Husby Group
Haida Gwaii

Forest Stewardship Plan
Supporting Information

2023 – 2028

September 2023

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1.0 Preamble

This Forest Stewardship Plan (FSP, “the Plan”, “this Plan”), Supporting Information document is meant to assist reviewers in the FSP approval process. Where necessary, rationales have been provided for results and strategies within the FSP that may require added clarification and background info, for FSP reviewers to more fully understand the intent and direction proposed by the Plan Holder.

2.0 Application

In general, it is understood that the Plan Holder's operations must factor in adjacent landholders and that operations within the Plan Holder's tenures should not adversely affect areas outside of the Plan Area, including Parks or Protected Areas. As such, the Plan Holder will plan their operations to factor in adjacent landholders and the values that may potentially be affected. Any management strategies or actions implemented to protect adjacent landholders will be confined to the Plan Area (i.e., treatments will not occur outside of the FSP Area).

Where the Plan Holder operates near other stakeholders or landholders, the standard approach taken will be to contact the stakeholder/landholder early in the development process and work proactively to ensure that stakeholder/landholder concerns are considered.

Legal Surveys

Where the Plan Holder proposes development areas near a Protected Area or other property/ tenure boundary, it is incumbent on the Plan Holder to ensure they are not operating outside of the Plan Area and that they do not encroach on Protected Areas or other tenures. This is a requirement established under the Forest Act and is not an objective to be addressed under the FSP. It is expected that when the Plan Holder commences development adjacent to a Protected Area or other property/tenure boundary, the first issue that will be addressed is the location of the tenure boundary utilizing original boundary descriptions and locating blazes and pins in the field. Newer boundaries such as those along Protected Areas and Cedar Stewardship Areas will use commercial grade GPS equipment. In addition to spatially locating boundaries, the Plan Holder will typically contact potentially affected stakeholders and work collaboratively to ensure that their management concerns are addressed (e.g., offer to meet with adjacent tenure holders to field-check boundary locations).

3.0 Clarifications

Operational Feasibility is clarified in the Forest Stewardship Plan to mean "that a Qualified Professional rationalizes that a goal can be completed without unreasonable difficulty, without employing unnecessary means, and without incurring extreme costs to achieve the same outcome by removing the factor that will require said difficulty, unnecessary means and incurring extreme costs."

Operational feasibility is referred to in the FSP regarding alterations, removals, and/or reduction in the size of the reserves associated with Cultural Cedar Stands, CMTs and/or Monumental Cedars.

The Plan Holder is committed to maintaining the integrity of these features and their reserves but there are examples when alterations, removals, or reductions in the size of reserve zones would allow for the best management of these features when considering cultural, social, environmental, and economic factors. These objectives are considered in no order but rather considered together to determine the best management option. Some examples to illustrate when Operational Feasibility may be considered while determining a management strategy are:

Example 1: Several CMTs are located along a proposed road location. The original road location is considered the optimal route. The Plan Holder moves the road location to the second- best route and 1 CMT is located along this route. If the road route is moved again to avoid the one CMT then the only other road routes would result in extreme cost. The Plan Holder would remove the CMT because of Operational Feasibility reasons resulting in the best management of the other resources.

Example 2: A monumental cedar >120cm dbh is located within a development area near the top of a ridge. The area is known to have a high risk for windthrow. If the entire area of the reserve associated with the monumental cedar is retained a portion of the reserve (.2 of a tree length) would be located at the top of the ridge completely exposed to wind and at an extreme risk for windthrow. The reserve would be reduced to an appropriate size so that the reserve is not exposed to the wind because of Operational Feasibility.

4.0 Results & Strategies

Cultural Objectives

The Council of the Haida Nation has developed a competency-based program (open to Haida and non-Haida) that caters to the LUO requirements. Certified surveyors need to pass a written and practical examination (65% minimum on both to pass). Examinations are 1.5 days in length and include testing for CMT identification, Monumental cedar identification, cultural plant identification, survey methodology, and standards and ecosystem classification.

The Cultural Features Identification Survey (CFIS) program also includes a quality assurance/audit aspect to ensure that the quality of surveys remains consistently high. Approximately 10% of surveys will receive full audits annually.

The Plan Holder will adhere to the FSP and their Standard Operating Procedures (SOPs) which are in accordance with the objectives of the Cedar Stewardship Area Management Plan found at http://www.haidanation.ca/wp-content/uploads/2018/02/Cedar-Man-Plan.FINAL-downsized.pdf.

Tracking Ledger – The Plan Holder utilizes a tracking ledger to track harvesting area, hydrological recovery area, total area of upland stream area, % hydrological recovery, % hydrological recovery balance, and sensitive watershed available area to harvest.

The current "Inventory of Cedar Stewardship Areas" is established under the LUO. Where the Plan Holder proposes to harvest within a Cedar Stewardship Area (CS Area) they will track the depletions, as outlined in the FSP. To ensure all commitments are met, the Plan Holder will maintain a ledger to track the additions/removals to the baseline inventory noted above. The Ledger is an electronic database that tracks both the hectares of CS Area harvested by LU, as well as a spatial representation to identify areas.

Haida Traditional Heritage Features

Applicable HTHFs

The Council of the Haida Nation's Cultural Features Identification Survey manual indicates that where potential HTHFs are identified during a survey an independent Archaeological Impact Assessment (AIA) will be required/conducted.

Karst

"Karst Features" are identified in the LUO as Class 2 HTHFs and have results specific to the LUO Objectives for HTHFs. Under the LUO, Karst Features are not well defined and would therefore include all potential karst occurrences.

However, "Karst Resource Features" have also been established under GAR, which includes a more specific definition. Additional results have been specified for the FRPA requirements.

For clarity, if a karst occurrence meets the definition of Karst Resource Feature as designated under the GAR Order, it will also be managed to the higher standard, which will ensure that it is not damaged or rendered ineffective, regardless of any intergovernmental processes that may be completed under the LUO Objective for HTHFs.

Haida Traditional Forest Features

Class 2 HTFFs

To be consistent with the LUO, the establishment of stand level retention will be one of the strategies employed to maintain the integrity of the HTFF. The use of stand level retention will be at the discretion of the signing Forester and will be detailed in the Site Plan.

Cedar Retention

15% Cedar Retention Requirements

The Plan Holder has implemented strategies in the FSP to meet the objective. The prescribing Forester will illustrate in the site plan how the objective was met. If required, the weighted cedar retention requirements will be calculated using the inventory mapping information available. An example to illustrate the calculations is provided in Figure 1 below.

Figure 1: 15% Cedar Retention Calculation Example.

Sample Development Area

Development Area = 35.0ha, consisting of 3 inventory polygons

Polygon A= 15.0ha - Inventory= C_{10}

Polygon B = 10.0ha - Inventory= H_5B_5

Polygon C = 10.0ha - Inventory = H_5C_5

No-harvest zones established for Type I Fish Habitat= 3.5ha (Inventory = C_{10}) Monumental Cedar No-harvest zone=

2.5ha (Inventory = H_5C_5)

Weighted Cedar Content Calculation

The weighted pre-harvest cedar composition for the Development Area is calculated as follows:

Cedar % = (sum areas of inventory polygons * associated % cedar content)/area of Development Area

= [(Polygon A* Cw inv. for A) + (Polygon B * Cw inv. for B) + (Polygon C * Cw inv. for C)]/ area of Development Area

= [(15.0ha*100%) + (10.0ha*0%) + (10.0ha*50%)]/35.0ha

= [(15.0 + 0 + 5.0ha)]/35.0ha

= 20.0ha/35.0ha

= 57% = pre-harvest combined cedar content for the Development Area (or 20.0ha, measured in area)

Therefore, as the Development Area is > 10.0ha and the combined pre-harvest cedar content is> 30%, the 15% cedar retention requirement applies.

Calculation of Cedar Area Required

In order to meet the cedar retention requirement, Plan Holder must retain a minimum of 15% cedar, measured in hectares, consistent with the FSP Strategies. For the example above, the minimum cedar retention area required would be calculated as follows:

The minimum Cedar Retention Area required = 15% * the weighted cedar content for the Development Area. As calculated above, the weighted cedar content was 57%, or 20.0ha

= 15%*20.0ha

= 3.0ha

Therefore, for the Development Area, 3.0ha of cedar area must be reserved (i.e., 3.0ha of C_{10} inventory; or 6.0ha of H_5C_5).

Establishing Cedar Reserves

In this example, there are two retention areas already established. The sum of the weighted cedar retention areas associated with the established retention areas is calculated as follows:

Cedar content for Type I Fish Habitat no-harvest zone = (area* cedar inventory for polygon)

= 3.5ha*100%

= 3.5ha

Cedar content for Monumental Cedar no-harvest zone = (area* cedar inventory for polygon)

= 2.5ha*50%

=1.25ha

Therefore, the total weighted area of existing cedar retention areas = 3.5 + 1.25ha = 4.75ha

Summary

Given that there are > 3.0ha of cedar retention areas established for the Development Area and that both of the designated cedar retention areas are greater than 1.0ha in size, for this example, provided that the prescribing Forester confirms that the cedar retention stands contain a range of diameters of cedar that are representative of the preharvest stand, all of the strategies for the 15% cedar retention requirement are deemed to be met.

With regards to the strategy committing to retaining a range of cedar which is representative of the pre-harvest area, the Plan Holder will do this by selecting areas of similar species and stand characteristics as the harvest area. Where the prescribing Forester cannot easily determine that 15% weighted cedar is retained the weighted cedar area retained will be calculated as above to ensure the objective is met. It will be left to the prescribing Forester to ensure that the cedar retention stands that are selected to meet the 15% cedar retention requirement are representative of the pre-harvest stands and this should be documented within the Site Plan.

20% Cedar Regeneration Requirements

The Plan Holder will calculate this strategy by defining "composition" based on live stems per hectare of western red and yellow cedar (as indicated in the cruise compilation), rather than a volumetric approach (use of sph is consistent with previous MSSc procedures). A cedar requirement survey will be completed within 20 years and made available to the Province.

Specific rationales for Cedar Retention objective are provided (in FSP section) as follows:

> *Where development areas have pre-harvest cedar (western red cedar and yellow cedar) composition greater than 20% in the harvested area, as indicated in the cruise compilation (measured in percent of cedar sph, not including dead potential or dead useless), then the Plan Holder will regenerate the area according to the minimum post-harvest cedar composition and strategies listed below.*

In regard to the use of stem per hectare (sph) versus volume (m^3) or basal area (m^2), it was thought that sph would provide the most accurate picture of what was located (found) on site. Using volume or basal area may have resulted in varying percentages for similar blocks. With regards to the removal of dead potential and dead useless from the cruise information (i.e., net-merch volume), it was determined that they should not be included in the calculation, as they are no longer contributing to the Mean Annual Increment of the site. This portion of the LUO objective is focused on cedar regeneration, in essence, replacing live trees with live trees.

> *The cedar commitment will be determined on a cutblock-by-cutblock basis. The cedar regeneration requirement for a cutblock will be calculated by multiplying the NAR times the appropriate Minimum Post-Harvest Cedar Composition, as indicated in Table 1 below. Location of planted cedar within the cutblock will be at the discretion of the prescribing Forester, and consistent with approved stocking standards.*

Table 1: Minimum Post Harvest Cedar Composition, Based on Pre-Harvest Cedar Composition.

Pre-harvest Cedar Composition %	Minimum Post-Harvest Cedar Composition (sph)
20–29	100
30–39	150
40–49	175
50–59	200
60–69	250
70–79	300
80–89	350
90–100	400

The Net Area to be Reforested (NAR) is used as this is the only area that will be restocked. All reserves and NPUNN will not be restocked. Table 1 was established based on the former Cedar Policy for the Haida Gwaii

Forest District, with the top two pre-harvest composition categories being increased from those stated in the Policy.

The location for planting the required cedar has been left up to the prescribing Forester so that they can maximize site productivity and plant the cedar in the most desirable locations.

The use of naturals will be encouraged and will count towards the final survey of cedar.

The Plan Holder is committed to protecting planted trees as well as monitoring plantations for survival. The 80% survival target was established as a reasonable benchmark to initiate fill planting. By allowing up to 20% mortality of planted cedar, the Plan Holder is afforded a reasonable amount of operational flexibility. The 20% leeway in survival will also temper any variation or anomalies that come about during surveys.

a) Cedar acceptability criteria will be as follows:

i) Regenerated cedar will only be accepted if they are of good form and vigour.

ii) Regenerated cedar will only be accepted if they are ≥ 1.2m tall.

Acceptability criteria are provided to support the fact that the Plan Holder are working to establishing the cedar regeneration such that they will be reasonably expected to form part of the future stand. While the cedar obligation is not part of a Free Growing Survey, the acceptability criteria are much the same. Acceptability criteria are based on the Free Growing standards as defined in the Ministry of Forests Silviculture Survey Procedures Manual- 2022.

The 1.2m minimum height is provided to ensure that the cedar regen is above deer browse height and beyond the need for protection.

While the cedar obligation resembles a free growing survey in some respects, the cedar obligation is a different and as a stand-alone obligation it will be managed accordingly. The obligation due date has been established such that the Plan Holder is encouraged to meet the cedar regen obligation as early as possible but is still provided enough time to allow for fill planting and stand tending activities, if required.

It should be noted that while there will be a minimum post-harvest cedar composition calculated for the block, the final amount of cedar established may not always meet the requirement. Provided that the Plan Holder has shown due diligence in attempting to re-establish a cedar composition (i.e., planted, protected, surveyed, fill planted once) then the obligation will be deemed fulfilled based on the amount of cedar that have been established.

The cedar regeneration requirement for a given cutblock may be lower than those set in the FSP, provided that the new requirement is consistent with the outcome of a completed intergovernmental process.

An intergovernmental process option was added to the Cedar Regeneration Section, to allow the Plan Holder the option of addressing exceptional circumstances, for example other objectives established under the LUO.

Western Yew

The Plan Holder's objective is to protect as many western yew trees as possible. The Licensee wishes to target protection of 100% of individual western yew on a development area level. This target can be tracked by comparing the pre-harvest and post-harvest mapping and recording of western yew occurrences. The Plan Holder will use the following strategies to retain individual Western Yew:

- Western Yew will be retained in reserves outside of the block boundary,

- During harvesting operators will fall and yard away from Western Yew.

Monumental Cedars

The Licensee will do the following to track the harvesting and provide Monumental Cedars to the Haida Nation:

1. Monumental Cedars will be identified during the block planning stage by certified CFI surveyors.
2. Prior to harvesting, Monumental Cedars will be marked in the field using unique ribbon and/or paint.
3. Prior to harvesting, Monumental Cedars will be provided to Haida Gwaii Cultural Wood Program and an estimated availability date will be proposed.
4. Once harvested, Monumental Cedars butts will be marked, with a unique identifier, and will be placed in a landing on along the road.
5. Once harvested, the Haida Nation will be provided the Monumental Cedar for an amount equal to the associated logging costs.

Social Objectives

Aquatic Habitats (LUO) & Riparian Areas (FRPA)

Stream Riparian Classifications and Management – LUO vs. FRPA

There is significant "overlap" between the requirements under the LUO and FRPA (including the FPPR). For most objectives, reconciling the differences between the LUO and FRPA is straightforward. However, there is significant conflict between the LUO and FRPA regarding stream classification, and to a lesser extent, stream management requirements.

The LUO and FRPA both establish stream classification systems, which do not correlate 100% of the time. Both the LUO and FRPA also establish reserve and management zones, which again, do not correlate (FRPA zones are measured in metres and LUO zones are measured in tree-lengths, which are linked to site series and seral stage). Lastly, the LUO and FRPA both establish restrictions and management requirements within riparian areas, but again, these do not necessarily correlate.

Table 2 below provides a brief comparison of the riparian requirements between the LUO and FRPA. For analysis purposes, the tree-length height for LUO streams was assumed to be 40m, based on an average tree-height for zonal sites across all BEC units and seral stages. If anything, this assumption is conservative, as most riparian areas are likely richer than zonal sites, resulting in taller tree-heights.

Table 2 shows that in most cases, the riparian reserve requirements meet or exceed those established under FRPA, especially for Type I and II Fish Habitat streams.

Table 2: LUO vs. FRPA Stream Management Comparison.

	Stream Class	RRZ / No-Harvest Zone	RMZ	RMA	RMZ BA Retention
	FRPA - S1	50m	20m	70m	0–100

Comparable large fish stream classes and management zones (LUO vs. FRPA)	FRPA - S2	30m	20m	50m	0–100
	FRPA - S3	20m	20m	40m	0–100
	LUO - Type I Fish Habitat	2.0 Tree-lengths (80m)	-	2.0 Tree-length (80m)	N/A
Comparable small fish stream classes and management zones (LUO vs. FRPA)	FRPA - S4	-	30m	30m	0–100
	LUO - Type II Fish Habitat	1.0 Tree-length (40m)	0.5 Tree-length (20m)	1.5 Tree-lengths (60m)	~100%
Comparable "non-fish" stream classes and management zones (LUO vs. FRPA)	FRPA - S5	-	30m	30m	0–100
	FRPA - S6	-	20m	20m	0–100
	LUO - Upland Stream	-	-	30m	N/A

Two realistic options exist when trying to develop results/ strategies to address both the LUO and the FRPA objectives: follow the LUO only or try to develop a process to simultaneously meet the conflicting objectives of both the LUO and FRPA.

The FSP has been developed to address all the stream riparian requirements using the LUO approach except for where a LUO approach does not address a stream, as is the case for S5 and S6 streams. These examples will be managed as per FRPA (and FPPR) requirements.

The Plan Holder ensures that aquatic habitat features are identified in the engineering and Site Planning phases by employing experienced and educated forest professionals. This includes registered forest technicians, professional foresters, and foresters in training. These people are trained by accredited schools in species and habitat recognition. The Site Plan forester ensures that features are properly identified, described and management is properly prescribed to meet the legal requirements.

Wetlands & Lakes

The FSP was developed to where wetlands and lakes meet the definition of Type I or II Fish Habitat, they will be managed as such. However, in all other cases, wetlands and lakes will be managed as per FRPA (and FPPR) requirements.

Upland Stream Areas

Hydrological Recovery

In the Upland Stream section of the Plan, the term "hydrologically recovered" is used when referring to Upland Stream Areas. Hydrological recovery will be determined by applying a consistent methodology utilizing:

- Most current inventory – includes plan holder's updates from field verifications and inventory investments,
- the total area of the sub-unit less Type I and II Fish Habitat area; and

- Hydrological Recovery curves appropriate for the area.

Inventory & Tracking Ledger

Prior to initiating developments within one of the designated watershed-sub-units, the Plan Holder will complete an analysis to determine the "baseline inventory" of Upland Stream Area and the proportion that is not hydrologically recovered. The analysis is meant to be a GIS exercise that produces a tabular summary of areas that are hydrologically recovered or not, as well as a spatial element to illustrate the results. These two outputs will form the basis for the Tracking Ledger.

To ensure all commitments are met, the Plan Holder will continue to maintain the Ledger to track the hydrological status of the watershed sub-unit.

Watershed Assessments

Where the Plan Holder proposes to harvest such that <70% of a watershed sub-unit is hydrologically recovered, they have committed to ensuring that watershed assessment is completed by a qualified professional. Given that the Plan Holder is exceeding the "default" threshold of 70%, a more stringent assessment of the watershed sub-unit is required. Therefore, the "watershed assessment" is meant to be detailed in nature and will be completed by a Qualified Professional (e.g., like a Coastal Watershed Assessment Procedure).

High-Humidity Microclimates

The Plan includes a result regarding stream channels in Upland Stream Areas that are incised, have steep gradients, and support riparian plant communities that are dependent on high-humidity microclimates.

The key pieces in determining whether a stream supports a riparian plant community that is dependent on a high-humidity microclimate is two-fold. First, the stream must possess characteristics sufficient to produce the high-humidity microclimate. Second, the diagnostic high-humidity-dependent plant community must be present. These two factors are interdependent, and therefore the Plan Holder must consider both when identifying these unique Upland Stream channels.

As a general guideline for identifying these key pieces, the following is provided:

Riparian Plant Community

- on creek sidewalls and adjacent trees plant communities will consist of ferns, herbs, and shrubs that are dependent on moist/ wet soils (e.g., maidenhair fern, lady fern, and salmonberry); as well as an abundance of bryophytes that are dependent on high moisture levels.

Stream Channel Characteristics

- Streams are typically 1–3m wide, with bedrock-rock substrates and are generally steep (>20% slope) and broken/ irregular with step-pool structure.
- Channels are typically deeply incised (like a gully, sidewalls >3m, side-slope >50%) and rock controlled, with minimal soils, thus leaving minimal potential for erosion or debris flows.
- Channels typically contain waterfalls, and a spray/ mist is produced or will be during high water flow, creating a cooler microclimate (noticeable on a warm day).
- Usually shaded by trees or oriented such that shade is produced within the reach, regardless of canopy closure.

Sensitive Watersheds

Inventory & Tracking Ledger

Prior to initiating developments within one of the designated sensitive watersheds, the Plan Holder will complete an analysis to determine the "baseline inventory" for the watershed, including determining the current ECA. The analysis is meant to be a GIS exercise that produces a tabular breakdown of the ECA, as well as a spatial element to illustrate the results.

ECA will be calculated based on:

- Most current inventory – includes plan holder's updates from field verifications and inventory investments.
- The total area of the sensitive watershed.
- Hydrological recovery curves appropriate for the area.

To ensure all commitments are met, the Plan Holder will maintain the Ledger to track the ECA for the watershed.

Watershed Assessments

Where the Plan Holder proposes to harvest such that exceed the prescribed ECAs for a sensitive watershed, they commit to ensuring that a watershed assessment is completed by a qualified professional. Given that the Plan Holder is exceeding the "default" ECA, a more stringent assessment of the watershed is required. Therefore, the "watershed assessment" is meant to be detailed in nature and will be completed by a Qualified Professional (e.g., like a Coastal Watershed Assessment Procedure).

Temperature Sensitive Streams

There are no temperature sensitive streams designated in the Plan Area. Should a temperature sensitive stream be designated, the Plan Holder will follow the practice requirements under FPPR s.53.

Community Watersheds

Watershed Assessment & Tracking Ledger

Prior to initiating developments within one of the designated Community Watersheds, the Plan Holder will ensure that a watershed assessment is completed. This assessment is meant to be detailed in nature and will be completed by a Qualified Professional (e.g., like a Coastal Watershed Assessment Procedure). The outputs from the watershed assessment will form the basis for the Tracking Ledger.

To ensure all commitments are met, the Plan Holder will continue to maintain the Ledger to track the developments within the watershed.

Active Fluvial Units

Refer to the *Glynnis Horel* Alluvial Fluvial Units for Haida Gwaii paper in Appendix G.

Ecological Representation

Representation Analysis

The representation analysis proposed by the Plan Holder is a GIS oriented exercise to determine the inventory of ecosystems, based on the best information available and updates to the information including but not limited to field verifications and TEM updates.

Tracking Ledger

To meet the LUO Objectives, the Plan Holder maintains a ledger to track the additions/removals to the baseline ecosystem inventory, including areas that have been designated for recruitment.

Adjacency

The Plan Holder recognizes the importance of biodiversity on the landscape. They refer to the Biodiversity Guidebook developed in 1995 along with FRPA and FPPR requirements to determine adjacency and connectivity.

Bird Nest Identification

The Plan Holder recognizes that importance of correctly identifying bird nest. The Plan Holder will provide their forestry development staff with training in correctly identifying nests. Indications of active bird nests include:

- Seeing a nest with eggs
- Birds flying up or out just in front of you
- Birds swooping at you or attacking you
- Birds dropping down in front of you without flapping their wings
- Cheeping coming from tree cavities or trees or shrubs
- Birds flying into tree cavities.

Northern Goshawk, Great Blue Heron, and Northern Saw-Whet Owl

An objective of the Plan Holder is to identify and manage for the habitats of Northern Goshawk, Great Blue Heron, and Northern Saw-Whet owls' habitats. Experience, education, and further training of the Plan Holder' forestry development team in nest identification should result in potential nests being identified during the planning phase. If/when the forestry development team identifies a potential nest site the plan holder shall have the potential nest and surrounding area assessed by a Qualified Professional working within their scope of practice to determine/confirm if the nest is present and a Northern Goshawk, Great Blue Heron, or Northern Saw-Whet Owl. The prescribing Forester will consider Northern Goshawk, Great Blue Heron, and Northern Saw-Whet owl habitat creation when prescribing stand level retention strategies. Retaining snags and larger trees with old growth characteristics will be prescribed and documented in the Site Plan when the prescribing Forester determines that the cutblock is suitable for such methods.

Marbled Murrelet Nesting Habitat

Inventory

The "inventory" is meant to be an GIS exercise to clarify the Marbled Murrelet nesting habitat that has been identified, and what nesting habitat has been reserved. The "inventory" in not meant to be a field analysis to identify or refine nesting habitat. The inventory analysis will be based on the best information available (i.e., the "Ecological Representation analysis conducted during Detailed Strategic Planning by the Joint Technical Working Group 2010").

Tracking Ledger

In order to meet the LUO Objectives, the Plan Holder will maintain a ledger to track the additions/removals to the baseline Marbled Murrelet nesting habitat inventory.

Northern Goshawk Habitat

Restricted Activities

As the restricted activity zones have the potential to significantly impact forest operations, especially where nests are close to major roads. The Plan Holder will complete an assessment to determine if the nest is active and where the assessment determines that the nest site is inactive, the restricted activity zone will not be required. The assessment completed by the qualified professional:

1) will be completed within the Goshawk Breeding Season; and
2) will be re-assessed each breeding season, unless the Plan Holder elect to maintain the restricted activity zone, regardless of nest use; and
3) will consider the various Northern Goshawk nest uses, nest fidelity and the best information available with regards to Northern Goshawk recovery strategies.

Great Blue Heron Nesting Habitat

As the restricted activity zones have the potential to significantly impact forest operations, especially where nests are close to major roads. The Plan Holder will complete an assessment to determine if the nest is active and where the assessment determines that the nest site is inactive, the restricted activity zone will not be required. The assessment will be completed by the Qualified Professional within the Great Blue Heron Breeding season, and:

1) will be re-assessed each breeding season, unless the Plan Holder elect to maintain the restricted activity zone, regardless of nest use; and
2) will consider the various Great Blue Heron nest uses and the best information available with regards to Great Blue Heron habitat management.

Black Bear Dens

An objective of the plan holder is to protect active Black Bear dens used for over winter hibernation. A qualified person, that is defined as a Forestry Professional, or someone working under the direct supervision of a forestry professional, who has completed wildlife and bear identification training or has equivalent experience, will complete a Black Bear den reconnaissance of each block during the planning stage. If an active Black Bear den used for over winter hibernation is identified, then the plan holder will adhere to the results and strategies of this plan. Where possible the plan holder will include management zones, areas adjacent to management zones, and Black Bear day dens in stand level retention. Stand level retention will be prescribed and documented in the Site Plan and when the prescribing Forester determines the cutblock suitable for such methods retention patches will be linked together. A windthrow assessment will determine the likelihood of wind damage and the prescribing Forester will use this information to prescribe the appropriate stand level retention strategy.

Annual Reporting and Data Submission

Throughout the FSP, the Plan Holder committed to submitting documentation and digital spatial data to the Council of the Haida Nation, and to the Province of BC, on an annual basis. For clarity, a December 31st deadline was chosen, as this is typically an effective time operationally, as well as administratively. Generally, all development area information is submitted at the RP and CP stages, meeting the annual

reporting and data submission objective. The December 31 deadline will still be utilized for any updates to the data or features outside development areas that did not get captured in the RP or CP submission process.

Windthrow Management & Management Prescriptions

It is recognized that windthrow is a significant management issue within the Plan Area. Although objectives are not clearly established in legislation for windthrow management, the Plan Holder completes a windthrow assessment that is included in the Site Plan for all cutblocks. The assessments will be completed to standards as outlined in windthrow assessment training on Haida Gwaii and will include a consideration of both windthrow hazard and consequence criteria, resulting in an overall windthrow risk rating. Additionally, the windthrow assessment:

a) will be signed-off by a Qualified Professional; and

b) will be used to develop management prescriptions for appropriate areas, particularly management zones or no-harvest zones, based on knowledge of prevailing winds and resource features in the area.

The objective for windthrow management is to minimize the impacts of wind on standing timber commensurate with the stand and landscape level values located within the Development Area. This includes the protection of timber supply and stand level features (e.g., features protected by management and/ or reserve zones). The Plan Holder will assess potential windthrow impacts at the Site Planning phase. A Qualified Professional will determine the windthrow risk throughout the development area using tools such as the BCTS Windthrow Manual. The Qualified Professional will consider hazard and consequence of windthrow on the cut block boundary timber and other retained timber. Where practicable, windthrow management treatments will be prescribed. These treatments could include engineering cutblock boundary locations to minimize windthrow; feathering (partial cutting) timber edges.

Tracking Ledgers - General

The concept of maintaining a Ledger was developed during the implementation of the 2011 Haida Gwaii FSP to track the requirements associated with Cedar Stewardship Areas, Upland Streams, Sensitive Watersheds, Ecological Representation, Marbled Murrelet nesting habitat, and Community Watersheds.

The intent for the Ledgers is to provide a clear picture of the baseline/ existing status of the element in question and allow the Plan Holder and Ministry of Forests staff to understand and track the progress of forest operations and planning. The Ledger forms part of the due diligence system, as well as being a planning tool for meeting FSP obligations. The Ledger will continue to be maintained by the plan holder for their tenure areas.

Ledgers will also be used to track depletions and deletions from said features above until spatial updates are completed at which time the ledgers will “re-start” with new numbers, except for the case of tracking CSA harvest areas and/ or 5-year harvest levels in sensitive watersheds. Spatial updates and ledger updates occur at minimum annually.

5.0 Climate Change

The Plan Holder recognizes the significance of climate change and how it may alter their management strategies in the future. The Plan Holder is taking steps to prepare and plan for the changing climate. The Plan Holder will adhere to the *Chief Forester's Standards for Seed Use* and will revise their procedures if or when the standards are amended. The Plan Holder will plant ecologically suited tree species.

There is increasing interest regarding the impacts of climate change on Haida Gwaii forest resources. The BC government continues to monitor the environmental impacts of a changing climate on Haida Gwaii forest resources. Models are now available that predict the shift of Biogeoclimatic Zones across Haida Gwaii and coastal BC. Fortunately, due to the moderating influences of the ocean, the climatic changes on Haida Gwaii are predicted to be less dramatic as compared to the interior of BC.

Forest geneticists and tree breeders have begun to provide foresters with information and tools that will provide assistance in the establishment of tree species given changing environmental conditions. For example, the Chief Forester has provided guidance to assist foresters in the selection of tree species given the elevational influences of climate change. This FSP incorporates management strategies and stocking standards (e.g., ecological/ commercial species, SEDRSS) that will provide stand retention and establishment flexibility. This will help to promote adaptive management with respect to climate change.

The Plan Holder will continue to monitor climate change impacts on the ground through Site Plan surveys (e.g., monitoring stand and understory conditions) and silviculture surveys (e.g., survival, forest health). Significant findings will be communicated back to researchers and the governments.

6.0 Measures to Prevent Impact on Natural Range Barriers

For the purposes of this FSP, forage refers to forage for Range purposes only. As of the submission date of this FSP, there are no Range activities on the FSP area. As there are no objectives for forage, there are no results or strategies that relate to forage.

Measures to prevent impact on natural range barriers are not submitted in the FSP as there currently are no agreements under FRPA within the Plan Area.

7.0 Stocking Standards

Stocking Standards - General

The Stocking Standards proposed within the FSP are based on the Chief Foresters draft recommended Stocking Standards for LMH 68, that were provided to Husby by the Ministry of Forest as well as stocking standards from the currently approved FSPs for the Plan Area, and the experience and local knowledge of Foresters who work in the Plan Area.

Ecologically Acceptable and Commercially Valuable Species

Ecologically and commercially suitable species are provided in the stocking standards in the Appendix. The suitability/acceptability of regeneration will be determined in the field by a Qualified Professional based on site-specific soil moisture, nutrient, aspect, elevation characteristics, and tree performance in response to the site. Tree species that are ecologically suitable and commercially valuable are listed in the standards provided in the Appendix.

It should be noted that while the concept of preferred and acceptable species was commonly used in previous FSPs, recently tenure holders have moved away from this prescriptive approach and moved towards allowing the prescribing Forester to determine the appropriate species selections for a site (as detailed within the Site Plan), based on the ecologically suitable species for the ecotype, as detailed within the FSP stocking standards. The difference between “Preferred” and “Acceptable” has to do with increased site limitations for management activities, not ecological suitability. For the stocking standards for this FSP, the ecologically suitable species for a given BEC unit are simply a combination of the “Preferred” and “Acceptable” species.

The Plan Holder does not intend to change the way that they manage their silviculture obligations under the proposed stocking standards. Prompt reforestations efforts will be maintained, with planting being the primary mode of reforestation. Prescribing Foresters will focus on matching the most appropriate tree species to the reforestation sites, without compromising the economic value of future stands (i.e., match the best tree species to the given site; avoid conversion of cedar stands to hemlock).

Given that the Plan Holder must ensure that crop trees (at Free Growing) must be of good form and vigour, free from competition, and expected to remain so, it can reasonably be expected that the Plan Holder will manage reforested areas such that tree species are well suited/adapted to their sites.

Minimum Stocking Standard Cedar Content (MSSc)

One of the changes in the proposed stocking standards, from previous FSPs, is the elimination of the Minimum Stocking Standard for cedar (MSSc). As discussed under the Cedar Retention strategy (LUOs. 7) above, while the MSSc will be eliminated, the concept of maintaining cedar in the regenerating stands has been carried forward and it is estimated that the amount of cedar planted will increase under the new FSP, compared with previously approved FSPs.

Free-Growing Heights

Free-Growing heights have been established based on previously approved FSPs, as well as local knowledge and experience. While some Free-Growing heights may deviate from FDP stocking standard guides, at the time of Free-Growing the trees must still be of good form and vigour, ensuring that they are well adapted to their sites. Additionally, the trees that are accepted at Free-Growing must be reasonably expected to

continue growing well and be part of the stand at rotation age (i.e., be above brush competition and no longer under deer browse pressure).

As Free-Growing declarations must be signed-off by Registered Professional Foresters or Registered Forest Technologists, there is a professional reliance safeguard in place to ensure that crop trees are well suited to their growing sites and expected to remain so into the future.

Silviculture Surveys

Silviculture surveys collect data to demonstrate that Forest Licensees are adhering to the legislated obligations and Results and Strategies in the FSP. In addition, the survey data is used by Qualified Professionals to make decisions regarding stand management. Survey data can be collected to apply stand-tending duties that are essential in completing silviculture obligations outlined in the FSP. Survey information also assists in determining species composition, density, competition, and other reporting requirements.

Husby adheres to the 2022 Ministry of Forest Silviculture Procedures Manual. This manual is the recognized standard in the BC Forest Industry and that the surveys completed are statistically sound. In accordance with the Manual, surveys are completed by qualified individuals and that survey reports are Signed by a Qualified Professional. Surveys are completed on harvested blocks, the typical timeline of these surveys is shown below in Table 3. Results from surveys are used to achieve management objectives and adhere to Results and Strategies of the FSP.

Table 3: Outlines a typical timeline of the activities completed on a cutblock post-harvest. Although, this timeline may vary on a site-by-site basis but this typical timely is representative of normal schedule of activities.

Year	Activity	Survey Rationale
Year 1	Plant and Protector Installation	Harvested areas are planted in a timely manner to avoid competition, protectors are installed to minimize risk of deer browse.
Year 1	Regeneration Survey	Newly planted areas are surveyed to confirm sufficient stocking of well-spaced trees. This data is submitted into RESULTS (Information Submission Specification).
Year 2	Regeneration / Survival	This survey confirms plantation survival and may be used to confirm regeneration of the site.
Year 4	Stocking	Progress of plantation to determine if fill plant is needed or, if planted openings are on track to meet free growing requirements as outlined in FSP.
Year 5 - 6	Protector Monitoring	A walkthrough from a Qualified Professional is completed in planted areas to create timeline of protector removal.
Year 6	Protector Removal	Protector removal is completed once heights of seedlings have grown above the height of the protectors.

Year 8 - 10	Green-up *(if required)*	A walkthrough from a Qualified Professional is completed to monitor the density and height of the reforested area. Healthy trees taller than 1.3 metres in height, and harvested openings less than 40 hectares in size are acceptable for achieving green-up requirements, as stated in FSP.
Year 10 - 20	Free Growing	Ideally these stands of trees have reached a minimum height that has outgrown surrounding vegetation and is sufficiently stock with preferred species. A second free growing survey can be prescribed if stand requires additional time to grow to reach free growing standards.

Sitka Spruce (Ss)

Free-Growing heights for Sitka Spruce are reduced as indicated given the reduction in brush competition (as a result of deer browse). While the height requirement is reduced, the performance expectations are still such that acceptable trees must be of good form and vigour and reasonably expected to continue growing well.

Red and Yellow Cedar (Cw and Yc)

Free-Growing Heights for cedar are provided and consistent with the cedar regeneration objective, above. While cedar Free-Growing heights are reduced from FDP stocking standard guides, the performance expectations are still such that acceptable trees must be of good form and vigour and reasonably expected to continue growing well. Furthermore, the 1.2m minimum height will ensure that the cedar are above deer browse height.

Minimum Inter-Tree Distance Exceptions

Exceptions to the standard 2.0m inter-tree distance have been included for situations where plantable spots may be limited in availability. By reducing the minimum inter-tree distance, the Plan Holder will be able to utilize the best available growing sites, ensuring effective reforestation is achieved.

Mixed Conifer–Hardwood Management

Red alder has been included as an ecologically suitable species for some BEC units. For these situations, the intent is for the Plan Holder to identify the hardwood management strategies and stocking standards within the Site Plan, prior to harvesting. For the development area, separate stocking standards for conifers and red alder are to be assigned (based on a 0.25ha minimum stratum size). Where red alder is the leading species, the hardwood stocking standard will be applied. Where red alder is not the leading species, it will not be accepted as a crop tree.

As mixed hardwood management is relatively new on Haida Gwaii, the application of the hardwood stocking standards has been limited to a maximum of 200ha per year, for all the Plan Holders combined. It is acknowledged that the hardwood stocking standards will need to be reviewed in the next 5 years (i.e., at the end of the term of the FSP), including a review of any Timber Supply impacts.

Free Growing Survey System

Development areas will be pre-stratified into appropriate polygons assigning alder or conifer stocking standards and surveyed as separate strata, consistent with standard survey procedures and the Site Plan.

All red alder and conifer plots will be tallied separately, according to the respective stocking standards, to determine the overall achievement of stocking and reporting of inventory labels for each stratum within the development area.

The mixed-wood stocking standards have been prepared, based on the work done by the Coast Region FRPA Implementation Team – Silviculture Working Group, as presented in the paper, "Hardwood Management in the Coast Forest Region" (2009-2014). The stocking standards are intended to be consistent with the direction provided in the Hardwood Management paper.

FSP Implementation

The Plan Holder is committed to adhering to the 2018 Haida Gwaii FSP Implementation Agreement found in Appendix H.

Appendix A: Watersheds – Hydrologic Recovery

SUMMARY TABLE - WATERSHEDS - HYDROLOGIC RECOVERY
HUSBY'S AREA OF INTEREST - 2022, QUARTER 1 - ANALYSIS COMPLETED 2022 Aug 04

Key Notes:
* Watershed or subunit area minus Sched04 Type 1 & 2 Stream Buffers, FWA stream polygons, and Lake polygons. This watershed or subunit area also includes a proportion of adjacent Park (Conservancy) areas if applicable, minus FWA stream polygons and Lake polygons (note: Park areas did not exclude Sched04 Type 1 & 2 Stream Buffer areas, since parks are not under an FSP).

Additional Notes:
- Salvage and Roads are not calculated for this analysis. Salvage is often only a small area that is negligible in the calculations, and often has missing fields to query for analysis. Road polygons are often not included in the VRI, and querying is very complex on a landscape level.
- Age for each opening is calculated by taking the current year (i.e., 2022) and subtracting the year in the VRI field "HARVEST_DATE". If there is no data under "HARVEST_DATE", the Age is calculated using the VRI field "PROJ_AGE_1".
- If a polygon's age is 0-60 years old and the VRI fields for "SITE_INDEX" and Leading Species (SPECIES_CD_1) is empty, these 2 fields are calculated via a neighbouring polygon with data, orthorectified to contain a similar polygon. This is done via ArcGIS manually. If not conducted, it forces the analysis to choose between 0%-100% hydrologically recovered, which would be a grand assumption.
- Any alder (DR) polygons have a hydrologic recovery of 50%, as per Glyynis Horel's methods for previous watersheds within Haida Gwaii.

Watershed	Watershed Analysis Area (ha)*	Forest cover allowed for harvest must be less than (%)	ECA not hydrologically recovered (ha)	Area already harvested (%)	Area available for harvest (%)	Area available for harvest must be less than (ha)	Harvest Availability
Ain River	1473.2	20.0	151.6	10.3	9.7	143.0	Available for Harvest
Davidson Creek1	2853.9	20.0	604.6	21.2	-1.2	Over Threshold	Over Threshold
Davidson Creek2	1809.4	20.0	376.9	20.8	-0.8	Over Threshold	Over Threshold
Davidson Creek3	1749.6	20.0	340.5	19.5	0.5	9.4	Available for Harvest
Davidson Creek4	1812.7	20.0	410.5	22.6	-2.6	Over Threshold	Over Threshold
Davidson Creek5	1656.8	20.0	210.5	12.7	7.3	120.8	Available for Harvest
Naden River1	1680.9	20.0	273.2	16.3	3.7	63.0	Available for Harvest
Naden River3	2615.6	20.0	400.3	15.3	4.7	122.8	Available for Harvest
Naden River4	2475.5	20.0	361.0	14.6	5.4	134.1	Available for Harvest
Naden River5	982.1	20.0	131.4	13.4	6.6	65.0	Available for Harvest
Roy Lake1	825.4	20.0	190.9	23.1	-3.1	Over Threshold	Over Threshold

Appendix B: Subunits – Hydrologic Recovery

SUBUNITS - HUSBY - HYDROLOGIC RECOVERY - 2022 QUARTER 1
Analysis Completed: 2022 Aug 04

Key Notes:
* Watershed or subunit area minus Sched04 Type 1 & 2 Stream Buffers, FWA stream polygons, and Lake polygons. This watershed or subunit area also includes a proportion of adjacent Park (Conservancy) areas if applicable, minus FWA stream polygons and Lake polygons (note: Park areas did not exclude Sched04 Type 1 & 2 Stream Buffer areas, since parks are not under an FSP).

Additional Notes:
- Salvage and Roads are not calculated for this analysis. Salvage is often only a small area that is negligible in the calculations, and often has missing fields to query for analysis. Road polygons are often not included in the VRI, and querying is very complex on a landscape level.
- Age for each opening is calculated by taking the current year (i.e., 2022) and subtracting the year in the VRI field "HARVEST_DATE". If there is no data under "HARVEST_DATE", the Age is calculated using the VRI field "PROJ_AGE_1".
- If a polygon's age is 0-60 years old and the VRI fields for "SITE_INDEX" and Leading Species (SPECIES_CD_1) is empty, these 2 fields are calculated via a neighbouring polygon with data, orthorectified to contain a similar polygon. This is done via ArcGIS manually. If not conducted, it forces the analysis to choose between 0%-100% hydrologically recovered, which would be a grand assumption.
- Any alder (DR) polygons have a hydrologic recovery of 50%, as per Glyynis Horel's methods for previous watersheds within Haida Gwaii.

Subunit	Subunit Analysis Area (ha)*	Forest cover allowed for harvest must be less than (%)	ECA not hydrologically recovered (ha)	Area already harvested (%)	Area available for harvest (%)	Area available for harvest must be less than (ha)	Harvest Availability
88	619.3	30.0	93.2	15.0	15.0	92.6	Available for Harvest
95	1025.6	30.0	199.5	19.4	10.6	108.2	Available for Harvest
96	511.5	30.0	81.2	15.9	14.1	72.3	Available for Harvest
102	645.4	30.0	60.0	9.3	20.7	133.6	Available for Harvest
107	950.7	30.0	297.5	31.3	-1.3	-12.3	Over Threshold
109	1130.5	30.0	177.0	15.7	14.3	162.1	Available for Harvest
112	357.4	30.0	34.6	9.7	20.3	72.6	Available for Harvest
113	732.8	30.0	160.6	21.9	8.1	59.3	Available for Harvest
117	951.4	30.0	134.2	14.1	15.9	151.3	Available for Harvest
121	606.5	30.0	79.6	13.1	16.9	102.3	Available for Harvest
124	566.5	30.0	95.5	16.9	13.1	74.5	Available for Harvest
126	543.4	30.0	102.6	18.9	11.1	60.4	Available for Harvest
131	1024.5	30.0	260.7	25.4	4.6	46.7	Available for Harvest
132	639.0	30.0	32.9	5.2	24.8	158.8	Available for Harvest
133	706.9	30.0	146.8	20.8	9.2	65.3	Available for Harvest

137	418.1	30.0	107.6	25.7	4.3	17.9	Available for Harvest
142	507.2	30.0	26.1	5.1	24.9	126.1	Available for Harvest
146	474.2	30.0	54.6	11.5	18.5	87.7	Available for Harvest
148	670.1	30.0	74.1	11.1	18.9	127.0	Available for Harvest
149	622.4	30.0	150.0	24.1	5.9	36.7	Available for Harvest
154	648.7	30.0	143.4	22.1	7.9	51.2	Available for Harvest
157	454.5	30.0	90.3	19.9	10.1	46.0	Available for Harvest
158	666.8	30.0	143.0	21.4	8.6	57.0	Available for Harvest
162	391.9	30.0	43.8	11.2	18.8	73.8	Available for Harvest
166	640.8	30.0	72.3	11.3	18.7	119.9	Available for Harvest
167	754.8	30.0	20.7	2.7	27.3	205.7	Available for Harvest
492	1201.2	30.0	101.6	8.5	21.5	258.8	Available for Harvest
493	608.6	30.0	195.9	32.2	-2.2	-13.3	Over Threshold
557	636.7	30.0	164.2	25.8	4.2	26.8	Available for Harvest
721	455.8	30.0	115.3	25.3	4.7	21.4	Available for Harvest
723	375.5	30.0	66.2	17.6	12.4	46.5	Available for Harvest
724	733.5	30.0	303.5	41.4	-11.4	-83.4	Over Threshold
725	429.3	30.0	66.8	15.6	14.4	61.9	Available for Harvest

Appendix C: Sustainable Forestry Management & Environmental Policy

Husby Forest Products Ltd.

Sustainable Forestry Management & Environmental Policy

We are committed to responsible stewardship of the forest and the environment throughout our operations. In conducting our business, we are committed to:

- practice Sustainable Forestry (SFI 2015-2019) which ensures forest productivity and health;
- protect the water resources, biological diversity, special sites, and aesthetic values of the forests under our management;
- maintain our infrastructure of roads as per our plans to allow for the public access to the forest resources and recreational opportunities;
- meet or exceed all applicable environmental and social laws, regulations, policies, and other pertinent requirements;
- minimize adverse environmental impacts and striving to prevent pollution;
- promote Sustainable Forest Management awareness throughout our operations;
- monitor our Sustainable Forest Management performance by regularly reviewing our activities, practices, performance measures, and indicators;
- provide training for our employees and contractors in environmentally responsible work practices;
- broaden the practice of sustainable forestry on public lands through community involvement, socially responsible practices, and through recognition and respect of Indigenous Peoples' rights and traditional forest-related knowledge;
- support advances in sustainable forest management through forestry research, science and technology; and
- continually improve the practice of forest management and monitor, measure, and report performance publically in achieving the commitment to sustainable forestry.

President: _____

Date: **December 15, 2016**

Appendix D: SOP – Sustainable Forest Initiative

Standard Operating Procedures

2012 May 1

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1. Soil Conservation – Standard Operating Procedures

Field Operations

A) **Before operations start, the operation must:**

1) **Complete a pre-work meeting & checklist** with the Company supervisor to discuss:
   - strategies to stay within acceptable soil disturbance limits (e.g., low ground pressure equipment, avoid areas, skid pattern, etc.);
   - sediment control measures to be used, particularly around streams, wetlands, and lakes (e.g., silt fences, straw bails, etc.)
   - strategies to deal with any special requirements, potential problems or unforeseen conditions, e.g., fish stream crossings, culvert installations, in-stream work windows or variances
2) **Have a copy** of the appropriate plan such as Logging Plans, Fire Preparedness Plan (fire season only), the Spill Plan, geotechnical assessment report, SP's, and this standard operating procedure.

B) **During operations, the operation must:**

1) **Follow** the Workers Compensation Act and regulations, TDG regulations and any other pertinent regulations.
2) **Ensure** erosion control measures are readily accessible.
3) **Not** construct bladed skid trails unless approved in the logging plan or authorized in writing by the Company Supervisor.
4) **Ensure** that when constructing an excavated or bladed trail;
   - keep soil and slash out of any nearby streams wetlands or lakes;
   - place soil or slash where it cannot get into any of these watercourses;
   - construct cut and fill slopes that are stable and will not slump or rave;
   - maintain surface drainage patterns;
   - divert seepage water so it flows away from unstable slopes or streams; and
   - build it so that soil erosion is minimized and rehabilitation is facilitated.
5) **Do not operate machinery within 5 m of a stream bank,** unless specified in the SP, or for designated crossings, or during fire fighting. Minimize damage to stream bank and vegetation
6) **Install** all stream crossings and culverts during adequate lighting
7) **Keep fuel** and oil contained as required by the Company Spill Prevention and Response Plan. **Fuel and service** the machine a minimum of **50 m** from streams, wetlands, and lakes.
8) **Cross streams** at designated locations only and a minimum number of times & use sediment control measures as required. Ensure equipment is in good running order & that there are no fuel or oil leaks.
9) **Maintain** natural drainage patterns by employing drainage structures as required.
10) **Ensure** waste areas for road fill or logging debris are not located in Riparian Management areas.
11) **Check** your work in progress to ensure it meets the specifications.
12) **Employ** preventative measures in areas identified where siltation has a relatively high likelihood of entering a stream. These include, but are not limited to, tail ditches, settling ponds, hay bales, silt fences, curlex and geotextile fabric.
13) **Never** leave the job without fail-safing the drainage structures from an uncontrolled weather event
14) **Re**-vegetate (grass seed, whippets, etc.) exposed soil as required.
15) **Ensure** the site is left in a clean and orderly manner by removing all garbage & waste materials

STOP WORK IF:	
	Stop work and notify your supervisor if you are encounter any of the following conditions: 1. **Weather (avalanche hazard, rain, wind, cold)** 2. **Excessive soil disturbance, compaction, rutting, siltation, slumping, or sliding of land is suspected.** 3. **Adverse conditions are encountered during construction activities (i.e. heavy rain, erosion, siltation, unstable soils, etc.).** 4. **Soils (sedimentation to water, erosion, degradation, mass wasting)** 5. **Fire (hazard ratings – high or very high)** 6. **Non-compliance with the FRPA or plans (trespass, SP etc)** 7. **Non-conformance with the EMS (major oil spill, chemical spill, fire etc)** 8. **Wildlife issues** 9. **Unidentified cultural or heritage values** 10. **Safety Issues** If you are uncertain about your task – stop work and ask your supervisor for clarification.

2. Water Management – Standard Operating Procedures

Field Operations

A) **Before operations start, the operation must:**

1) **Complete a Pre-work Meeting & complete the checklist** with the Company Supervisor to discuss:
   - the designated stream crossing locations.
   - the sediment control measures to be used, particularly around streams, wetlands and lakes i.e. silt fences, straw bails etc.
   - strategies to deal with any special requirements, potential problems or unforeseen conditions, eg. fish stream crossings, culvert installations, in-stream work windows or variances.
2) **Have a copy** of the appropriate plan such as bridge or major culvert site plan and map, Fire Preparedness Plan (fire season only), the spill plan, geotechnical assessment report, road permit & schedules and this standard operating procedure.

B) **During operations, the operation must:**

1) **Follow** the Workers Compensation Act and regulations, TDG regulations and any other pertinent regulations.
2) **Ensure** erosion control measures are readily accessible
3) **Install** all stream crossings and culverts during adequate lighting
4) **Keep fuel** and oil contained as required by the Husby Forest Products Spill Prevention and Response Plan. **Fuel and service** the machine a minimum of **50 m** from streams, wetlands and lakes.
5) **Cross streams** at designated locations only and a minimum number of times & use sediment control measures as required. Ensure equipment is in good running order & that there are no fuel or oil leaks.
6) **Maintain** natural drainage patterns by employing drainage structures as required.
7) **Install** culverts, cross drains and ditches as per the road construction design & road permit schedules concurrent with construction operations if possible. Install ditch blocks where required.
8) **Keep** equipment above the high water mark while installing the crossing unless the plans allow for in-stream work.
9) **Ensure** that culverts are armored on both the culvert outlet and inlet with suitable rock material as required.
10) **Ensure** waste areas for road fill or logging debris are not located in Riparian Management areas.
11) **Check** your work in progress to ensure it meets the specifications.
12) **Employ** preventative measures in areas identified where siltation has a relatively high likelihood of entering a stream. These include, but are not limited to, tail ditches, settling ponds, hay bales, silt fences, curlex and geotextile fabric.
13) **Never** leave the job without fail safing the drainage structures from an uncontrolled weather event.
14) **Re**-vegetate (grass seed, whippets, etc) exposed soil as required.
15) **Ensure** the site is left in a clean and orderly manner by removing all garbage & waste materials .

STOP WORK IF:	
	Stop work and notify your supervisor if you are encounter any of the following conditions: **1. Weather (avalanche hazard, rain, wind, cold)** **2. Adverse conditions are encountered during construction activities (i.e. heavy rain, erosion, siltation, unstable soils, etc.).** **3. Soils (sedimentation to water, erosion, degradation, mass wasting)** **4. Fire (hazard ratings – high or very high)** **5. Non-compliance with the FRPA or plans (trespass, SP etc)** **6. Non-conformance with the EMS (major oil spill, chemical spill, fire etc)** **7. Wildlife issues** **8. Unidentified cultural or heritage values** **9. Safety Issues**
	If you are uncertain about your task – stop work and ask your supervisor for clarification.

3. Protection of Wildlife Habitat & Biological Diversity – Standard Operating Procedures

Field Operations

A) **Before operations start, the operation must:**

1) **Complete a Pre-work Meeting & complete the checklist** with the Company Supervisor to discuss:
   - **Strategies** to deal with any special requirements, potential problems or unforeseen conditions;
   - **Review** of SP and Logging Plan to ensure that any known Species at Risk requirements noted are discussed to ensure proper management techniques are employed;
   - **Review** of SP and Logging Plan to ensure that Coarse Woody Debris requirements noted are discussed to ensure proper management techniques are employed;
   - **Review** of SP and Logging Plan to ensure that Leave Tree and Stubbing requirements are discussed to ensure proper management techniques are employed;
   - **Review** Invasive Plants that are known in the area of operation and strategies to ensure seed is not transferred to other operating areas
   - **Have a copy** of appropriate plans such as Logging Plans, Fire Preparedness Plan (fire season only), the spill plan, geotechnical assessment report, SP's and this standard operating procedure;
   - **Pre-work** to be completed by Contractor Supervisor with the crew and documented highlighting strategies for management of Wildlife Habitat, Invasive plants (noxious weeds) and Biological Diversity;
   - **Training** of crew by Contractor Supervisor in how to ensure requirements are to be achieved.

B) **During operations, the operation must:**

1) **Follow** the Workers Compensation Act and regulations, TDG regulations and any other pertinent regulations; Check your work in progress to ensure it meets the specifications for the project.

2) **Employ** preventative measures in areas identified where potential damage to a raptors nest or leave tree may occur.

3) **Reserve** old wolf trees identified in the harvest area for wildlife purposes.

4) **Ensure** the site is left in a clean and orderly manner by removing all garbage & waste materials.

STOP WORK IF:	
	Stop work and notify your supervisor if you are encounter any of the following conditions: **1. Wildlife issues such as SARA sighting, bear dens, and raptor nests** **2. Unidentified Ecological, Geological , Cultural or Heritage values** **3. Weather (avalanche hazard, rain, wind, cold)** **4. Excessive soil disturbance, compaction, rutting, siltation, or slumping or sliding of land is suspected.** **5. Adverse conditions are encountered during construction activities (i.e. heavy rain, erosion, siltation, unstable soils, etc.).** **6. Soils (sedimentation to water, erosion, degradation, mass wasting)** **7. Fire (hazard ratings – high or very high)** **8. Non-compliance with the FRPA or plans (trespass, SP etc)** **9. Non-conformance with the EMS (major oil spill, chemical spill, fire etc)** **10. Safety Issues** **11. Invasive Plants identified in the plan are noted in the area**
	If you are uncertain about your task – stop work and ask your supervisor for clarification.

4. Protection of Ecological, Geological, Historical, & Culturally Special Sites – Standard Operating Procedures

Field Operations

A) **Before operations start, the operation must:**

1) **Complete a Pre-work Meeting & complete the checklist** with the Company Supervisor to discuss:
   - **Strategies** to deal with any special requirements, potential problems or unforeseen conditions;
   - **Review** of SP and Logging Plan to ensure that any special site noted is discussed to ensure proper management techniques are employed;
   - **Have a copy** of appropriate plans such as Logging Plans, Fire Preparedness Plan (fire season only), the spill plan, geotechnical assessment report, SP's and this standard operating procedure;
   - **Pre-work** to be completed by Contractor Supervisor with the crew and documented highlighting special site management techniques are understood;
   - **Training** of crew by Contractor Supervisor in how to identify Culturally Modified Trees.

B) **During operations, the operation must:**

1) **Follow** the Workers Compensation Act and regulations, TDG regulations and any other pertinent regulations; Check your work in progress to ensure it meets the specifications for the project;
2) **Employ** preventative measures in areas identified where the potential to damage a special site may occur;
3) **Ensure** the site is left in a clean and orderly manner by removing all garbage & waste materials.

STOP WORK IF:	
	Stop work and notify your supervisor if you are encounter any of the following conditions: **1. Unidentified Ecological, Geological , Cultural or Heritage values** **2. Weather (avalanche hazard, rain, wind, cold)** **3. Excessive soil disturbance, compaction, rutting, siltation, or slumping or sliding of land is suspected.** **4. Adverse conditions are encountered during construction activities (i.e. heavy rain, erosion, siltation, unstable soils, etc.).** **5. Soils (sedimentation to water, erosion, degradation, mass wasting)** **6. Fire (hazard ratings – high or very high)** **7. Non-compliance with the FRPA or plans (trespass, SP etc)** **8. Non-conformance with the EMS (major oil spill, chemical spill, fire etc)** **9. Wildlife issues** **10. Safety Issues**
	If you are uncertain about your task – stop work and ask your supervisor for clarification.

Appendix E: Standard Operating Procedures – Engineering

TECFOR RESOURCES LTD

Eng Field Method

The following information is presented as a guide for standards of cutblock layout and field data collection. These standards are specific to the Husby Forest Products Ltd. operations on Haida Gwaii. Over time there will be updates. The current standards and additional reference data can be found at: First Class, Conferences, Engineering, Tecfor, Tecfor SOP's

Field Notes Title Page (for handwritten notes)

Date (ddmmyy)	Pages 1 of ?
License #	Client
Operational Area	Block
Type of Traverse (What is being surveyed)	
POC POT	
Declination: (2015 = 19.4°E) Equip-ment:	
Crew: (Note Taker/Compass Person) Wx: (Weather)	

For field note page numbering: Title page is page 1, first A-side is page 2, first B-side is page 3, etc.

General Layout and Traversing Guidelines

Hang ribbons heavy enough so that you can see 2-3 ribbons in a row (~5m. apart)

Hang ribbons at eye level or higher for FL, High and low for Rd CL

At each station hang a white ribbon with traverse info

White station ribbon knot faces boot mark on ground

Mark ground with blue ribbon (boot mark) secured for easy location in the future, if hand traversing

The white station ribbon is the boot mark when GPS traversing

Note any distinct and important areas (i.e. possible

quarries, rock faces, creeks, etc.) Note other features:

Possible CMT's, Monumentals, etc. GPS locate these

features. Tags are located at eye level for FC's and around knee level for road stations.

GPS

All GPS points need to have better than **5m** accuracy. Spending a longer (occupancy) time at the point will generally help.

Differential correct all data collected.

Block Naming

The current standard is: Three letters (e.g. COL, LIG, REN) and three digits (eg. 7xx, 3xx, 2xx). If doing sub blocks or pods have a single letter (e.g. COL777A, COL777B, etc).

Falling Boundary (FL)

Notes:	A Side: Station/Comment, FS, BS, SD, %, HD B Side: Station and Traverse Detail
Colors:	Orange ribbon, White station ribbon, Orange paint
Field:	FL ribbon knots face into cutblock area
	Keep FL as smooth as possible, no narrow fingers (<30m) wide
	Falling corners every 100m, and at hard corners (90 deg +)
	Corners can be located up to 5m outside FL
	Corners tagged head high
	Corner info will be Block number and FC#. Double orange ribbon above the tag
	White/Orange tag ribbon with traverse info
Computer:	File names:e.g. FL-COL777, FL-COL777A, FL-COL777-Res A, FL-COL777-Amend 1

Road Naming

The current standard is: Mainlines (ML) are named after the general geo-graphical area or the direction they are traveling (e.g. Lignite, East). Branches (BR), and Spurs (SP) are named after the block number they are in or they access. Only one branch per block unless there is a

junction with a branch accessing another block or area beyond. Spurs are given a letter after the block number. Some examples: LML, EML, BR777, BR778, SP777A, SP777B.

Road (RD)

Notes: A Side: Station, FS, BS, SD, %, HD, CC B Side: SSL, CL Detail, SSR

Colours: Pink ribbon, White station ribbon, blue boot mark

Field: Limit station spacing to 30m, recognizing grade breaks and side slope changes.

Use IFS's as much as possible for traverse detail

IFS at middle of all creek crossings

Use a stake where no tree is available

Every station tagged with chainage or incremented index and road name

Every station white ribbon labeled with chainage or incremented index and road name

Carry decimal in notes and round chainage on tag (e.g. 0+105.5 in notes = 0+106 on tag)

Carry decimal in notes and write on white station ribbon

CL tag below stump height (30cm) on larger trees

CL tag can be up to 1m off ribbon line

CL tag waist high on smaller trees and stakes

CL tag info: road name, chainage

CL ribbon knot faces back to start of road

Double pink ribbon at junctions

Triple pink ribbon on POT Tree with end incremental index or end chainage. Computer: File names: e.g. RD-EML, RD-SP777, RD-BR777, RD-SP777A

Side Slope Shots (SSL, SSR)

Side shots at every station (including IFS's) = % slope for 15m (SD) left and right. Extend to 30m+ for end haul and spoil areas. Take shots centerline out, point to point, or combination. Don't round distance or slope measures.

If the slope is 17% for 13m then record it as such. If there is a major break at 25m, extend the side shot to show it. Be aware of the first 5m either side of the CL as this is within the road building prism.

Creek Crossings

All crossings larger than 3m have a tree or stakes marking sill log locations. Locate sill log stakes 1m+ back from TOB or HWM. Span width is from middle of sill to middle of sill. Layout all crossings prior to traversing CL.

Calculate Q100 for all 3m+ span crossings. All crossings spanning 6m+ require a site plan (BSP) measure up.

Reference Point (RP) - When required

Notes:Road name, station, HD, Bearing to RP Tree

Colors: White ribbon, Tag

Field:RP placed up slope from centre line at 15m HD

RP at: POC, Junction, POT, Start and end of end haul sections, one end of major crossings.

Tag below stump height(<30 cm)

On RP tree tag: "RP", CL Station, Station Info, HD and Bearing to CL Station

Same info on white ribbon hung on RP tree

On CL tag write "RP" with an arrow pointing to RP tree

Construction Category (CC)

Category	Cut Face Ht. (m)	Description
LB	n/a	Local Ballast, does not require hauling or blasting
PR	n/a	Pit Run Ballast, requires hauling, but no blasting
RB	n/a	Rock Ballast, requires hauling and blasting from a quarry
TR	(up to 1.5)	Toe Rock
MR		Medium Rock
HR	(1.51 - 3.00)	Heavy(High)
X1		Rock Extra

X2	(3.01 - 4.50) (4.51 - 6.00) (6.01 - 7.50)	Heavy(High) Rock Yikes! Very rare on HG

Note - this chart is a summary. For more info refer to the detailed version.

Chainage Equations - When required

Where tagging a large section of amended road becomes onerous, a chainage equation is used. The station (tag and ribbon) at the end of the amendment will have the equation: chainage (new) back = chainage (old) ahead.

Curves:

General curve guidelines: only 30° of separation for roads at junctions, more than two 20 or 30° turns in a row is considered a switch back, enter and exit a curve with the same turn (e.g. 15°-30°-15°), anything different is considered a diminishing radius, more than 10° is a turning point and will be a station in the road notes.

Turn Degrees then Distance = Length of Radius

30° then 10m = 18m radius

30° then 12m = 25m radius

30° then 15m = 27m radius

20° then 10m = 30m radius

15° then 10m = 38m radius

10° then 10m = 58m radius

Minimum Curve Radius:

Main Line = 50m

Branch = 25m

Spur = 10m

Grades: Recommended %

ML	BR	SP
10	15	20

Max Fav	5	8	9
Max Adv	5	8	10
Grade Brk			

Deflection Lines (DL)

Notes:A Side: Station, Bearing, SD, %, HD, VD, Total VDB Side: Traverse detail

Colors:Lime green ribbon with white ribbon at stations

Field:Station at every grade break, and generally not more than 50m apart

D-line name, bearing and accumulated SD on white ribbon at every station

Double up ribbons at POC and POT

Hint: Hang white station ribbon at eye level for accurate % when surveying alone

Note any distinct and important areas (i.e., timber types, rock faces, creeks, etc.) Office review critical DL's

D-line Sag:

SD	Sag %
<150m	6
150-175m	7
175m +	8

Grapple Yarder Height = max 18m

Mobile Back Spar Height = max 6m

Baselines (BL)

Notes: A Side: Station, Bearing, SD, %, HD B Side: Traverse detail

Colors:Lime green ribbon with white ribbon at stations

Field:Station at every major change of ground/stand characteristic

Baseline name, heading and station written on white ribbon at every station

Double hang ribbon at beginning and end of baseline

LG ribbon hung between stations

Note any distinct areas and features (i.e., Timber types, rock faces, creeks, etc.)

Creek Naming

The current standard is: Named by block number (e.g., 777-1, 777-2). Larger streams within the drainage will be named appropriately (e.g., A1, this stream is near Allan Point). Check an overview map for possible names already in place, otherwise no personal naming.

Creeks (CRK)

Notes: A Side: Station, Bearing, SD, % B Side: Traverse detail, Creek data

Colors: Non-fish = Blue/White stripe ribbon, Fish = Red/White stripe ribbon, White station ribbon

Field: Ribbon all creeks within and adjacent to FL

Station at every major change in slope or heading, and possible reach break

Tie creek traverse into other traverses such as RD or FL - when hand traversing

Creek data at every station

Creek data: Width (W), Bank Height (BH), Substrate, Depth (D), Slope (%)

Other data: junctions, gully info, falls or cascades, forest cover, tree height

Double ribbon at junctions, Triple ribbon at end of traverse, Banner at reach breaks Reach breaks at every major change of creek characteristics (i.e. Fish/No fish, gully, etc.) Reach Break locations recorded with GPS and picture taken if discernible.

Complete creek cards for every creek reach within or adjacent to FL Complete creek card for every crossing

HGLUOO: Type 1 streams (S1,S2,S3) (Fish & 1.5m+ wide) = 2 tree height reserve + 0 tree height MZ, (adjusted for operational or safety purposes) Type 2 streams (S4) (Fish & <1.5m wide) = 1 tree height reserve + 1/2 tree height MZ, (adjusted for operational or safety purposes)

Type 3 streams (S5,S6) (No Fish) = MZ as required

Fish Trapping (FT)

Traps left in for 24hrs and the more traps set the better

Mark trap location with three ribbons of different color (white, green, yellow)

White ribbon mark: FT#, Date/Time in & Date/Time out, fish caught by species and size, or no fish

Record FT data on stream card and/or separate piece of note paper for/in the block folder, this info is reported annually to DFO. Tie fish trap location to creek traverse station, or make the location a station, GPS point required!

Tree Heights

For buffering or reserve purposes:

- five tree heights (suggested number) will be taken adjacent to the feature being buffered.
- tree locations done with the GPS (Sample Tree in Data Dictionary)
- record tree height data for future reporting (i.e.. RMA plans, Cultural Forest Stands)

Block Paintmarking (PM)

FL will be marked with orange paint. Mark all trees (not snags) at or just outside the FL ribbon with a hand sized dot. Dot will be shoulder high and facing into cutblock area. At Falling Corners paint the FC number on or behind the corner, large enough to be seen from a distance, of course facing into the cutblock.

Cultural Feature Reserves and Buffers

These standards are only a portion of those outlined in the Haida Gwaii Land Use Objectives Order (HGLUOO):

Class 1 Traditional Forest Features (e.g., Fairy Slipper, Devils Club) = 1 tree height reserve + 1/2 tree height mz, (adjusted for operational or safety purposes). No cut Monumental, CMT's, Cultural Cedar Stand = 1/2 tree height reserve + 1 tree height mz (adjusted for operational or safety purposes). Bear Den = 20m+ reserve + 1 tree height mz, (adjusted for operational or safety purposes).

Forest Feature Field Marking

<u>Western Yew trees</u>

Orange/Black striped ribbon on individual stems

<u>Western Yew patches</u>

Orange/Black striped ribbon on individual stems within the patch

Orange/Black stripe banner at geographical patch centre

Patches within cutblock boundary are ribboned out in orange

<u>Class II</u>

Yellow banner at geographical centre of feature

<u>Pacific Crab Apple</u>

Yellow ribbon on each individual stem

Yellow banner at geographical patch centre

* Where patches occur outside of the cutblock boundary they **may be** identified solely with a banner at geographical patch center.

Monumentals

Yellow/Black striped ribbon around stem with additional white ribbon indicating feature ID and tree measurements

Additional purple ribbon around stem of 120+ DBH monumentals

Monumental identification number painted in orange on two sides of stem

Management Zones

Yellow/Black striped ribbon

Bridge Site Plan (BSP)

Field data collection consists of a series of radial shots from a known point (proposed end of crossing in the road traverse). The general idea is to gather information of the stream bank location (both sides) for 30m+/- above and below crossing. Note and include any significant changes in elevation outside the range of the road survey side shots. Calculate a Q100 for crossing, and take notes (drawing) of stream profile at CL.

Appendix F: SOP – Field Marking

Husby Forest Products Ltd.

Standard Operating Procedures - Field Marking

Sept. 2019

Activity	Ribbon Colour / Comments		Paint Colour
Falling Boundary		Orange	Orange
Road Center Line		Pink	Pink
Reference Point	-----	-----	Pink "RP"
Traverse Station		White	-----
Machine Free Zone	"MFZ"	"Machine Free Zone" on Yellow Ribbon	-----
Deflection Line		Green	-----
Cruising		Blue	Blue
Road/Culvert Maintenance & Deactivation		Pink with White	-----

Activity	Ribbon Colour / Comments		Paint Colour
Streams (Fish Bearing)		Red and White Stripe	-----
Streams (Non - Fish Bearing)		Blue and White Stripe	-----
Leave Tree (Single Tree)	-----	"Leave Tree" Painted on Stem	Orange
Culturally Modified Tree	"CMT"	"CMT" on Yellow Ribbon	-----
Class 2 Forest Feature		Yellow	-----
Yew / Yew Patch		Orange and Black Stripe	-----
Monumental Cedar or "MZ"		Yellow and Black Stripe	Orange
120+ DBH Monumental		Purple with Yellow and Black Stripe	Orange

Appendix G: Active Fluvial Units updated 2016

Updated June 2016 for Haida Gwaii

Glynnis Horel, P. Eng.

G.M. Horel Engineering Services Ltd.

Active fluvial units include alluvial streams and their associated active floodplains, and active fans. They are of special significance because of the high ecological values often associated with them; and because the behaviour or character of these features might well be changed through harvesting. The critical deposits are those where erosion within the rooting depth is likely if the trees are removed; or in the case of active fans, where removal of trees can allow increased spread of sediment and debris deposition on the fan surface.

An initial identification of potential active fluvial units is typically done using office-based information (e.g., air photos, topography, hill shade, and stream patterns); but requires field verification to delineate the extent of the active portion of the unit. Features of these types occur across the landscape at all scales, from high energy fans and large floodplains to small low-energy features on S6 upland streams.

STREAM CHANNEL TYPES

There are a number of stream classification systems in the scientific literature for denoting the physical attributes of channels and surrounding valley forms. For the purpose of forest management, and for identifying active fluvial units under the Haida Gwaii Land Use Objectives Order, coastal B.C. streams are categorized into three types based on characteristics relevant to forest management of coastal streams. The main distinction between the types is susceptibility to channel bank erosion and channel disturbance. This is consistent with the principles of the CIT Technical Report #3 (Church and Eaton 2004)[1]. For clarity, definitions for the stream types used in this document are provided in Table "Alluvial" streams are those with alluvial channel bed and bank material, where one or both banks are in alluvial deposits – **these are active fluvial units**. "Semi-alluvial" streams are low-gradient streams (less than 8%) in confined channels with fluvially transported bed material and non-alluvial banks, or banks in glaciofluvial terraces that no longer inundate (e.g., were not formed by the contemporary stream). "Non-alluvial" streams are typically steeper gradient streams that are bedrock or boulder controlled but may have forced alluvial or semi-alluvial morphologies at choke points ("vertical jams"); or have log steps that store sediment. Low-gradient streams that have primarily bedrock or boulder-dominated channels are also non-alluvial streams.

[1]Coast Information Team reports prepared for ecosystem-based management, 2004.

ALLUVIAL STREAMS AND THEIR FLOODPLAINS

The importance of forests on floodplains

Because stream floodplains are composed of materials deposited by the contemporary stream, these materials can be moved by the stream. Thus, they are susceptible to erosion during peak stream flows. In large alluvial streams, riparian forests provide critical erosion resistance in the rooting zone along channel banks. They also provide large wood debris (LWD) which has many functions depending on the size of the alluvial stream; and is crucial for channel morphology and habitat features. During overbank flows in flood events, both LWD and the standing riparian forest provide roughness to the surface of the floodplain and slow the velocity of stream flow, thus reducing its erosive power.

The portion of the floodplain area that floods frequently (typically within 5 years) is the most vulnerable to forest removal and to other disturbances. If this zone is logged, severe effects (significant channel widening, aggradation, loss of channel structure) often occur within a few years with normal peak flows. Large alluvial streams may take many decades to recover from these effects.

Identifying the active floodplain

The frequently flooded portion of a floodplain typically shows visible evidence of water flow or inundation (vegetative indicators, water-borne sediment, or wood debris); and includes medium bench terraces adjacent to the stream and flood channels where this evidence is apparent.

In an extensive floodplain with multiple stepped benches or terraces, an extreme event such as a 100-year flood may inundate a much larger area than the frequently flooded zone. During an extreme event, the stream may completely change its location within the floodplain.

The Haida Gwaii land use order defines an active floodplain to be “where water flows over land in a 1 in 100-year flood event, and includes low and medium benches…”

This provision conveys an intention to protect floodplains from these much rarer extreme events; and to ensure that, should such an event occur, and the stream channel changes location within this larger floodplain, it would still be protected by riparian forest.

On these rarely inundated parts of the floodplain there may be little physical evidence to indicate the extent of the 100-year floodplain unless there has been an extreme event within the past few years. There may be no vegetative indicators or visible signs of water-borne sediment or wood debris. Determination of the 100-year floodplain in the field can be difficult unless there is a distinct topographic break. As well, medium benches are often not continuous or well defined; terraces may be discontinuous, or with varying stepped surface elevations.

Identification of the 100-year floodplain can be aided at locations where there is a designed bridge crossing on a floodplain. Bridge designs typically include flood frequency analysis and stage-discharge determination to set the design height of the bridge. The 100-year flood elevation is usually indicated on the design drawings; however, it is usually a relative elevation to a local benchmark established for the purpose of bridge design and construction. From this, one metre lidar contours, if available, can be used to determine the absolute elevation and then extrapolate that to the limits of the floodplain.

However, one cannot extrapolate this flood elevation too far upstream or downstream of the bridge because the flood surface will be on a gradient similar to the stream gradient, and because the volume of water in the flood changes with distance along the stream channel. Note that not all bridges show a 100-year flood elevation; for example, if the bridge height is determined by the road grade well above a possible 100-year flood.

In the absence of design flood elevations, a best estimate of the 100-year floodplain can be made using the lidar hill shade image and 1 m contours, and then field checking to see if the floodplain delineated by this means appears reasonable.

Table 7: Stream Channel Types.

Alluvial Channel	Alluvial channels are active fluvial units. They have at least one unconfined erodible bank in alluvial deposits. Alluvial deposits are material that was deposited by the stream under the contemporary flow regime. The stream has an identifiable floodplain (channel migration zone) and a riffle-pool or cascade-pool channel bed with a channel gradient up to 8% but typically =<5%. Alluvial streams on fans can be steeper. The stream can erode its bank(s) and widen its channel. Riparian vegetation is critical to limit bank erosion. If there is a significant channel migration zone, stream position may change within this zone, triggered by disturbance or a large flood event. Abandoned channels or flood channels may be present. LWD is important for channel structure and habitat features. Alluvial channels are often reaches of highly productive fish habitat and are highly sensitive to disturbance such as increase in sediment, logging of riparian forest, removal of LWD from the channel, or loss of LWD supply.
Semi-alluvial Channel	Semi-alluvial channels are not active fluvial units. The channel has confining banks in non-alluvial material (e.g., till, colluvium, rock). The channel position is stable; the stream cannot move laterally beyond its active channel. The stream has a riffle-pool or cascade-pool channel bed and gradients less than 8% but typically =<5%. LWD varies from important in small channels to absent or non-functional in large channels. Quality of habitat may be affected by aggradation or scour, removal of LWD, or loss of LWD supply.
Non-alluvial Channel	Non-alluvial channels are not active fluvial units. They are typically confined to entrenched channels with a stable position, although some non-alluvial channels flowing over rock or boulders may have limited lateral confinement. Banks are resistant to erosion (such as till, colluvium, rock). Non-alluvial channels are less sensitive to disturbance than semi-alluvial or alluvial channels. Banks in non-rock material may experience minor local widening or undercutting from erosion if vegetation is removed or in extreme storm events; and may experience bed or bank scour. Non-alluvial channels are typically transport zones. LWD function depends on stream energy and channel character. LWD is non-functional in high energy non-alluvial streams but may function in small streams (especially those where gully processes occur) to trap sediment, limit scour, and control sediment transport. Channel bed is typically cascade-pool, step-pool or rock-dominated.

Wetland	Low-energy stream through wetland, typically fine-textured deposits or organic material in bed and banks.

FANS

Background

- This landform is a cone- or fan-shaped deposition area where a confined tributary enters a larger valley and becomes unconfined. The fan limits may extend to a half circle or may be limited by topography or cutting by the main valley stream to a narrow arc.
- Fans can have surface slopes up to 20^{O} (38%). Landform's steeper than this are considered cones.
- Alluvial processes dominate where the slope on the fan surface $<4^{0}$ (7%). Fans may be transitional – predominantly colluvial processes (debris flows) on the upper part of the fan, and alluvial processes on the lower fan. Between major colluvial events it is common for alluvial process to modify colluvial fans. For the purpose of defining "active fluvial units", no distinction is made between these processes.
- Fan sediments are typically coarsest at the apex, becoming finer downstream, although boulders can be scattered across the full length of debris flow fans, and entrenched streams can transport coarse material farther down the fan.
- The natural stability of a fan is related to the relative ratio of sediment and water being delivered from a watershed. Many of the fans in BC were essentially formed during deglaciation, and contemporary fan-building or fan-eroding activity is frequently limited to only a portion of the fan surface.
- Active deposition processes that originate from sources in the drainage area above the fan may be from:
    - Natural landslides – either chronic or infrequent, or
    - Land use effects such as slides from roads or cutblocks.
- A watershed that is producing more sediment relative to water usually has a shallow, poorly confined channel, with evidence of water flows and sediment accumulation on the fan surface laterally beyond the stream channel.
- A watershed that is producing more water relative to sediment usually has a channel that is entrenched. However, an entrenched channel does not always indicate a naturally stable fan. Periodic debris flows can fill a 4 m deep, entrenched channel in one event, leading to broadcasting of water and sediment.
- Debris flow levees, either recent or historic, can be features that "entrench" a channel.
- Multiple channels may be present on fan. It is common for these channels to be established historically, with water flow in any channel being the result of localized sediment accumulations (frequently associated with debris jams) that partially or totally block off flow in other channel(s).
- Consequences of logging a fan can be:
    - Nil on stable fan with stable watershed upslope and appropriate engineering and harvesting prescriptions; or
    - Destabilisation of channels because of loss of root reinforcement along channel banks, increased sediment broadcasting, or stream diversion from wood debris, inadequate drainage structures, and inappropriate road construction; and/or

- Difficulty of reforestation due to ongoing sediment deposition.

Destabilised fans can take decades to recover, and restoration is rarely feasible.

Definition: Fans as active fluvial units

Determination of fan characteristics and assessment of fan activity follow the hydrogeomorphic criteria from Land Management Handbook 57 (Wilford et al. 2005)[2] and Land Management Handbook 61 (Wilford et al. 2009)[3].

Based on field evidence, individual fans can be stratified into two components: inactive and active units. The "active fluvial unit" is the active component of the fan (described below).

All or parts of fan surfaces with stands 200 years and older undisturbed by visible hydrogeomorphic processes, are considered stable within the timeframe of forest management and are not "active fluvial units".

If no hydrogeomorphic processes are evident, the stream channel position is stable, and the fan is forested with stands 50 -200 years because of disturbances other than hydrogeomorphic processes such as fire, disease, or insects, then the fan is not an active fluvial unit.

If no hydrogeomorphic processes are evident, the stream channel position is stable, and the fan has been previously harvested more than 50 years ago with no evidence of post-harvesting disturbance, then the fan is not an active fluvial unit.

The active fluvial unit (rarely the whole fan surface) is defined as the "hydrogeomorphic riparian zone". This is the zone where the forest stores sediment, maintains the stream location, and reinforces the soil mass.

Identification of hydrogeomorphic riparian zone

Indicators of hydrogeomorphic processes are:

<u>Airphoto evidence</u>

- Visible sediment sources such as landslides in the watershed upstream of the fan indicate potentially high sediment loads are being delivered to the fan.
- Variations in forest canopy on the fan surface linked to stream channels, such as deciduous bands or bands of younger stands than the surrounding forest (cohorts) indicate either multiple channels or land-clearing by debris flows or floods.

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[2] Wilford, D.J., M.E. Sakals, and J.L. Innes. 2005. Forest management on fans; hydrogeomorphic hazards and general prescriptions. B.C. Min. For., Res. Br., Victoria, B.C. Land Management Handbook No. 57.

[3]Wilford, D.M., M.E. Sakals, W.W. Grainger, T.H. Millard and T.R. Giles. 2009. Managing forested watersheds for hydrogeomorphic risks on fans. B.C. Min. For. Range, For. Sci. Prog., Victoria, B.C. Land Management Handbook 61.

- Multiple channels which may appear as streams radiating out from the fan apex; may be inferred by the abrupt disappearance of the main channel from the airphoto view (smaller channels under the forest canopy); or may be visible as multiple points of discharge at the lower margin of the fan.
- Visible sediment accumulation in the channels or on the fan surface.
- Visible increase in gravel bars in the main stream immediately downstream of the confluence of the fan with a larger stream.
- Abrupt angles in the stream channel on the fan indicate a high potential for channel straightening.

Field evidence

- Unconfined stream channels with evidence of periodic flow on the fan surface outside the channels.
- Recent sediment distributed through the trees. "Recent" is defined as unvegetated or with limited accumulation of organic matter.
- Log steps storing sediment and debris.
- Visible channel diversions caused by jams of wood and sediment.
- Visible channel avulsions caused by sediment infilling or by erosion of the channel banks.
- Trees with partially buried boles (as evident from lack of butt flare).
- Scars on trees from impacts by transported sediment or wood.
- Levees of sediment and/or wood debris along the channel sides.
- Wood debris in jams, dikes along the channel sides, log walls piled against trees, or on the fan surface but recently water or debris flow transported.
- Root reinforcement along channel sides or across the fan surface which may appear as a network with minor erosion behind or below the roots.

(For more detailed descriptions of the hydrogeomorphic riparian zone, refer to Land Management Handbooks 57 and 61).

The limits of the hydrogeomorphic riparian zone are defined by delineating the zone from the apex down where these processes occur. The top of the zone is the upstream point at which it is possible for the stream to be diverted from its present channel and re-occupy an older channel on the fan surface; or to flood the fan surface; or to establish a new channel in the event of a debris flow/debris flood/ flood event. This point may be at the fan apex, or if the stream is well entrenched in the upper part of the fan (such as in a complex fan where the contemporary stream has down cut through an earlier fan formed during deglaciation), at the lower limit of entrenchment.

If no clear margins are evident (such as topographic changes) the limit of the active fluvial unit is at the transition to undisturbed forest stands 200 years or older.

Roads on fans

The preferred location to cross a fan is at the apex. Crossing at the apex limits the length of road that can be affected by fan behaviour; however, if the channel above the fan is subject to debris flows or debris floods, the structure must still be able to accommodate this. The road location to the apex should be outside the limits of the fan and not cross up the fan surface.

Where this is not feasible, a road across the surface of an active fan must be able to accommodate debris deposition and channel switching. Because fans are permeable, they may at times have significant subsurface flows that could be intercepted at road cuts and ditchlines. Ditchlines will also intercept broadcast surface flow occurring on the fan surface. If a road location crosses contours on a fan, the road ditch can encounter sufficient broadcast flow, seepage, or channelized flow to become a stream channel; or the road ditch can intercept a channel and divert the stream down the road. Channel avulsion above a road can wash out or bury a road. Active deposition can plug drainage structures or bury a road.

A road across the surface of an active fan should:

- Be located parallel to the contours to the extent possible and avoid alignments up or down the fan surface. In particular, ensure drainage structures are either on flat grades or at dips in the road gradeline.
- Minimize cuts and fills to avoid intercepting seepage; and so that debris flows/debris floods reaching the road, or new stream channels cutting across the road, cause minimal impacts that are not significantly different than the natural behaviour of the fan.
- Have drainage structures preferably designed to be overrun if this is feasible. If this is not feasible, special designs may be needed for structures to accommodate debris flows or debris floods as well as anticipated stream floods. Armouring to train stream channels or construct ditchplugs must be durable rock coarser than the fan material, properly sized and founded to resist scour and entrainment. Avoid excavating sumps at the inlets of drainage structures in active channels as these will tend to aggravate bedload mobilization.
- Avoid excavating stream channels on fans if possible. If this can't be avoided, and it is necessary to do so to control stream flow to structures, the channels must be properly designed and constructed with suitable armouring to resist erosion, and other design features as appropriate such as subchannel groins to limit bedload mobilization. Be aware that maintaining a channel to a structure could have consequences such as increased sediment deposition downstream on the fan surface. The downstream consequences should be carefully considered when reviewing options for drainage structures.
- Be deactivated when not in active use, with drainage structures removed or backed up with cross channels.

SMALL ACTIVE FLUVIAL UNITS ON LOW-ENERGY UPLAND STREAMS

Small fans and floodplains can be found on small streams as well as large streams, including on S6 upland streams, especially where topography is highly variable. They occur at topographic widenings and gradient breaks along stream channels. There are many of these small AFU's across the landscape in Haida Gwaii. Because they lack the energy of large streams, riparian vegetation such as shrubs or young trees can be sufficient to maintain channel erosion resistance; and smaller trees can provide functioning large wood debris. Recovery of channel disturbance therefore takes place over much shorter time intervals than for large streams, often in just a few years when shrubs and young regen

take hold. However, disturbance of these features (such as by yarding) can cause accelerated transport of sediment downstream until vegetation takes hold. Individually these are small sources but the cumulative effects of many such small sources can be significant with respect to sediment loading in channels downstream.

Appendix H: Haida Gwaii FSP Implementation Agreement

Haida Gwaii Licensees' FSPs Implementation Agreement

April 16, 2018

The undersigned Parties commit to working collaboratively and as per individual Forest Stewardship Plan (FSP Results or Strategies) to ensure the Haida Gwaii Land Use Objectives Order targets are met. In particular, FSP implementation as it relates to Cedar Stewardship Areas, Upland Stream Areas, Sensitive Watersheds, Ecological Representation and Marbled Murrelet Nesting Habitat. Individually and when required collectively, the Parties will conduct inventory assessments, determine proportional targets, and establish tracking and reporting mechanisms that demonstrate achievement of FSP Results or Strategies.

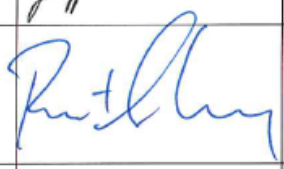
By signing this agreement, the Parties agree to work collaboratively to ensure:

1. Haida Gwaii Land Use Objectives Order targets are met consistent with Forest Stewardship Plan (FSP) Results or Strategies including but not limited to Cedar Stewardship Areas, Upland Stream Areas, Sensitive Watersheds, Ecological Representation and Marbled Murrelet Nesting Habitat. Within the TFLs, the targets will be based on proportional tenure area; while in the TSA, targets will be based on Allowable Annual Cut (AAC) apportionment.
2. The Licensees will complete analyses (independently for area based tenures, including FLTC A87661); or as a group for volume based tenures. Licensees will provide annual reports to the Province (MFLNRORD) and the Council of the Haida Nation (CHN). Licensees will report individually and as a group depending on the HGLUOO/FSP requirement.
3. Proposed development area information is shared at least annually with the effected Parties in shared Landscape Units (e.g. watersheds, and/or watershed sub units, Cedar Stewardship Area harvesting).
4. Manage the cedar (red and yellow) harvest volumes as set by the Chief Forester's partition within the TSA.
    a. The volume of cedar will be changed in accordance with new AAC determinations.
    b. Each Licensee will submit to the Council of Haida Nation and the MLLNRORD, a cedar (red and yellow) harvest volume report for cedar harvested on TSA 25 in the previous calendar year consistent with the Chief Forester's cedar partition.
    c. Individual Cedar Management Strategies will be provided by Licensees as to how each licensee will manage and report their portion of the partition.

The term of this agreement will be from the date signed and will remain in place for the duration of the licensee's FSPs approved in 2018, until such time as a new agreement is reached or the agreement is cancelled by the parties.

This agreement may be amended from time to time with mutual consent of the parties.

Additional Licensees may join this agreement with mutual consent of the parties.

Licensee	Authorized Signatory & Title	Signature	Date
Taan Forest Unit 3 Hwy 16 Commercial Cent Box 1384 Skidegate, BC V0T 1S1 Ph: (250) 559-2337 Fx: (250) 559-2367	Jeff Mosher, RPF Planning Manager		April 16, 2018
Husby Group 6425 River Road Delta, BC V4K 5B9 Ph: (604) 940-1234 Fx: (604) 940-1236	Rob Sandberg, RPF VP Forestry & Engineering		APRIL 16, 2018
A&A Trading Ltd. 1210-1111 Melville St. Vancouver, BC V6E 3V6 Phone: (604) 684-2107 Fax: (604) 689-0977	Dave Marquis, RPF Forestry Manager	David Marquis	April 16, 2018