB) in the v2dx dataset, less the area required to be reserved to meet Old Growth Representation Targets, Minimum Old Growth Inventory Levels and proposed BMTAs. Subsequent updates to the dataset have occurred and are expected to occur as new datasets are created. Hence the Managed Forest has already been spatially refined and is expected to continue to be refined in the future.

Ongoing, the Managed Forest will be spatially refined and calculated as follows:

a. The area of forest in the Order Area identified in the v2dx dataset as THLB that was harvested as of December 31, 2012; MINUS

b. Any area of the forest that becomes constrained from timber harvesting after December 31, 2012 (e.g. as a result of part of this area being include in a SLRD or because of new legal requirements); PLUS

c. The area of forest within the Order Area harvested after December 31, 2012 until such time that the aggregate spatially identified Managed Forest equals 550,032 hectares.

d. Areas that will be deemed to be harvested (i.e. part of the Managed Forest) include:

i. All area reserved for in-stand retention in Type 1 Restoration Landscape Units where the in-stand retention is either (i) less than 7 hectares and greater than 1.5

tree lengths from the edge of the block or (ii) less than 3 hectares within 1.5 tree lengths from the edge of the block; or

ii. Any area in any other LU that is reserved for in-stand retention that is less than 1 hectare (i.e. not mappable); and

iii. All Temporary Old Forest Reserves

Therefore areas that are classified as THLB in the dataset that in field review are found to be inoperable could be considered part of the Natural Forest and areas outside the THLB that are field verified to be operable and incorporated into harvest plans could be considered Managed Forest. These field re-classifications as noted previously will be tracked separately from the initial planning data set. To provide planning stability, the Order Area version 5 dataset used to set targets will be held static for a minimum of 5 years.

2) Incorporation of refined MF/NF field data

The intent is to annually report out on the field verified polygon re- classifications leaving the original data set unchanged but incorporating the field verifications into a modified total for MF and NF per LU. Collection of information gathered, that meets inventory standards, will be incorporated into the Order Area version 5 dataset at a frequency of up to every 5 years and targets re-run at that point.

Example:

For LU "A" the original MF total hectares in the planning data set was 150 hectares and NF total was 100 hectares.

10 hectares of original MF polygons are considered inoperable and 5 hectares of NF are considered operable. The adjusted totals for the LU are thus 145 Managed Forest (150-10 + 5) and 105 hectares of Natural Forest (100 +10 -5). The total productive forest in an SSG is not affected by these adjustments so there is no change in target hectares by SSG. However it provides a more accurate assessment of the Managed Forest/Natural Forest composition of the LU. The original classifications would also be reported on to allow assessment of the accuracy of the initial data set. It is likely the two totals could be substantially different in some LUs but over a larger area very close. This is common in operability classifications such as TSRs.

In the very long term the 550,032 hectares of Managed Forest will need to be identified and will include original MF polygons that have persisted over time and polygons that have been re-classified MF polygons. The same is true for the Natural Forest. There would only be an issue if there was a consistent trend towards MF polygons in the inventory being re-classified as NF then the achievement of the 550,032 hectares could be at risk. If there was a consistent trend the other way, with NF polygons being re-classified as operable this would enable more choice as to which hectares would be designated as MF in the long term as there could be in that circumstance more than 550,032 hectares to select from.

3) Accounting for the Managed Forest by Landscape Unit

The Managed Forest target for each SSG within an LU has been calculated and provided in the Landscape Unit target tables.

Tracking Managed Forest designations

During LRD, in order to clearly track and easily see which design choices were made, colour code/mark polygons and track by the following categories while doing the design to enable a quick aspatial and visual check on selections:

- inoperable suitable for design selected to meet targets
- inoperable not suitable for design but was counted in the assessment of the expected baseline Managed Forest target .
- Surplus inoperable above target requirements for the SSG. Some SSGs will have more inoperable than is needed to meet the target but this will not help meet a target in another SSG without trading.
- operable selections required to meet SSG targets (all inoperable used is not enough to meet target)
- operable selected for design above required amount (i.e. design choices made to consciously capture values) - will likely trigger a need to utilize the flexibility provisions within the LUO to meet the Managed Forest target within the LU or between LUs in a trading group (TBD). These may have to be balanced off within the LU or within the trading group (TBD) if the Managed Forest target is not anticipated to be met for the LU.

Specific tracking by these categories makes it easy to assess what choices in an LRD resulted in exceeding the Managed Forest target for the LU.

For all data sets field/better information on polygons will be tracked and used for LRD selections and reporting out of values contained in LRD selections. The original strategic data sets will remain separate to allow a consistent starting point for planning and reporting out. The field/better information will be noted separately to produce the final reporting out on value capture and Managed Forest.

As another example, an LRD polygon has 50 hectares of THLB and 200 hectares of NC in the TSR data set and 100 hectares of MAMU class 2 habitat based on a modelled assessment. Field assessment of the LRD polygons determines that 25 hectares of the NC is operable, 10 hectares of the THLB is inoperable and the MAMU is actually class 1 habitat.

The reporting out for this polygon would show 65 hectares of Managed Forest, 185 hectares of natural forest and 100 hectares of class 1 MAMU habitat. In the large roll out reporting the field/better information would be a separate tally vs the strategic inventory information. This allows planners to see how “certain” the information for a given value is overall (e.g. if in a given LU 80% of the Managed Forest total in LRD was field verified then there would be a high level of confidence in that Managed Forest impact estimate).

The original strategic data sets are not changed. Over a large number of field/better information LRD polygons this information will inform planners as to the typical accuracy

of the strategic data. For example it may show that the MAMU modelled assessment is incorrect 25% of the time and tends to underestimate habitat quality.

4) Assessing the Baseline Managed Forest Target

The resultant from this assessment will inform the designer on the potential to achieve a good design within the Managed Forest target for the LU. It is an aspatial assessment of the expected baseline Managed Forest target for that LU. It can identify if trading within the trading group (TBD) would be required to achieve the desired capture of values. Baseline assessment occurs as follows:

a. If the amount of operable area likely to be used in the LRD results in more Managed Forest remaining than the Managed Forest target, then it is likely that an optimal design can be completed within the limits of the Managed Forest target for the LU and no trading will be necessary.

b. If the amount of operable area used to achieve the LRD results in less than the Managed Forest remaining than the MF target, then this is a flag that the final design will not be able to achieve the Managed Forest target that was expected for that LU. This can be further exacerbated as not all of the polygons in the assessment will be suitable as LRD reserves and some further operable area may need to be used in LRD for future elements found in the course of harvesting (i.e. that are now part of the AOLN portion of the design and would reduce the Managed Forest in the LU.

c. At this point the designer will need to assess the potential of the LU level flexibility provisions in the GBR LUO to see if they apply to the LU and what effect using them will have on the meeting the desired Managed Forest target in the LU target tables. If application of the LU level flexibility provisions do not apply or are insufficient to make up the shortfall then the trading group(TBD) will need to be assessed for the potential to make up for a shortfall. The nature of the trading group (TBD) will limit the amount of Managed Forest and representation trading that can be done to try and achieve an optimal design. In some cases in heavily harvested groups options may be limited to adjust the design to improve upon the pattern resulting from the baseline assessment for meeting the Managed Forest target. The flexibility provisions in the GBR LUO will assist significantly in providing sufficient flexibility to achieve an optimal design.

d. If the amount of operable area used in the LRD results in more Managed Forest remaining than the Managed Forest target then it is likely that an optimal design can be completed within the limits of the Managed Forest target for the LU and no trading will be necessary. For example the Managed Forest Target for LU A is 1000 hectares and the total Managed Forest remaining after the LRD is drafted is 980 hectares. In this scenario continue to adjust the baseline for the elements of optimal design, tracking how much Managed Forest is actually used. The goal is to achieve an optimal design that meets the target for Managed Forest.

Note that some of the Managed Forest target may be used for the capture of elements that will be identified over time in the field as part of the AOLN portion of the LRD for incorporation into the LRD.

For example, in many instances, it may be known that rare old growth site series, exceptionally old stands, habitat for species or other desired elements for a LRD occur in a general area but their precise locations have not been identified or cannot be mapped at the landscape unit scale. An LRD may actually leave more Managed Forest in an LU then the Managed Forest target to recognize that Managed Forest will be needed for small elements that will be incorporated over time as part of the spatialization of the AOLN as the managed and natural forest reserves are defined over time or traded in for equal impact areas in the LRD if no Managed Forest target is kept in reserve for them. The qualified professional preparing the LRD will need to assess how many hectares of managed forest target if any should be kept for future AOLN spatial application of areas in the managed forest.The alternative is to use all of the managed forest target in the initial spatial portion of the LRD and if necessary trade off managed forest suitable for LRD found in spatilization of the AOLN The quality and amount of field level information will inform this potential set aside; in areas with good quality field data on a large scale there will be less uncertainity about the managed forest impact of incorporating these small elements into the LRD and this will adjust the set aside up or down depending upon the nature of the LU data incorporation. If no Managed Forest target is kept in reserve then as elements are found they will have to be swapped for existing LRD polygons with the same impact in order to keep the MF balanced.

5) Changes in Productive Forest Landbase

The Productive Forest Land Base (PFLB) is the sum of the Managed forest and Natural Forest. Potential changes to the productive forest total based on field verification will be tracked. In the Woodflow Gap Analysis (2013) and the v2dx dataset the PFLB that contributes to meeting objectives was expanded to include all stands with a forested ecosystem type in PEM/TEM data that had an age in the vegetation inventory. Changes to the mapped PFLB need to be tracked. For example if an area not classified as PFLB is field verified as ecologically valuable forest that should be incorporated into an LRD, then those hectares would be additive to the current assessment of PFLB. The opposite would be true for an area field determined to be a non-forested ecosystem type (e.g. areas of rocky bluff and/or bog which do not contain trees). Reclassification of the PFLB for the derived dataset is intended to occur to a minimum of 1 ha and is consistent with the dominant decile approach for which ecological representation is being met.

Land allocation decisions that result in alienation or ownership change may impact the PFLB that is used to calculate the targets for the GBR Order. A new land allocation decision such as a Treaty settlement could significantly reduce the PFLB that can be considered to contribute to the GBR targets. A reduction in the PFLB may require a re-consideration of the LUO representation targets, in addition to requiring a re-consideration of Managed Forest and Natural forest targets as it would affect many of the assumptions on which the LUOs were based. Conversely a large increase in PFLB would be less of an issue as targets are a percentage of the PFLB and they would proportionally be maintained, increasing the size of both the Natural Forest and the Managed Forest.

For LRD planning it is only necessary to track field-verified changes to the PFLB that are encountered as part of LRD planning or forest operations. Large scale changes to the PFLB will be dealt with by G to G in consultation with industry and stakeholders and is outside the scope of LRD planning.

APPENDIX VI: Red/Blue Listed Plant Communities in the GBRO

I. Definitions and Criteria

The LUOs in Schedules N and O provide criteria for application of red and blue listed plant communities. Definitions that go with these criteria are as follows:

"**red-listed plant community**" means a plant community listed in Schedule M that meets the age, stand structure and area criteria described in Schedule M;

"**blue-listed plant community**" means a plant community listed in Schedule N that meets the age, stand structure and area criteria described in the Schedule N;

"Sufficiently established" means, a red or blue listed plant community most commonly associated with late mature or old forest stand characteristics (with the exception of floodplains) and/or a red or blue listed plant community found in a stand not defined as old forest but with a complex, open stand structure, along with a quantity and distribution of indicator plants for the listed community, that constitutes an element occurrence with a good or better viability rank.

"Veteran overstory tree layer" means trees that are considerably older than the rest of the stand and are remnants of a much older stand. Veteran trees will have a much larger diameter or height than the main stand. The size or age of the trees, along with the density of veteran trees required to constitute a layer will be dependent on the characteristics of the rest of the stand as well as the overstory trees.

For the purposes of the objectives for blue-listed or red listed plant communities, a plant community occurrence must:

a) be sufficiently established;

b) have a minimum area of:
   - 0.25 hectares for a discrete occurrence; or
   - 2.0 hectares for a complex occurrence where the blue-listed plant community is the dominant community; and

c) be associated with forests 200 years of age or older; or

d) be associated with forests less than 200 years of age and;
   - be a floodplain ecosystem;
   - have a veteran overstory tree layer remaining; or,
   - have a structural stage of either 6 or 7.

Thus, for strategic inventory purposes (LRD and timber supply modeling) - use 200 years as the age when a plant community becomes 'old' and listed, and note connection to updates and improvement with field information as this becomes available (i.e. if the plant community is found and sufficiently established (indicator is opening canopy/stand structure >5) then the community is added to red/blue mapping for the landscape unit and managed accordingly (see next section below).

II. Target Setting for Listed Plant Communities

In addition to representation targets, the operator is required to maintain 100% of red-listed and 70% of blue-listed plant communities as listed in Schedules N and O in the GBR LUO

Calculation of total hectares is based on first decile of ungrouped TEM to calculate ha by Site Series (where not all the site series in a group are listed). Evaluation is based on the proportionate hectares within TEM polygons or field mapping where completed. These calculations are to be continuously updated based on field findings over time as per the "hybrid" approach as described below.

Hybrid Approach for Target Setting and Monitoring

100% of red-listed communities are to be reserved. Those can be identified by TEM site series map polygons, but need to be confirmed in the field. Field mapping should inform subsequent maps.

Initial targets for Blue-listed plant communities use mapped site series (the 70% of Plant Communities by Landscape Unit Approach)

1. Using the Version (5) dataset, and the dominant decile calculate the decile proportioned (polygon area * decile proportion) for each site series (that might contain a blue-listed plant community) within each landscape unit.
2. Multiply the Decile proportioned area by 70% to generate target area.

These initial targets areas based on mapped sites series are adjusted as plant communities are found, or found not to be present, in the field.

1. If a listed plant community is found in the field and not accounted for in the Version (5) dataset, then:
    a. Calculate the total area that the plant community occupies.
    b. Add that total area to the decile proportioned area.
    c. Recalculate the decile proportioned target by multiplying the decile proportioned area by 70%
2. If a blue-listed plant community is found not to be present where it was assumed to be, then:
    a. Use the total surveyed area where the ecosystem does not occur
    b. Overlay the surveyed area with the version 5 dataset
    c. Remove the surveyed area from the area where the ecosystem was estimated to occur
    d. Multiply the remaining Decile proportioned area by 70% to generate target area.

    Canopy/stand structure >5) then the community is added to red/blue mapping for the landscape unit and managed accordingly.

III. Meeting the Targets

Areas to meet targets for red and blue-listed plant communities should be incorporated into LRD polygons where possible to manage impacts to the managed forest.

1. Retain larger and older blue-listed plant community occurrences where possible to reach the 70%
2. Retain all red list occurrences that meet minimum occurrence size.

Minimum Occurrence Size and Ecosystem Viability:

Note that occurrence size and location will affect whether the listed plant community is considered a stand level feature or incorporated into the LRD (i.e. generally ≥ 1 ha) in non-Restoration zones, ≥3 and less than or equal to 1.5 tree length from a cutblock edge and/or ≥7 ha in type 1 restoration zones within the limitations of meeting the managed forest target for the LU). The intention is to incorporate the listed plant community into the LRD where it meets the size and location criteria (or where it is smaller but can be incorporated into larger reserves), or to manage as stand level retention otherwise.

Recruiting red and blue-listed ecosystems

The GBR LUO provides two tools to manage for recovery of red and blue listed ecosystems:

1. In the short term, the Minimum Old targets by SSG and specific 70% and 100% targets for red and blue listed plant communities reserve the older elements of these ecosystems; and
2. Old growth representation targets provide a second mechanism to recruit and recover red and blue listed ecosystems over time.

Site series provides an indication of the potential for a listed plant community. The minimum old targets for SSGs will reserve current (now old) red and blue-listed site series and field verification will adjust those targets as the listed plant communities are found to be present or absent in the field. The long term representation targets can be used to provide for recruitment of those site series that may have the potential to develop listed plant communities over time. The recruitment principles in Appendix IV should be used to achieve good ecological design of recruitment to meet GBR LUO Old growth representation targets for each site series group.

Sometimes in a SSG, a listed site series is grouped with a site series of another status. This SSG combination does not happen often, but when it does, monitoring should occur over time to assess if each site series in the SSG is contributing the appropriate amount to the long-term old forest representation targets. This monitoring is meant to ensure that recruitment of listed site series into the LRD is occurring at expected levels (within the constraints of optimizing multiple design considerations simultaneously). That is, monitoring should reveal that the long term representation target for that SSG includes areas of both non-listed and listed site series.

APPENDIX VII: Guidance for field identification of old growth in restoration zones

For areas with low existing OG (<30%) i.e. in restoration zones a greater emphasis in recruitment to capture old elements in recruitment stands should be considered as follows.

For SSGs with Less than 30% Total Old within Restoration landscape unit apply the following:

Stands should be considered old if they have:

1. A veteran overstory tree layer that meets or exceeds the density threshold (to be defined in field manual) or,
2. The stand has high structural complexity i.e. have a component of very large or very old trees, vertical or horizontal diversity, multi-story canopy, gaps, developing understory, large snags;

Thresholds

1. The threshold for density of old trees required for the stand to be considered as old growth should be appropriate to the rarity of old growth in the ecosystem and should consider the absolute age of the structures in the stand. This will be further developed in the field manual.

Occurrence Size

1. For the purposes of meeting landscape unit representation targets, the stand occurrence has a minimum occurrence size of 1 hectare.
2. For the purposes of stand level retention, to the extent practicable, include remnant patches that meet the minimum occurrence size of 0.25 ha, of old that meet the criteria (1, 2 and threshold 1) above.

"veteran overstory tree layer" means trees that are considerably older than the rest of the stand and are remnants of a much older stands. Veteran trees will have a much larger diameter and/or height than the main stand. The size and/or age, along with the density of veteran trees required to constitute an old growth stand will be dependent on the characteristics of the rest of the stand as well as the overstory trees (as defined in field manual).

Recommendation

A field manual to be developed in conjunction with ecologists (perhaps in conjunction with the Red and Blue Listed Field Manual process?) highlighting the alternate types of values to be used in defining old forest in Site series with less than 30% old, and across a range of ecosystem types (E.g. fir / not fir dominated). The field manual should also define varying density thresholds relative to the rarity of old growth in the ecosystem SSG(s) and minimum occurrence size.

APPENDIX VIII: Initial Potential TBD Trading groups for LRD

LU Group Number	Landscape Unit	LU Group Number	Landscape Unit
1	Estero	9	Braden
	Fulmore		Calvert
	Gray		Denny
	Thurlow		Ellerslie
	Stafford		Evans
	Phillips		Hunter
			Nootum/Koeye
2	Ahnuhati-kwalate		Outer Coast Islands
	Ahta		Roscoe
	Kakweiken		Yeo
	Knight East		
	Broughton	10	Butedale
	Gilford		Green
	Miriam		Tolmie
	Lull-Sallie		Butedale
			Don Penisula
3	Wakeman		Green
	Charles		Price
	Lower Kingcome		Roderick
	Upper Kingcome		Sheep Passage
			Swindle
4	Franklin		Tolmie
	Klinaklini Glacier		Kynoch
	Lower Klinaklini		
	Middle Klinaklini	11	Aaltanhash
	Sim		Chapple
	Upper Klinaklini		Helmcken
			Khutze
5	Allison		Klekane
	Belize		Laredo
	Huaskin		Surf
	Snowdrift		Whalen
	Walker		
6	Draney	12	Clayton
	Nekite		Smitley Neoick
	Seymour		Taleomey Asseek
	Smith Sound		
	Smokehouse	13	Saloompt
7	Neechanz		Bella Coola
	Machmell		Nusatsum
	Kilippi		Sumquolt
	Sheemahant		Talchako Gyllenspetz
8	Doos Dallery	14	King Island
	Clyak		Kwatna/Quatlena
	Fish Egg		Labouchere
	Johnston MC		South Bentinck
	Kilbella-Chuckwalla		Twin
	Washwash		
	Owikeno		

LU Group Number	Landscape Unit	LU Group Number	Landscape Unit
15	Dean	21	Kaien
	Jump Across		Khyex
	Lower Kimsquit		Stephens
	Nascall		Tuck
	Sutslem Skowquiltz		Dundas
	Upper Kimsquit		Pearse
			Quottoon
16	Crag		Somerville
	Atnarko		Union
	Sigulat		Dundas
	Young		Kwinamass
	Nechacko		Khutzeymateen Park
17	Campania	22	Kitsault
	Hevenor		Kshwan
	Trutch		Chambers
	Banks		Belle_Bay
	Captain		Observatory East
	McCauley		Anyox
	Pa_aat		
	Upper Dean		
	Entaiko		
18	Porcher	23	Marmot
	Aristazabal		Stagoo
	Gil		Observatory West
	Gribbell		Olh
	Hartley		
	Hawkes		
	Kitkiata		
	Monckton		
	Red_Bluff		
19	Bishop		
	Kiltuish		
	Triumph		
	Bishop		
	Crab		
20	Johnston_NC		
	Kumealon		
	Sparkling		
	Big Falls		
	Brown		
	Khtada		
	Scotia		
	Skeena_Islands		

APPENDIX IX: PEM/TEM Decile Hybrid Approach for Setting and Implementing Old Growth Representation Targets

PEM/TEM Decile Hybrid Approach for Setting and Implementing Old Growth Representation Targets

Where an occurrence analysis indicates that to ensure adequate representation for 2nd or 3rd decile Site Series within an SSG, RLDs should take into account all deciles within a TEM polygon (for specific SSGs as identified by the occurrence analysis), LRD methodology will be modified to:

1) Initially look at all deciles within TEM/PEM polygons within the reserve designs that are based on dominant decile to determine if the ecosystem has been represented in the initial design; (note the legal targets are set based on the dominant decile for the SSG).
2) If the targets for 2nd and 3rd decile site series within an SSGs have not been represented then when spatially locating the reserve network, planners will look at all of the deciles in TEM/PEM polygons and make best efforts to meet the LU Old Growth Representation target area within the LRD.
3) Where planners are not able to design reserves that meet the total LU Old Growth Representation target area for a specific 2nd or 3rd decile site series within and SSG, that site series within the SSG will be flagged for operational staff to identify at the field level.
4) For those flagged 2nd and 3rd decile site series within SSGs, where the occurrence of the ecosystem is greater than 2 ha, field staff can either: (Note in circumstances that fall within Appendix VI Red and Blue-Listed Plant Communities this may be a smaller area limit)
    a. Reserve for the occurrence, the percent of the LU Old Growth Representation target area (i.e. the % short fall in reserved area) for that SSG which has not been identified in the reserve network, or
    b. Reserve the whole occurrence where practicable and count that area towards meeting the LU Old Growth Representation target for that SSG