Forest and Range Practices Act

Forest Planning and Practices Regulation -

Section 7 Notice for Marbled Murrelets

Woodlot Licence Planning and Practices Regulation -

Section 9 Notice for Marbled Murrelets

Backgrounder

2020

British Columbia

Ministry of Forests, Lands, Natural Resource Operations and Rural Development

<u>**INFORMATION CONCERNING WILDLIFE HABITAT FOR THE SURVIVAL OF MARBLED MURRLET**</u>

This document is intended to provide background information and support to the legal framework of the notice of indicators of the amount, distribution and attributes of wildlife habitat required for the survival of Marbled Murrelet in the South Island Natural Resource District, Campbell River Natural Resource District, North Island Central Coast Natural Resource District, Chilliwack Natural Resource District, Sea to Sky Natural Resource District, Sunshine Coast Natural Resource District and Cariboo Chilcotin Natural Resource District.

This document is not part of the legal notice. Its purpose is to provide additional information for review and consideration by delegated decision makers and by those persons required to prepare results and strategies consistent with section 7(1) of the Forest Planning and Practices Regulation or act in a manner consistent with section 9(3) of the *Woodlot Licence Planning and Practices Regulation*.

Marbled Murrelet (*Brachyramphus marmoratus*)

1   Preamble

This document outlines provincial policy for the spatial habitat management of Marbled Murrelet (MAMU) nesting habitat (suitable habitat) on provincial Crown land in British Columbia. A revised Section 7 Notice under the *Forest Planning and Practices Regulation* and revised Section 9 Notice under the *Woodlot Planning and Practices Regulation* is proposed to support the future establishment of MAMU wildlife habitat areas (WHAs) under the *Forest and Range Practices Act* (FRPA) and old growth management areas (OGMAs) under the *Land Act.* Combined with existing spatial protection, these future reserves containing suitable habitat are intended to meet the spatial habitat management

commitments outlined in the *Implementation Plan for the Recovery of Marbled Murrelet (Brachyramphus marmoratus) in British Columbia* (FLNRORD 2018)[1].

2   Background

The federal Marbled Murrelet (*Brachyramphus marmoratus*) recovery strategy[2] identifies critical habitat for nesting in British Columbia (Env Can 2014). The federal *Species at Risk Act* gives provincial governments first opportunity to protect critical habitat under their jurisdiction. Approved in February 2018, the Marbled Murrelet Implementation Plan (FLNRORD 2018) is key to demonstrating provincial leadership on Marbled Murrelet (MAMU) recovery. The Implementation Plan addresses terrestrial nesting habitat and contains habitat management commitments for provincial Crown land. Implementation Plan objectives involve maximizing conservation efforts and supporting recovery efforts for Marbled Murrelets while also providing resource development opportunities.

In the four Northern MAMU Conservation Regions (Alaska Border, Haida Gwaii, Northern Mainland Coast, Central Mainland Coast), spatial suitable habitat analyses indicate that amounts of suitable habitat will exceed minimum habitat thresholds without the need for additional habitat protection measures. In Northern Regions, the amount of suitable habitat will be monitored over time to ensure minimum habitat thresholds are achieved.

In the three Southern MAMU Conservation Regions (East Vancouver Island [EVI], West and North Vancouver Island [WNVI], and Southern Mainland Coast [SMC]), a Land Use Objectives Regulation (LUOR) Order under the provincial *Land Act* is proposed to be established to maintain suitable habitat amounts above minimum habitat thresholds and distribute habitat retention requirements across provincial Crown land. In the EVI region, all remaining MAMU habitat on provincial Crown land is required to be maintained as habitat availability is less than the minimum habitat threshold. In the WNVI and SMC regions, in addition to the LUOR Order, the Implementation Plan has an objective that at least 80% of the minimum habitat threshold in those regions will be spatially protected in mapped reserves. The remaining habitat (≤ 20%) will be managed and maintained aspatially. This means that although the suitable habitat layer is in spatially defined polygons, the areas of suitable habitat

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[1] https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/species-ecosystems-at-risk/recovery-planning/implementation_plan_for_the_recovery_of_marbled_murrelet.pdf
[2] https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/marbled-murrelet-2014.html

contributing solely to aspatial objectives may not be spatially protected in a mapped reserve but amounts of suitable habitat will be managed and tracked.

The intent of this spatial habitat management approach is to increase certainty on the land base for resource development and improve the likelihood that suitable habitat is maintained in a patch size and configuration that represents functional habitat; habitat that provides viable nesting opportunities not impacted by forest fragmentation and associated negative edge-effects such as increased predation risk. Collaboration with First Nations and stakeholders on spatial reserve planning and minimizing impacts to resource development are other fundamental objectives of MAMU spatial habitat management.

The completion of Landscape Unit (LU) planning and Old Growth Management Area (OGMA) establishment varies across Vancouver Island and the southern mainland coast and several LUs do not have legally established OGMAs. A higher proportion of LUs in the SMC region have legal OGMAs compared to Vancouver Island. As of 2019, in the WNVI region, spatial draft (non-legal) OGMAs include over 12,000 ha of suitable habitat; whereas approximately 2,100 ha of suitable habitat is included in spatial draft (non-legal) OGMAs in the SMC region. OGMAs are designed and managed for several values, including functional MAMU habitat, and trade-offs are made when designing OGMAs to balance the capture of multiple values and minimize impacts to resource development. Therefore, due to other OGMA planning objectives, legal OGMAs may include mapped suitable habitat that may not be characteristic of functional MAMU nesting habitat polygons (see Section 8 below). Due to their small patch size and lack of interior forest condition, these OGMAs may not meet MAMU Wildlife Habitat Area (WHA) design standards. However, mapped suitable habitat in all mapped reserves will contribute to spatial habitat management goals so both MAMU WHAs established under the *Forest and Range Practices Act* (FRPA) and OGMAs established under the *Land Act* containing suitable habitat will be established to achieve the 80% spatial habitat management goal outlined in the Implementation Plan.

The following guidance is intended for First Nations, stakeholders, including forestry licensees, and government staff involved in spatial MAMU habitat planning. This guidance provides a framework for prioritizing areas for MAMU WHA establishment under *FRPA* and outlines MAMU WHA design standards. Other areas of suitable habitat that do not meet MAMU WHA design standards will be

established as OGMAs based on the *Landscape Unit Planning Guide[3]* and will contribute to multiple objectives including priorities identified by First Nations, old-growth forests, biodiversity conservation, and spatial MAMU habitat management goals. This guidance also provides information for statutory decision makers to consider when determining if areas proposed for MAMU WHA establishment meet the habitat requirements of the species; a legislative test in the G*overnment Action Regulation* for MAMU WHA establishment.

Section 3 describes the tables in Schedule 1 of the proposed notice that indicate the target and minimum amount (hectares) of suitable habitat, to be established in 1) MAMU WHAs and OGMAs combined and 2) MAMU WHAs. Once established, these reserves, combined with existing protection on provincial Crown land, will achieve the spatial habitat management commitments outlined in the Implementation Plan. The revised Section 7/Section 9 notice for MAMU is proposed to be implemented at the same spatial scales with similar flexibility provisions as the proposed MAMU LUOR order to guide the distribution of future MAMU WHAs and OGMAs to maximize biological outcomes and minimize impacts to resource development.

3   Section 7/Section 9 Notice Tables: MAMU WHA and OGMA Suitable Habitat Targets and Suitable Habitat Minimums

Section 7 of the *Forest Planning and Practices Regulation* and Section 9 of the *Woodlot Licence Planning and Practices Regulation* of FRPA provides the ability to identify indicators of the amount, distribution and attributes of wildlife habitat to be maintained on provincial Crown forest lands. Existing Section 7/Section 9 notices for MAMU in each Natural Resource District within the proposed LUOR order area are proposed to be rescinded and replaced with a new notice that also applies to Natural Resource Districts in the LUOR order area that did not previously have a notice for MAMU. The proposed Section 7/Section 9 notice is intended to maintain spatial habitat planning options and guide the establishment of new or amended legal MAMU WHAs and OGMAs.

Due to legalities, the Section 7/Section 9 Notice refers to Forest Districts instead of Natural Resource Districts and references Forest District names that may have changed when they became Natural

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[3] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/policies-guides/lup_guide.pdf

Resource Districts. For example, the Squamish Forest District is now the Sea to Sky Natural Resource District.

Table 1 of the proposed Section 7/ Section 9 Notice for MAMU establishes a minimum amount of suitable habitat to be established in both Marbled Murrelet WHAs and OGMAs combined as well as a minimum amount of suitable habitat to be established in MAMU WHAs for each Natural Resource District in the WNVI and SMC regions.

Table 2 of the updated Section 7/Section 9 Notice for MAMU establishes a minimum amount of suitable habitat to be established in both Marbled Murrelet WHAs and OGMAs combined and a minimum amount of suitable habitat to be established in MAMU WHAs for landscape unit aggregates in the WNVI and SMC regions. LU aggregates are groups of landscape units usually geographically adjacent to one another and generally located within the same Natural Resource District and MAMU Conservation Region.

Table 3 establishes both a target and minimum amount of suitable habitat to be established in both MAMU WHAs and OGMAs combined and a target and minimum amount of suitable habitat to be established in MAMU WHAs for landscape unit portions; portions of landscape units that may span Conservation Region or Natural Resource District boundaries. The suitable habitat targets can be considered a default planning target and the sum of these targets for all LU portions in a LU aggregate equals the suitable habitat minimum for that LU aggregate. Suitable habitat minimums are established for LU portions to provide some flexibility in the amount and distribution of spatial reserves (MAMU WHAs and OGMAs) within LU portions.

The minimum amounts of suitable habitat in the Schedule 1 tables include suitable habitat that is currently established in legal MAMU WHAs as well as suitable habitat that is currently established in OGMAs incremental to all other reserves. This is an important distinction because OGMAs may overlap other reserves such as ungulate winter ranges (UWRs) or WHAs and the suitable habitat in those areas of overlap has already been accounted for as existing protection. The proposed MAMU LUOR order establishes new and additional MAMU habitat protection requirements and it is anticipated that existing MAMU WHAs and OGMAs containing suitable habitat may be revisited and proposed for amendment because of these new MAMU habitat objectives.

This approach provides some flexibility in how the establishment of MAMU WHAs and OGMAs will be distributed across landscape unit portions within a LU aggregate. The combined MAMU WHA and

OGMA and MAMU WHA suitable habitat minimums at the Natural Resource District equal the sum of the LU aggregate minimums. The LU aggregate suitable habitat minimums **do not** equal the sum of the LU portion suitable habitat minimums as the LU portion suitable habitat minimums have been set at 80% of the LU portion suitable habitat targets. This provides some flexibility in how suitable habitat in MAMU WHAs and OGMAs is distributed across LU portions within a LU aggregate. However, the flexibility is limited as suitable habitat minimums must be achieved at all spatial scales. In other words, if only the minimum is achieved in one LU portion, then the difference between the minimum and the target must be made up in other LU portions within an aggregate. This approach also means that if the amount of suitable habitat in MAMU WHAs exceeds the MAMU WHA suitable habitat minimum, the remaining amount of suitable habitat required to meet the MAMU WHA and OGMA combined suitable habitat minimum can be established in OGMAs.

4   MAMU Section 7/Section 9 Backgrounder Tables

The MAMU Section 7/Section 9 Backgrounder Tables contain additional information that summarize MAMU habitat at different spatial scales, including the Conservation Region (Table 1), Natural Resource District (Table 2), Landscape Unit Aggregate (Table 3) and Landscape Unit Portion (Table 4). The tables include aspatial objectives from the proposed land use objectives regulation order tables, spatial objectives from the Section 7/Section 9 Notice tables and additional information to support amendments to operational plans and reserve planning.

Columns in Tables 1 through 3 for the Conservation Region, Natural Resource District and Landscape Unit Aggregate contain:

- **2019 SH Crown:** the total number of hectares of suitable habitat on Crown land (depleted to the end of 2018)
- **MHT:** the minimum habitat threshold (LUOR Order)
- **MOE Protected SH (Parks and Protected Areas):** the amount of suitable habitat in parks and protected areas (PPAs) administered by the Ministry of Environment
- **FLNR Protected SH:** the amount of suitable habitat in reserves established on the Crown forest land base administered by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development

- **MAMU WHA and OGMA SH Minimum:** the minimum amount of suitable habitat to be established in both MAMU WHAs and OGMAs combined (Section 7/Section 9 Notice)

- **MAMU WHA SH Minimum:** the minimum amount of suitable habitat to be established in MAMU WHAs

- **SH in legal MAMU WHAs:** the current amount of suitable habitat in legally established MAMU WHAs

- **Additional MAMU WHA SH Planning Target (SH required incremental to SH in legal MAMU WHAs):** the amount of suitable habitat to be established in new MAMU WHAs that combined with the current amount of suitable habitat in legal WHAs equals the minimum amount of suitable habitat to be established in MAMU WHAs (MAMU WHA SH Minimum).

- **SH in legal OGMAs (incremental to all hard reserves):** the current amount of suitable habitat in legal OGMAs incremental to (outside of) all other reserves.

- **Additional OGMA SH Planning Target (incremental to all hard reserves):** the amount of suitable habitat, that represents a 'default' planning approach, to be established in new, legal OGMAs that combined with the suitable habitat to be established in new MAMU WHAs and other existing protection, meets provincial MAMU spatial habitat protection objectives.

In addition to the above-mentioned column headings in Tables 1 through 3, Table 4 at the landscape unit portion scale includes additional column headings including:

- **SH Target (of Land Use Order):** the amount of suitable habitat, that represents a 'default' planning approach, to be maintained within LU portions. The total of the SH Targets for LU portions in a LU aggregate equal the LU aggregate MHT.

- **MHT (80% of SH Target (of Land Use Order)):** the minimum habitat threshold and minimum amount of suitable habitat to be maintained within LU portions. The MHT equals 80% of the SH Target.

- **MAMU WHA and OGMA SH Target (of Section 7/Section 9 Notice):** the amount of suitable habitat, that represents a 'default' planning approach, to be protected in both MAMU WHAs and OGMAs combined within LU portions. The total of the MAMU WHA and OGMA SH Targets for LU portions in a LU aggregate equal the LU aggregate MAMU WHA and OGMA SH Minimum.

- **MAMU WHA SH Target (of Section 7/Section 9 Notice):** the amount of suitable habitat, that represents a 'default' planning approach, to be protected in MAMU WHAs within LU portions.

The total of the MAMU WHA SH Targets for LU portions in a LU aggregate equal the LU aggregate MAMU WHA SH Minimum.

5 MAMU WHA and OGMA Suitable Habitat Objectives

At present, there is an uneven amount and distribution of suitable habitat protected in parks and protected areas (PPAs), administered by the Ministry of Environment, and reserves established on the Crown forest land base administered by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (i.e. ungulate winter ranges, old growth management areas, wildlife habitat areas, etc…). To account for this and meet the 80% spatial goal at the Conservation Region scale, the MAMU WHA and OGMA suitable habitat minimums have been calculated based on an equal proportion of suitable habitat outside PPAs on the Crown forest land base. The goal of this approach is that forestry licensees contribute equally, proportionally, to spatial MAMU habitat management; to the extent the distribution of suitable habitat permits.

The WHA and OGMA suitable habitat minimums acknowledge previous reserve planning efforts that have protected suitable habitat on the Crown forest land base. This results in reduced spatial reserve planning requirements in areas where relatively more suitable habitat has already been protected. This approach is meant to provide administrative fairness as it ensures that forestry licensees are not exempt from spatial reserve planning due to the proximity of their forestry tenure to PPAs and/or their tenure being in a landscape unit portion or landscape unit aggregate with relatively large amounts of suitable habitat protected in PPAs. Therefore, the future distribution of suitable habitat in all spatial reserves (including PPAs) will not be evenly distributed across provincial Crown land. However, once MAMU WHA and OGMA planning is complete, the amount of suitable habitat in spatial reserves on the Crown forest land base will be equally, proportionally distributed.

A detailed methodology outlining how the MAMU WHA and OGMA suitable habitat minimums and suitable habitat targets were calculated is available by request during the review and comment period.

Section 7 of this document contains additional information to consider for setting priorities for reserve establishment to meet MAMU WHA and OGMA suitable habitat objectives to maximize biological outcomes related to maintaining functional nesting habitat while minimizing impacts to resource development.

6 WORKING TOGETHER

It is recommended that Natural Resource District working groups be convened shortly after the Land Use Order and Section 7/Section 9 Notice are established to meet the intended biological and administrative fairness objectives and six-month timeframe for Forest Stewardship Plan amendments. District level working groups can be a forum to ensure a consistent approach is taken when developing Results and Strategies in Forest Stewardship Plans (FSPs) to meet the LUOR Order and Section 7 Notice for MAMU. In addition to FLNRORD District staff, these groups could include representatives from FLNRORD Species at Risk Recovery Branch, FLNRORD Regions, Forest Act tenure holders and First Nations in the District.

When developing Results and Strategies in Forest Stewardship Plans (FSPs) to meet the revised Section 7 notices for MAMU, it is expected that FSP holders will commit to the establishment of future MAMU WHAs and OGMAs that would protect a proportional, administratively fair, share of the MAMU WHA and OGMA suitable habitat amounts identified in the Section 7 notice Schedule 1 tables. Therefore, not only is the amount of habitat to support future reserves important to maintain, but other spatial considerations such as patch size, shape, interior forest and habitat quality are also important in order to support the design and establishment of WHAs that meet MAMU WHA design standards (see Section 7 below). In addition, opportunities will be explored for woodlots to contribute to overall spatial reserve targets.

It is the intention of this habitat management approach that *Forest Act* agreement holders with area-based forestry tenures or access to timber within volume-based forestry tenures within the same landscape unit portion or landscape unit aggregate, work together collaboratively with First Nations and each other to develop results and strategies that, collectively, will support MAMU WHA and OGMA establishment that meets or exceeds the MAMU WHA and OGMA combined and MAMU WHA suitable habitat minimums for landscape unit portions and landscape unit aggregates. It is recommended that MAMU WHA and OGMA planning occur concurrently and collaboratively with First Nations, forestry licensees and government staff who will be leading consultation and supporting the statutory decisions that will establish those reserves.

7   Setting Priorities for Spatial MAMU Habitat Planning

7.1   Landscape Level Biological Priorities

At the Landscape Unit (LU) scale, biological prioritization for spatial planning is based on the spatial analysis of available habitat including habitat quality and amounts, distribution of habitat, levels of protection and rates of habitat loss. In addition, priority areas for spatial protection can be informed by other information, where available, on known use (e.g., nest sites, audio-visual surveys, radar counts and at-sea counts). High priority Landscape Units for spatial planning include:

- LUs with suitable and high quality (class 1 and 2) habitats but relatively low amounts of existing protected habitat;

- LUs with relatively high rates of habitat loss;

- LUs with large amounts of suitable and high quality (class 1 and 2) habitat due to their overall conservation value;

- LUs with small amounts of high quality habitat to maintain some nesting opportunities. Small amounts of habitat may be associated with resource development history and/or naturally occurring forest types;

- LUs with above-average (or relatively high) numbers of nesting murrelets based on dawn surveys and radar counts (where available) and/or at-sea distributions and known nearby foraging areas;

7.2   Landscape Level Operational and Planning Priorities

Landscape Units with draft OGMAs are higher priorities for planning than LUs with legal OGMAs. In LUs without legal OGMAs, MAMU WHA and OGMA planning should be done concurrently. Where practicable, operational planning within a larger spatial context (e.g., Landscape Unit aggregates and larger forestry tenures such as timber supply areas [TSAs] and tree farm licences [TFLs]) may occur to investigate options and inform spatial habitat planning at larger spatial scales.

7.3   Stand Level Priorities

Priorities at the stand or individual reserve level for protecting MAMU nesting habitat are based on, assessments of habitat functionality, socio-economic considerations and the likelihood of use. The following factors provide supporting information relevant to prioritizing areas for protection and establishing MAMU WHA design standards:

7.3.1 Timber Supply and Operational Impacts

The goal of spatial habitat management is to maximize the conservation benefit for MAMU while minimizing timber supply impacts and operational impacts to resource development.

7.3.2 Administrative Fairness

The uneven distribution of suitable MAMU habitat across the land base and a lack of information on known use influence spatial habitat management opportunities and objectives. However, to the extent possible, there is an expectation that MAMU spatial habitat management will be distributed equitably across LUs within a Conservation Region and across affected parties.

7.3.3 Co-location

Co-location of MAMU WHAs and OGMAs with areas identified by First Nations as priorities, other constrained areas (e.g., Visual Qualify Objective polygons, unstable terrain) and suitable habitat in the non-contributing land base is a high priority. Expanding existing reserves can increase their size and functionality and should also be considered during planning efforts. Bearing in mind that habitat protected in existing reserves is already accounted for and additional habitat protection is required beyond that already protected. The backgrounder tables include additional information on the amount of suitable habitat protected in different reserves including MAMU WHAs and OGMAs incremental to other reserves.

7.3.4 Known Use/ Occupied Detections

Modelled habitats and values should always be subordinate to inventory data. Areas with concentrations of known use are high priorities for conservation. In addition, known MAMU nest locations and areas with occupied detections that represent a high likelihood of nesting are high priorities for conservation.

Table 1. Definition Of 'Occupied' Stand

Definition of "occupied" stands	Audio/ Visual Survey Code	Audio/Visual Survey Code Definition
Discovery of a chick or egg shells on the forest floor	N/A	
Birds seen perching, landing or attempting to land on branches	L	Land on or depart from a tree

Birds calling from a stationary location	S	Bird emitting at least 3 calls from fixed point
Birds flying below, through, into or out of the forest canopy (not in transit)	DB	Direct flight at or below canopy height
	CB	Circling behaviour at or below canopy height
	W	Wing beats: tremulous fluttering sound
	J	Jet sounds: whooshing sound from diving bird's wing tips

7.3.5   Field Verification

Areas that have been verified at finer spatial scales in the field as suitable (e.g. class 1 to 3 low level aerial survey) habitats are high priorities for conservation. Wherever possible, candidate MAMU WHAs should be field verified prior to submission for statutory decision. The spatial delineation of OGMAs, which typically contain less suitable habitat than MAMU WHAs, does not require field verification and can be based on available mapping and other supporting information.

7.3.6   Habitat Quality

Much of the low level aerial survey (LLAS) and air photo interpretive mapping is done at a relatively coarse scale and uncertainties exist with all MAMU habitat mapping. In the absence of finer scale habitat mapping, suitable habitat is class 1-3. If finer scale habitat mapping is available, low level aerial survey class 1 and 2 habitat have the highest likelihood of nesting birds and are the highest priority for conservation (compared to class 3). The two highest classes have more suitable structure and higher certainty of providing nesting opportunities and selection for these upper two classes has been shown (e.g., Burger and Waterhouse 2009, and Waterhouse et al. 2008, 2009). In addition, except for some hyper-maritime or possibly wind prone forests, there is a lower likelihood of misclassification of high and very high quality mapped habitats at coarser scales (e.g., Burger et al. 2018). Ensuring habitat retention is, at a minimum, proportionally distributed among the three classes to what is available in a given area is therefore important to mitigate the risk that nesting opportunities associated with any one class could be lost; particularly where Class 1 and Class 2 habitats combined, make up smaller proportions of the landscape compared to moderate Class 3 habitat.

Retention of lower quality, non-suitable habitat (class 4 to 6) is not a priority for conservation planning unless it improves the likelihood of functionality of adjacent suitable habitat; such as reducing the impact of forest fragmentation and associated negative edge-effects. Inclusion of lower quality habitat

in MAMU WHAs requires a supporting rationale related to the factors described herein and should be considered on a case-by-case basis. In general, large areas of lower quality habitat or areas with a large proportion of lower quality habitat are undesirable features of MAMU WHAs but may be suitable for OGMAs. Lower quality, unsuitable, habitat (classified by LLAS as class 4 or greater) within MAMU WHAs or OGMAs does not contribute to minimum habitat thresholds; unless the MAMU WHA is established around a known nest site (see Section 6.4).

7.3.7   Patch Size

For MAMU WHAs, a range of patch sizes is desirable. The Identified Wildlife Management Strategy (IWMS) MAMU species account (MOE 2004) recommends habitat be retained in areas <50 ha, 50 ha to 200 ha, and >200ha. MAMU habitat availability (quality, patch size and distribution) is driven by both natural processes as well as anthropogenic factors. In general, size is positively correlated with conservation priority and larger areas are higher conservation priorities. Where possible, larger areas (>100 ha) are high conservation priorities and should be the focus of initial planning efforts. Generally, MAMU WHAs are > 20 ha in size because, depending on their shape and amount of hard edge, there is a higher likelihood they have interior forest conditions that would limit nest failure linked to edge predators.   Reserving smaller patch sizes as MAMU WHAs may be acceptable if few other options exist in a LU or general area; such proposals require a supporting rationale related to the factors described herein and should be considered on a case by case basis. In addition to patch size, the amount of interior forest (>100 m from a hard or unnatural edge) and interior suitable habitat is an important MAMU WHA design consideration. Therefore, maintaining a buffer of up to 100m of unsuitable, forested habitat around areas of suitable habitat may improve their functionality. Areas of mapped suitable habitat with little or no interior forest conditions, if meeting LU planning objectives, may be established as OGMAs.

7.3.8   Distribution

At a landscape scale, Marbled Murrelets nest at low densities therefore maintaining well-distributed nesting habitat across the land base is an important objective.

7.3.9   Distance from Ocean

There is some evidence that habitat <30 km from the ocean has a greater likelihood of use by nesting murrelets and is therefore a higher priority for spatial planning than areas 30 to 50 km from the ocean. 50 km is the furthest distance from the ocean for MAMU habitat management.

7.3.10 Interior Forest and Edge Effects

Due to known negative edge-effects because of increased predation risk and deleterious micro climates, habitat should be retained in a configuration that provides interior forest conditions and reduces the amount of edge. In general, MAMU WHAs should be at least 200 m wide and preferably >400 m wide to provide interior forest conditions and viable nesting opportunities. Up to 100m of unsuitable, forested habitat can be used to buffer areas of suitable habitat to increase the functional patch size of WHAs. Lower quality, unsuitable, habitat (classified by LLAS as class 4 or greater) within MAMU WHAs or OGMAs does not contribute to minimum habitat thresholds; unless the MAMU WHA is established around a known nest site (see Section 6.4). Suitable habitat that occurs naturally in smaller patches with natural edges is not considered to have the associated negative edge effects.

7.3.11 Reserve Boundaries

Reserve boundaries should follow features that are operationally relevant and identifiable in the field. Where possible, reserve boundaries should follow natural features such as streams, gullies, heights of land and changes in forest type. In addition, reserve boundaries can follow man-made features such as cutblock edges, roads and existing reserve boundaries. Forestry licensees are a good source of information to inform reserve boundary locations.

7.3.12 Additional Available Information

Additional information and resources not specifically covered herein should also be considered to validate MAMU habitat suitability and assist in MAMU WHA design, where available. Additional information sources include: LiDAR slope and crown height models, forest cover data, the BC MAMU model and high-definition imagery (air-photos, satellite imagery).

7.4 Reserve Design for Known Nest Sites

Regardless of the habitat classification around known nest sites, these areas are high priority for reserve establishment. In addition to the factors described above, the following are additional reserve design guidelines for protection of known nest sites. The old growth forested area within nest site reserves, regardless of habitat classification, is considered to contribute to minimum habitat thresholds and spatial habitat management goals. This includes forest ranked as class 4 or 5 by API or LLAS and forest with trees >30m tall.

- **Reserve size**: Reserve size will depend on the configuration and quality of habitat in the vicinity of the nest site as well as operational information. A minimum size of 20 ha is recommended to maintain interior forest conditions and a maximum size of 40 ha of old growth forest is

recommended for a reserve where the surrounding forest and habitat is classified as unsuitable or is unclassified.

- **Maximum distance of boundary from nest location**: Where habitat around nest sites is ranked as unsuitable (class 4 to 6) or unclassified, limit the size of the nest reserve by locating boundaries not more than 500 m from a known nest site unless supported by a rationale. Reserves can extend beyond 500 m into suitable (class 1 to 3) habitat.

- **Minimum distance of boundary from nest location:** Depending on the natural configuration of habitat, where possible, boundaries of nest reserves should be a minimum of 200 m from a known nest site. Where natural edges are present, this distance can be smaller.

- **Remain within boundaries of drainage where nest is located**: Reserves should be located within drainage boundaries and should not cross over height of land.

- **Reserve shape:** Consider Including other forest, including second growth forest, to buffer patches of interior suitable habitat and improve functionality. Buffer widths of unsuitable habitat should be limited to 100 m and only applied to achieve minimum patch size and interior forest objectives.

- **Use easily identifiable landmarks** as boundaries such as height of land (where appropriate), streams, block boundaries, and edge of modeled habitat when designing reserves.

8   Designing Marbled Murrelet Functional Habitat Polygons and Wildlife Habitat Areas

Below is an example from Barnewall (2013) showing how MAMU functional habitat polygons are designed that capture many of the design elements of MAMU WHAs. MAMU functional habitat polygons are primarily drawn based on the presence of class 1 to 3 MAMU nesting habitat polygons. Figure 1 provides an example of what MAMU habitat polygons look like prior to functional habitat delineation. Figure 2 shows how two functional habitat polygons ("A" and "B") are created and outlined in red. Close-ups of the functional habitat polygons with a detailed explanation of how the polygons
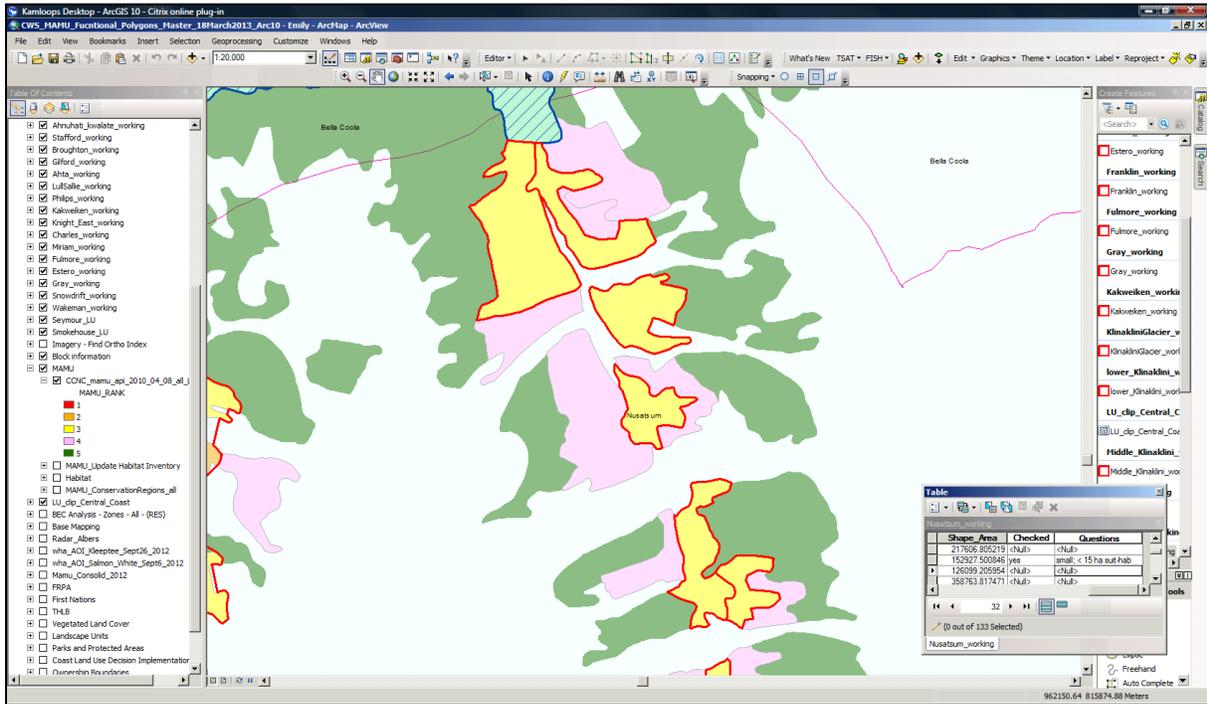
were drawn are shown in Figures 3 and 4.

Figure 1. Low level aerial survey nesting habitat prior to functional habitat polygon delineation. Nesting habitat classes: class 3 [yellow polygons outlined in red], class 4 [pink polygons], class 5 [green polygons], and non-treed areas [white polygons]. Classes 1-3 are considered suitable so the class 3 polygons are the focus of where functional habitat will be drawn. From Barnewell (2013).
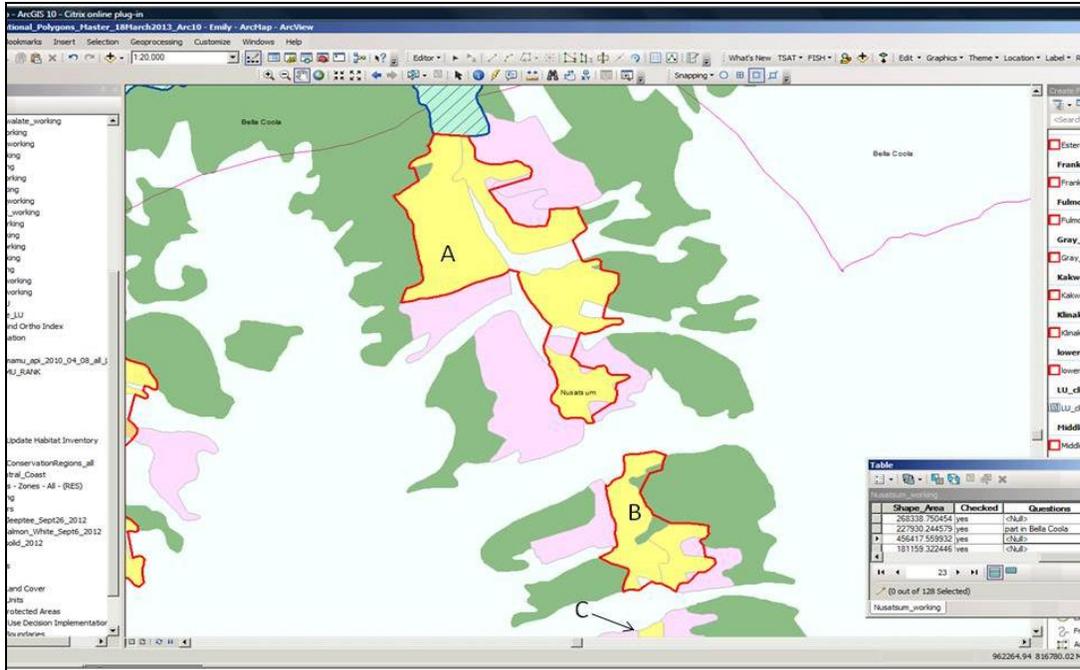
Figure 2. Marbled Murrelet functional habitat polygons ("A" and "B") and a class 3 habitat polygon that is not a functional polygon ("C"). Class 3 MAMU nesting habitat (yellow), Class 4 MAMU nesting habitat (pink), Class 5 MAMU habitat or treed forest (green), non-treed (white). Red outlined polygons are the complete functional habitat polygons. From Barnewell 2013.
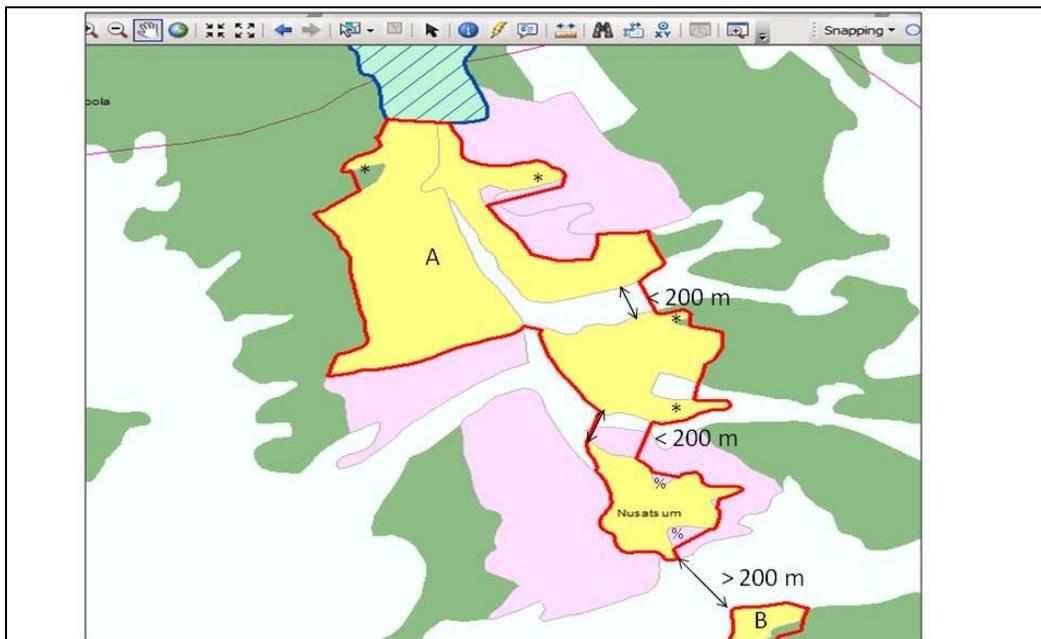

Figure 3. Close-up of functional habitat polygon "A". The northernmost functional habitat polygon (polygon "A") contains three class 3 MAMU habitat polygons that were connected because they were less than 200 m apart. To join the class 3 MAMU nesting habitat polygons, class 4 and non-treed habitat was included. Polygon "B" was not connected to polygon "A" because it was greater than 200 m away. To maximize interior habitat, areas with functional habitat less than 150 m wide (*) were increased so the minimum functional polygon width was between 150 – 200 m (*)Class 4 (pink), class 5 or treed (green) or non-treed with natural or soft edges (white) areas can be used to widen polygons to create functional habitat. Anthropogenic or hard edges such as cutblocks (light blue with dark blue diagonal stripes) are not included as functional habitat. To improve the interior habitat and configuration of the functional habitat polygons, edges can be "smoothed" (%). From Barnewell (2013).
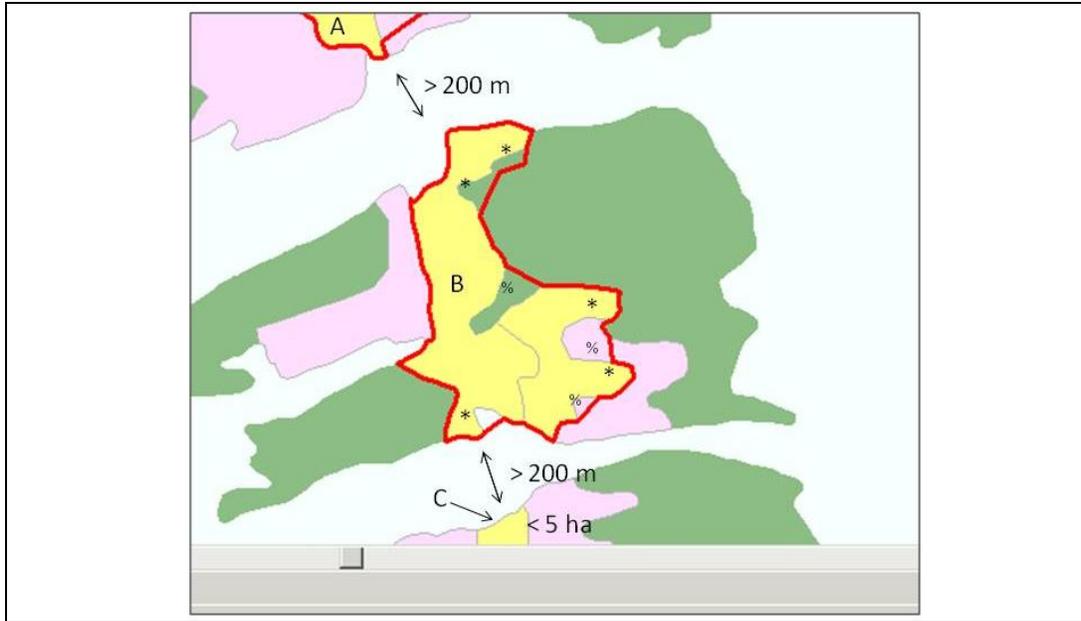
Figure 4. Close-up of functional habitat polygon "B" and "C". Polygon "B" shows numerous areas that are less than 150 m in width (*). These areas have been extended using class 4 (pink), 5 or treed (green), and non-treed (white) areas so the minimum width is at least 150 m. Polygon "B" was not connected to polygon "A" or "C" because the narrowest interval between the closest MAMU nesting habitat polygons was greater than 200 m. To improve the shape and to reduce edge effects, edges can be smoothed (%). South of polygon "B" is a small class 3 MAMU nesting habitat polygon that is not a functional polygon (polygon "C"). This is because polygon "C" is: a) greater than 200 m from polygon 2 and b) less than 20 ha. Since polygon "C" is greater than 200 m from polygon "B", it is not included as functional habitat nor can it be its own functional habitat polygon because, in the majority of instances, 20 ha is the minimum functional habitat polygon size. From Barnewell (2013).

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