Ministry of
Forests, Lands and Natural Resource Operations

Land Base Investment Strategy

Mountain Pine Beetle(MPB) Rehab Survey Standard 2012

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These standards apply, in addition to the General Standards for Ministry Funded Programs (FS 1001), to all survey activities funded under FFT Program.

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ARTICLE 1: GENERAL STANDARDS

NOTE (The following variation features of this document require the direction of the **Ministry Designated Representative**)**:**

1. (optional) - are specific underlined clauses available for optional selection (**underlined blue** are hyperlinks and are not optional clauses)

2. (insertion ~) –are where specific underlined values are required to be entered (suggested values maybe listed)

3. Direction required by Ministry Designated Representative highlighted in yellow

Definitions

1.1 In this document the following words shall have the following meanings.

(a) **"Accredited Silvicultural Surveyor"** means a person who is registered with the Resource Practices Branch of the Ministry of Forests, Lands and Natural Resource Operations (MoFLNRO) as an Accredited Silvicultural Surveyor.

(b) **"Approved Surveys Quality Inspection System"** or **"Approved SQI System"** means the inspection system contained in this Document **or** another similar system approved in writing by the, **Ministry Designated Representative** prior to the commencement of Work.

(c) **"Crew"** means one person, or a group of persons working together in the same Opening.

(d) **"Inspector"** means any person who performs a review of a survey or treatment prescription - this includes a Recipient (reviewing Contractor work) for the Ministry Designated Representative or the Ministry Designated Representative themselves;

(e) **"Ministry Designated Representative"** means the MoFLNRO staff person(s) or Ministry Designated Administrator/Authority, identified at the project pre-work and documented in Article 8 of this document, who is responsible for the outcomes of the surveys performed under this standard, and will be empowered to give approval and/or direction to specific article content in this standard that references this title.

(f) **"Mountain Pine Beetle (MPB) Impacted Stands"** means all stands that are:

i) Age Class 2 or older;

ii) Pl leading (overstorey) stands, and;

iii) ≥ 60% of Pli is successfully attacked by MPB in layers 1 and 2.

(g) **"MPB Rehabilitation Surveys"** means all surveys performed on MPB impacted stands where:

i) the Stocking status (SR or NSR) will be based on the Well Spaced (WS) stems per ha. using the Stocking Standards for assessing MPB impacted stands (Article 3.7 of this document); and

ii) All Treatment Prescription decisions for these stands will be based on the documents:

FFT Forest Licence to Cut (FLTC) / Overstorey Removal Stand Selection Criteria Standard or

BCTS FFT ITSL Stand Selection Criteria Policy (to be posted April 2012) and Memorandum of Understanding regarding Innovative Timber Sale Licence (ITSL) between BCTS and FFT where appropriate.

(h) **Multi-storey Stand"** means a stand with a mature or pole layer present in combination with a sapling and/or regeneration layer, managed on an uneven-aged basis.

(i) **"Opening"** means an area identified on a vegetation resources inventory map by an opening number.

(j) **"Overstorey Conifer"** means layer 1 and/or 2 stand structure coniferous trees as described in the *Silviculture Survey Procedures Manual*.

(k) **"Reconnaissance Survey or Recce"** means a form of screening walk-through survey that can be systematic or non-systematic in nature, and involves physically walking through a stand to visually note and record characteristics found in the stand and results in a next action recommendation.

(l) **"Standards Unit**" means one or more areas of an Opening for which there is only one of each of the following: Stocking Standard and soil disturbance limit standard.

(m) **"Stocking Standards"** means the stocking requirements applicable to an Opening that are stated in the FFT Stocking Standards link and/or in Article 3 of this schedule.

(n) **"Stratification Criteria"** means the criteria a contractor will use to stratify an opening for survey sampling and reporting purposes, as set out in these standards.

(o) **"Stratum"** or **"Strata"** means, respectively, a Survey area or areas for which the boundaries are determined by the Stratification Criteria for the type of Survey referenced.

(p) **"Survey"** means, as the context requires, a reconnaissance, a stocking, plantability, or free-growing survey as set out in the *Silviculture Survey Procedures Manual* and includes the collection and analysis of field data, and all forms, maps, reports, photographs, Survey Summary and Treatment Prescription required by the Ministry and FFT standards.

(q) **"Survey Map"** means a map produced according to the specifications in Article 3.

(r) **"Survey Summary"** means a short (no more than one page) summary report from a Survey (signed by the Accredited Silviculture Surveyor), composed of the outcomes of the data compilation (minimum inventory and silviculture label, and any brush competition data/issues) and an abbreviated Treatment Prescription (if a treatment is prescribed).

(s) **"Treatment Map"** means a map produced according to the specifications in Article 3.

(t) **"Treatment Prescription"** means a logical, biologically-sound, cost-effective recommendation, based on survey results and anticipated stand development, which specifies any future Surveys and/or silviculture treatments that are required for a Stratum, which will lead to a free growing stand and which also specifies the year and season during which any such Survey or treatment should take place.

(u) **"Understorey conifer"** means layer 3 and 4 stand structure coniferous trees as described in the *Silviculture Survey Procedures Manual*

(v) **"Vegetation Resources Inventory Map"** means a Vegetation Resources Inventory Map maintained by the Ministry of Forests and Range or by a holder of a Tree Farm Licence or Community Forest Agreement.

Information and Materials Furnished by the MoFLNRO

1.2 At the request of the Contractor, the Ministry Designated Representative will provide or facilitate access to :

(a) any Treatment Prescription or Work Plans applicable to the Openings, when they exist;

(b) copies of the Vegetation Resources Inventory Maps applicable to the Openings to be surveyed;

(c) applicable aerial photographs or access to ortho photos, subject to any conditions of use that may be attached; and

(d) all other available information considered by the Ministry Designated Representative to be pertinent to the Work.

ARTICLE 2: PERSONNEL

Crew Qualifications

2.1 Each Survey Crew must include at least one Accredited Silviculture Surveyor on the ground who has been to every Opening being surveyed greater than 5 ha. All personnel performing the Work must be familiar with the Treatment Prescription options that are appropriate and generally considered acceptable for the area.

2.2 Previously harvested (i.e. salvage) openings less then (insertion ~ 5) ha in size, do not require an Accredited Silviculture Surveyor on the ground per each opening.

Inspector's Qualifications

2.3 All Work must be internally inspected by a person who is:

(a) a Registered Professional Forester (RPF), or operates under the direction of a RPF;

(b) an accredited silviculture surveyor, experienced and competent in conducting Surveys;

(c) familiar with appropriate Treatment Prescription options; and

(d) who did not undertake the Survey.

ARTICLE 3: STANDARDS APPLICABLE TO ALL SURVEYS

3.1 The standards of performance in Article 3 apply to every Survey.

General

3.2 All Treatment Prescriptions must be signed and sealed by an RPF.

3.3 All contents and sections of this document pertaining to specific FFT Survey Standards, will supersede any similar content and section procedures stated in *Silviculture Survey Procedures Manual*

3.4 Any survey procedures not specifically referenced in this FFT Survey Standard document, will default to the *Silviculture Survey Procedures Manual*, as referenced in the text of this document.

Format of Documentation

3.5 Surveys must collect the information necessary to complete the required forms for each survey type. Where Survey data or results are summarized or represented using computerized or other electronic means, the display, content and format of the information must substantially duplicate the corresponding MoFLNRO forms – specifically the FS 657, 658 and 659 and its respective procedural requirements.

Stocking Standards and Damage Criteria

3.6 All MPB Rehabilitation Surveys will use one of the following tables:

Table 1 – Stocking Standards for FLTC or Rehab Treatments
(Preferred and Acceptable Species as per FFT Stocking Standards):

Pl leading Age Class (AC)	Layer	MITD m.	TSS (Unnested total of all layers) WS per ha.	MSSpa & p (Unnested total of all layers) WS per ha.	Damage Criteria (DC)
AC 2 21 to 40 years	**1**	0(1)	FFT Stocking Standards	FFT Stocking Standards	AC 2 & 3 Damage Criteria
	2	2.0 or SS			
	3 & 4	2.0 or SS			Advanced Acceptability Criteria for Layer 3 & 4(3) **plus** Dwarf Mistletoe(4) and Height Diameter Ratio (5) clauses
AC 3 41 to 60 years	**1**	0(1)	FFT Stocking Standards	60%(2) of FFT Stocking Standards	AC 2 & 3 Damage Criteria
	2	2.0 or SS			
	3 & 4	2.0 or SS			Advanced Acceptability Criteria for Layer 3 & 4(3) **plus** Dwarf Mistletoe(4) and Height Diameter Ratio (5) clauses
≥ AC 4 ≥ 61 years or >AC 2 SBPS subzones	**1**(6)	0(1)	FFT Stocking Standards	60%(2) of FFT Stocking Standards	AC 2 & 3 Damage Criteria
	2	2.0 or SS			
	3 & 4	2.0 or SS			Advanced Acceptability Criteria for Layer 3 & 4(3) **plus** Dwarf Mistletoe(4) and Height Diameter Ratio (5) clauses

Table 2 - Stocking Standards for ITSL's Treatments
(Preferred and Acceptable Species as per FFT Stocking Standards):

Pl leading Age Class (AC)	Layer	MITD m.	TSS (Unnested total of all layers) WS per ha.	MSSpa & $p_{(7)}$ (Unnested total of all layers) WS per ha.	Damage Criteria (DC)
AC 2 to AC 3 21 to 60 years	**1**	$0_{(1)}$	FFT Stocking Standards	FFT Stocking Standards	AC 2 & 3 Damage Criteria
	2	2.0 or SS			
	3 & 4	2.0 or SS			Advanced Acceptability Criteria for Layer 3 & $4_{(3)}$ **plus** Dwarf Mistletoe$_{(4)}$ and Height Diameter Ratio $_{(5)}$ clauses
≥ AC 4 ≥ 61 years or >AC 2 SBPS subzones	**1**$_{(6)}$	$0_{(1)}$	FFT Stocking Standards	FFT Stocking Standards	AC 2 & 3 Damage Criteria
	2	2.0 or SS			
	3 & 4	2.0 or SS			Advanced Acceptability Criteria for Layer 3 & $4_{(3)}$ **plus** Dwarf Mistletoe$_{(4)}$ and Height Diameter Ratio $_{(5)}$ clauses

Footnotes for Tables 1 and 2.

1) MITD for Layer 1 is 0 meters, for a Layered Survey, as per Section 9.2.2 of the *Silviculture Survey Procedures Manual*;
2) MSS for Backlog Stocking Standards is 60% of the MSS pa & p., for stands established pre-1987;
3) Located in Section 21 of the FS 660 -Advanced regeneration acceptability guidelines for Layer 3 and 4.
4) An Additional criteria applies for Dwarf Mistletoe Infection: A layer 3 or 4 tree is unacceptable if it is located within 10 m of an overtopping tree, which is infected with dwarf mistletoe
5) An Additional criterion applies for Height to Diameter Ratio (HDR): A layer 3 or 4 tree is unacceptable if the HDR is > 100 , as outlined in the AC 2 & 3 Damage Criteria.
6) Only assess and tally live Layer 1 Pli stems as contributing to WS stems if ≥ 10m2 basal area of Layer 1 Pli within the plot.
7) An area that meets the MSS for *preferred* and *acceptable* (MSS pa) species but does not meet the MSS for *preferred* (MSSp) species would be considered NSR, ***unless*** the Ministry Designated Representative is satisfied that there are an abundance of *acceptable* WS trees, (approaching target stocking), to declare the area to be stocked. This decision by the Ministry Designated Representative would be based on a field visit with the prescribing Accredited Silviculture Surveyor to confirm that the trees are of an *acceptable* species and are likely, in the judgment of the two parties, to develop into a quality stand of merchantable timber, within a reasonable timeframe for the site.

Survey Stratification Criteria

3.7 Unless otherwise specified in this Standard, Work Area(s) will be stratified as set out in *Silviculture Survey Procedures Manual* - Section 3.2: Preliminary Stratification and Section 3.8.1: Field Stratification.

Survey Lines and Plots (where applicable)

3.8 Survey lines and plots will be established using either Global Positioning System (GPS) units (preferred), or by manual chaining methods. Survey lines and plots must be identified as follows:

(a) For both GPS and manual chaining methods:

i) point of commencement (P.O.C.) must be marked with flagging tape showing the Opening number in waterproof ink;

ii) flagging tape must be affixed at a height of approximately 1.3 meters above each plot centre, showing in waterproof ink the plot number, (optional) date of survey, surveyors initials (if not included with the plot number);

iii) flagging tape must be affixed to the ground at all plot centers;

(b) If a GPS is being used, plot centre UTM Coordinates must be provided;

(c) If a manual chaining method is being used:

i) survey baseline (if established) and all strip lines must marked with flagging tape showing the baseline and strip line number in waterproof ink;

ii) all plot centre flagging tape affixed at 1.3 meters must have the bearing and distance to the next plot written in waterproof ink.

Minimum Height Criteria Total Tree (TT) and Total Conifer (TC) Count

3.9 All trees (conifer and deciduous) will be tallied that are greater than (insertion ~ 10) cm in height at the time of survey in the TT count, including germinants if applicable to the defined height criteria. This count can be an estimate, if initial tally exceeds 35 per 3.99 meter radius plot.

TC count will be tallied for all conifers that are greater than the height criteria defined above for the TT count, including germinants if applicable to the defined height criteria.

Minimum Height Criteria WS Count:

3.10 All WS crop trees of preferred and acceptable species will be tallied that are greater than (insertion ~ 50) cm in height.

Free From Brush Criteria

3.11 For the preferred and acceptable trees in a plot to qualify as WS, the trees must be:

- greater than the height of detrimental brush competition in a 1 m cylinder about the tree, or
- in the judgment of the Accredited Silviculture Surveyor, be deemed likely to remain free from brush competition to rotation.

Brush Assessment

3.12 For each Stratum in every Survey, brush hazard must be assessed using the following codes:

- HIGH - brush has encroached on some of the crop trees (control will be necessary);
- MED - brush will encroach on some of the crop trees (control may be necessary in the future);
- LOW - some brush present but no anticipated problem; or
- NIL - no brush hazard present.

Requirement for a Plantability Assessment

3.13 If a Survey indicates that a Stratum is not satisfactorily restocked (NSR and below the required WS stems per ha.), a plantability assessment must also be conducted on the Stratum while performing the survey. Assess plantability at (insertion ~ 1400) targeted plantable and /or preparable spots per ha. (defining the planting target inter-tree distance), in order to determine the amount of seedlings required.

Assess plantable and / or preparable spots **utilizing** the minimum inter tree distance (from the Stocking Standards for the Stratum) **up to** the target inter-tree planting density.

Site Index (SI) Methodology

3.14 Site index must be collected following the procedural guidelines outlined in *Land Management Handbook 12 - Selecting a Method to Estimate Site Index 2006*: Selecting a Method to Estimate Site Index, 2006.

3.15 The following is a summary of a combination of the site index hierarchy process presented above in Article 3.14 and FFT specific guidelines, relative to different FFT objectives and Stratum conditions:

a) SI for Inventory Labels – RESULTS

i. Immature and Mature Stands Even-aged / Single layered or Multi-layered:

1. First if possible, use of the growth intercept (GI) method is most recommended. Tally site index for the current dominant/co-dominant species of the leading species in the Stratum of the largest diameter, with a minimum of 3 samples per Stratum and a target of at least 5 samples per Stratum. If a leading species growth intercept cannot be collected, a secondary species will be collected (if possible), again from dominant/co-dominants, and converted for the leading species site index. Data should be collected from non-understorey or non-suppressed trees. Data should be collected on a **live** overstorey Pl trees preferably, if these are the suitable site species. Dead Pl stems are acceptable if mortality due to MPB is current (<2 years). Site Tools can be used to accurately calculate all SI from growth intercept measurements.

2. Second, if the growth intercept method cannot be used, the second choice is via Site Index by BEC (SIBEC) **second** approximation data for the appropriate species (usually denoted by a sample size, standard error and decimal site index in the SIBEC table); or

3. Third, the choice would be via SIBEC **first** approximation data for the appropriate species (usually denoted by no sample size, no standard error and whole number site index in the SIBEC table). SIBEC tables for all BEC subzones/site series by species, by old Forest Service Regions, are available at SIBEC link.

ii. Immature and Mature Stands Uneven-aged / Multi storied:

1. First, the growth intercept method cannot be used in these stands due the variable and possibly suppressed growth rates. Therefore, the preferred choice is via SIBEC **second** approximation data for the appropriate species (as described above).
2. The second choice would be via SIBEC **first** approximation data. SIBEC tables for all BEC subzones/site series by species, by old Forest Service Regions, are available at SIBEC link.

b. SI for Return On Investment (ROI) – Investment Decisions

i. Immature and Mature Stands Even-aged or Uneven aged:

1. If the methods and hierarchy listed above are unable to generate an estimate of the SI of the **projected** Stratum forecast for investment analysis (ROI test) **in the Stratum being surveyed**, then use of **an adjacent stand of similar BEC** and projected leading species is permitted - to estimate the SI for ROI purposes **only**.

(optional) Dead Tree Count

3.16 Estimates will be made for the total number of stable and total number of unstable dead trees greater than 5 m. in height, in the plot. This estimate will be used in NSR strata to determine if a Danger Tree Assessment by a qualified assessor is required, prior to treatment.

Additional Field Notes - Access and ROI

3.17 **Access:** Current access and required access improvement contained in inter-plot or recce notes, must be collected during all Surveys and documented/summarized with the Treatment Prescription.

ROI: To assist with estimating the total trees/ha and well spaced trees/ha for the return on investment (ROI) process, interplot or recce notes may be collected during all Surveys specifying the percentage of the total trees that are unlikely to develop into merchantable timber (e.g. 90% of the layer 2 and 3 PL are suppressed and/or infected with dwarf mistletoe).

Forest Cover Inventory Label and Silviculture Label

3.18 Surveys must produce a complete forest cover inventory label and silviculture label (use WS per ha. in silviculture label) for each Stratum, as specified in the *Silviculture Survey Procedures Manual* and the RESULTS Information Submission Specification - Government Submission

Labels for inventory and silviculture for Strata and WTPs where appropriate, should only contain live species in the species components – dead Pli components are not required.

Recommendations

3.19 Subject to the outcome of a Survey, Treatment Prescriptions must be developed in accordance with:

a) the procedures in the *Silviculture Survey Procedures Manual;*

b) any previous Treatment Prescriptions for the Opening, if one exists; and

c) will have all of their Treatment Prescription decisions for these stands based on the standard document FFT FLTC / Overstorey Removal Stand Selection Criteria Standard.

Survey and Treatment Maps

3.20 Survey and Treatment Maps must:

a) be submitted in accordance with the RESULTS Information Submission Specification - Government Submission Chapter 6 for use in RESULTS submissions; and

b) the two maps can be combined into one Survey and Treatment map if directed by the . Ministry Designated Representative.

Survey Maps - Additional Requirements

3.21 In addition to the requirements of Article 3.20, Survey Maps must also show:

a) the type of Survey;

b) biogeoclimatic (BEC) classification from the subzone to the site series level;

c) Opening and Strata area;

d) inventory and silviculture label;

e) points of commencement of the survey;

f) plot centers numbered at least every fifth plot; and

g) (optional) survey lines and direction travelled.

Treatment Maps - Additional Requirements

3.22 Treatment Maps must show:

a) biogeoclimatic (BEC) classification from the subzone to the site series level;

b) Opening and Strata area;

c) inventory and silviculture label;

d) treatment unit boundaries (treatable areas) and identifiers;

e) abbreviated Treatment Prescription Recommendations;

f) the direction and distance to nearest town; and

g) gross and net treatment area.

ARTICLE 4 MPB REHAB RECONNAISSANCE (RECCE) GROUND SURVEY STANDARDS

General

4.1 An initial reconnaissance (Recce) of a Stratum is a form of screening walk-through survey. The Recce will be either systematic or non-systematic in nature, and will involve physically walking through a Stratum to visually record information as defined in this standard. A small number of sample plots may be established if necessary (Article 4.5 and 4.6), but specified information (Article 4.4) must be collected to further define the characteristics of the Stratum and recommend the next course of action.

Recce Procedures

4.2 It is recommended that the Recce be performed on a transect basis so that the whole Stratum is covered. The transect can be established either on a predetermined basis or via a random walkthrough. The resultant Recce transect location will be rough mapped or GPSed.

4.3 Pre-stratification is recommended prior to performing the Recce in order to identify homogeneous Strata for sampling. This can be performed at a coarser (multi-Opening) scale than normally performed for a full silviculture survey scale. Photos, images and maps, and / or aerial overviews (i.e. by helicopter) are recommended in this pre-stratification procedure. Stratification criteria must follow the procedures included in Article 3.8.

Non-Plot Recce Information

4.4 Non-plot measurements/observations collected during the Recce and in-between plots (if established) include:

a) BEC classification from the subzone to the site series level;

b) mountain pine beetle (MPB) attack levels, distribution and age of attack;

c) forest health factors/damage agents (where applicable);

d) estimate dead tree total tally/ha. and (optional) if a Danger Tree Assessment is required (where applicable);

e) Overstorey stems per hectare (live and dead/dying) and live Overstorey stocking (well spaced and free growing as applicable);

f) Understorey conifers – species % and density, distribution, stocking (well spaced, and free growing as applicable), age and height;

g) competing (or potentially competing) vegetation and distribution;

h) site index via the hierarchy methods and protocol as outlined in Article 3.15;

i) delineation of stratum boundaries.

j) (optional) range of dbh's of overstorey pine;

k) (optional) basal area (using a prism sweep);

l) (optional) photographs representing the stand/stratum;

Recce Sample Plot Procedure and Information (if required)

4.5 Plots should be established "representatively" as per the representative sampling methodology outlined in the *Silviculture Survey Procedures Manual*.

4.6 Number of plots required are:

a) a minimum of (insertion ~ 1) plot(s) should be established for every (insertion ~ 10) hectare – or portion thereof, with a minimum of (insertion ~ 3) plots in total.

b) a minimum of 5 plots should be established in any Stratum which is recommended for a Treatment Prescription, and any Stratum where a change to the inventory label is being recommended (for example a Stratum with heavy mortality in the overstorey but good understorey stocking which will now create the new inventory label).

4.7 The following data shall be recorded at each Recce sample plot in addition to the data requirements of Article 3 and 5 of this standard (except for Article 5.2 & 5.3 - Sampling Intensity):

a) (optional) tally the number of Overstorey trees (Layer 1 and 2) by species, and dbh classes in a 3.99m plot or 5.64 m plot (at the surveyor's discretion);

b) (optional) classes of dbh for Overstorey should be as follows: ≥ 7.5 cm and <12.5 cm; ≥ 12.5 cm to 15.0cm; >15cm (or any combination of such as defined by the **Ministry Designated Representative**);

c) (optional) tally the number of Understorey (Layer 3 and 4) trees by species. Comment on their acceptability and height and age (average and range);

d) (optional) do a prism sweep of alive Overstorey trees (Layer 1) and record the number and BAF of prism used;

e) (optional) take (insertion ~ 2) photograph(s) per stratum representing the stratum.

Next Course of Action Recommendation

4.8 Upon completion of the Recce and/or Recce sample plot establishment, and the compilation of the data collected, there will be a recommended next course of action included in the Survey Summary. The categories are either:

a) **Re-assess** - Do another Recce in the future and recommend a date of reassessment (For example in MPB applications, strata which have only a small amount of MPB attack currently, but are susceptible to future attack, schedule a full survey for specific strata in 2 years after complete fader mortality appears);

b) **Leave as is** – No treatment or further assessment required (For example in MPB applications, Strata which have little to no MPB attack, and should not be susceptible to future MPB attack or stands which have an abundance of healthy acceptable understorey conifers which are maintaining the Strata stocked);

c) **Conduct a full survey** - Recommend a full survey and plot intensity. (For example in MPB applications, Strata which have a great deal of variability in levels and distribution of MPB attack, and/or in levels and distribution of potentially acceptable understorey conifers, and are therefore very difficult to accurately describe with a walk-through and limited plot establishment); **or**

d) **Develop a Treatment Prescription** - Includes planting, or a combination of site preparation and planting. (For example in MPB applications, Strata which are heavily attacked by MPB, and have little to no understorey conifers, and thus have very low current stocking. Therefore, it would be redundant to do a full survey, as Recce observations and possible Recce plots have provided enough information. Collection of current access and required access improvements are required, as outlined in Article 3.18).

ARTICLE 5: MPB REHAB PLOT SURVEY STANDARDS

General

5.1 The standards contained in this Article apply to MPB Rehabilitation Surveys in addition to the standards specified in Article 3.

Full Silviculture Survey Sampling Plot Intensity

5.2 The sampling design and intensity will be driven by the degree of variability and complexity found in the Stratum during the Recce. Increased Stratum variability and complexity typically will require more sampling. Plot intensity will range from 1 plot/ha to 1 plot/5 ha. A minimum of 5 plots/Stratum is required. Regardless of the plot intensity, the surveyor must ensure that their plot locations provide uniform coverage of the Stratum. This process will help ensure the plot data is representative of the whole Stratum.

5.3 (optional) Where the Recced stocking levels are between (insertion ~) and (insertion ~) WS sph, then (insertion ~.) plots per ha. will be established.

Tally of TT, TC, and WS Trees – Relative to Layers

5.4 The following defines the procedure for tallying TT, TC, and WS trees relative to layers and management regimes:

a) Even-aged management using single or layered survey procedures. These will be Strata that fit the FPPR definition of even-aged (FPPR Schedule 1 Sec 6: *"Even-aged means a stand of trees with 1 or 2 age classes"*). These will be Strata that are suitable for single entry harvest systems on a longer/conventional rotation age basis (for example: 80 years or older). Two types of survey procedures apply in these stand conditions:

i. Single Layered stand structure: These Strata will be surveyed tallying all TT, TC, and WS stems as one layer and will follow the standard base survey procedures as outlined in *Silviculture Survey Procedures Manual*

ii. Layered Even-aged stand structure: These Strata will be surveyed by tallying TT, TC, and WS stems by all 4 layers and will be totaled by adding all layers (without nesting) to compare estimates of the mean stocking values to the minimum Stocking Standards. Layers are defined by the following criteria for these surveys:

Layer 1 ≥ 12.5 cm dbh;

Layer 2 ≥ 7.5 cm dbh and <12.5 cm dbh;

Layer 3 >1.3 m ht and <7.5 cm dbh;

Layer 4 ≤ 1.3 m ht and ≥ the specified height in Article 3.10 and 3.11.

This procedure is outlined as well in the *Silviculture Survey Procedures Manual*. A commonly used terminology is to group Layer 1 and 2 into the term "Overstorey" and Layer 3 and 4 into the term "Understory". These terms are applicable for reference purposes only, but the layer designation should be used when entering the inventory and silviculture label data into RESULTS.

b) (optional) Uneven-aged management using Multi-storey survey procedure. These will be Strata that fit the FPPR definition of uneven-aged (FPPR Schedule 1 Sec 6: "*Uneven-aged means a stand of trees with 3 or more age classes"*). These would be Strata that have a uneven-aged management regime and would be suitable for multi-entry harvest systems on a cutting cycle shorter than conventional rotation ages (for example: targeting 20 to 40 year harvest re-entries). These Strata are to be assessed by tallying TT, TC, and WS stems by layer and using nested procedures as outlined in the Multi – Storey Survey procedure in *Silviculture Survey Procedures Manual*. Layers are defined by the following criteria for these surveys:

Layer 1 ≥ 12.5 cm dbh;

Layer 2 ≥ 7.5 cm dbh and <12.5 cm dbh;

Layer 3 >1.3 m ht and <7.5 cm dbh;

Layer 4 ≤ 1.3 m ht and ≥ the specified height in Article 3.10 and 3.11;

Specific Tallies for Pl stems:

5.5 **TT and TC Count:** Only Live Pl (no MPB infested stems) and all other live species will be included in these counts and the inventory label;

WS Count: Only Live Pl by layer (no MPB infested stems) and all other live preferred and acceptable species will contribute to the stocking status and be included in the silviculture label;

MPB Infected Pl (IBM - forest health code): All infested Pl will be tallied separately by layer (in the Forest Health Column of the FS 658 if used) and identified as dying (green attack) or dead (red or grey attack);

(optional) classes of dbh for Overstorey should be as follows: ≥ 7.5 cm and <12.5 cm; ≥ 12.5 cm to <15.0cm; ≥15cm (or any combination of such as defined by the **Ministry Designated Representative**);

(optional) Overstorey Pl and Understorey Regen Tallied Separately: It is recommended to tally separately the overstorey (Layer 1 and 2) **live Pl** out of the total WS count. This tally would provide a **"worst case scenario"** for the ROI analysis process (i.e. should the remaining Pl die from further MPB infestation spread throughout the surveyed Stratum, how would this change the Treatment Prescription).

(optional) Basal Area (BA) Sweeps

5.6 BA sweeps will be completed on all Strata (for all trees dead and live - immature and mature Pl) and at all plots for stems ≥12.5cm dbh -Layer 1 only. Select the lowest BAF prism that will provide a reasonable estimate of the residual basal area (i.e. targeting a minimum of 2 trees in each sweep as a guide for selection). Live trees must be tallied by species (i.e. 2 Pli, 1 Sx).

Brush Assessment

5.7 In addition to the requirements of Article 3.14, for all HIGH and MED brush hazard Strata, the species, percent cover and height of competing vegetation must to be recorded at every plot.

5.8 In addition to the requirements of Article 3.14, for all LOW and NIL brush hazard Strata, the species, percent cover and height of competing vegetation need only be recorded at the first and every fourth sample plot thereafter.

Required Photography

5.9 Stratum - One colour photograph must be taken, showing a representative view of each Stratum. Opening - Total number of photographs for an Opening must be labeled and attached to the hard copy of the Treatment Prescription and attached into the RESULTS opening file as a PDF file.

ARTICLE 6: REQUIRED SURVEY REPORT TEMPLATE, TREATMENT PRESCRIPTION, EVALUATIONS (ROI), LAYOUT & DELIVERABLES (APPLICABLE TO ALL SURVEYS)

General

6.1 MoFLNRO representatives may at any time request the Contractor to provide any information related to the Work, and the Contractor shall supply the information within a reasonable time period.

LBIS Survey Report Template

6.2 For each Opening that a Survey is preformed, the Contractor will complete the LBIS Survey Report Template (to be posted April 2012) that will contain all of the Survey compilation data elements.

Return On Investment (ROI) Analysis

6.3 For all Strata with proposed treatments (treatment areas), a financial analysis must be carried out to determine if the proposed treatments will meet the FFT required return on investment (ROI) criteria. The ROI will be calculated using methods provided by the Ministry. All resource tools, procedures and steps are provided at the following link on the FFT website under Return On Investment.

Individual **Ministry Designated Representative** will determine if the Survey Contractors will be required to complete ROI analysis on potentially treatable units within their respective TSAs. Key personnel who will be completing the financial analysis will be required to take a 2 to 3 hour training course on line, accessed at the same ROI web link above.

Treatment Prescriptions

6.4 The minimum treatment unit size is five (**5**) hectares.

6.5 For all Strata with proposed treatments (treatment areas), a complete Treatment Prescription will be produced by the Contractor, comprised of 4 components:

1. Completed LBIS Survey Report Template –manually completed and/or digitally uploaded, including the following elements in the Recommendations Section of the Template:
    a. a schedule of treatments including options/alternatives, preference rationale, and follow-up surveys;
    b. total hectares of the prescribed treatment unit (optional)as determined by a GPS traverse;
    c. site preparation prescription if applicable, with the planned year and season;
    d. danger tree assessment recommendation where applicable;
    e. numbers of seedlings to be planted by species, including recommended stock type, planting year and season;
    f. a statement addressing the use of genetically improved seedlings and greater species diversity (see FFT Policy on Management of Tree Species Composition);
    g. proposed brush control treatments with the planned year and season where applicable; and
    h. access notes including information on accessibility and any required access improvements (e.g. 4WD, quad access only).
2. Additional digital attachments relative to the LBIS Survey Template such as:
    a. ROI calculation sheet from the Return On Investment. website link;
    b. Colour photograph for each Stratum.
3. a Treatment Map;
4. a Survey Summary

(optional) Traversing and Layout of Treatment Units (treatable areas)

6.6 The Contractor will only layout and traverse those areas approved by the **Ministry Designated Representative**.

6.7 Traversing of treatment units, roads and spur roads will be done using GPS technology only and to FFT GPS Standards .

6.8 All non-GPS traverses (not preferred and only permitted if GPS failure) must be aerial-photo tied and ground-tied to a mappable unit.

6.9 All treatment unit boundaries will be flagged using winter weight ribbon of the colour and format as defined by the **Ministry Designated Representative** and TSA standard. All flagging shall be inter-visible at a glance (i.e. two consecutive ribbons are visible in one direction). and attached as high as possible, to residual stems.

Reports and Deliverables

6.10 For each Opening that a Survey is preformed, the Contractor will ensure the provision of the following products to the **Ministry Designated Representative** and deliverables 2 to 5 in the following table will be included as attachments in the RESULTS submission.

Recce, Stocking and Plantability Survey List of Deliverables	# of Originals	Digital Deliverable Format
1. All original field data and summary forms.	1	Not applicable
2. Survey Map and Survey Summary.	1	.pdf
3. LBIS Survey Report Template (signed by an RPF) and Treatment Map, where future treatments are recommended.	1	.pdf
4. ROI printout where applicable	1	.pdf
5. Colour photograph for each Stratum	1	.jpg

ARTICLE 7: SUBMISSION INTO RESULTS

General

7.1 For each Opening that a Survey is preformed, the Contractor must submit into RESULTS:

1. Completed Survey data digitally via the LBIS Survey Report Template, including prescribed planning activities (where applicable), forest cover polygon data, inventory label data, and silviculture label data;
2. Attachments to the Opening file such as listed above in Article 6.10 for deliverables 2 to 5;
3. Digital spatial information for strata and treatment areas using recommended Electronic Submission Framework (EZLink or CENGEA) or online submission (whichever is applicable).

Data Entry Standards

7.2 All data must be entered into RESULTS in accordance with the RESULTS Information Submissions Specifications - Government Funded. This standard describes the process of creating new Openings (as required with some Recce MPB and wildfire situations) and provides a link to the Provincial Standard for RESULTS submissions - “RESULTS Information Submission Specifications for Government Funded Silviculture Activities” and “Silviculture Information Submission Guidebook”.

RESULTS Quality Management

7.3 For the purposes of quality management, the Contractor must submit tabular and spatial data for 5 (five) Openings into RESULTS by a deadline specified by the **Ministry Designated Representative**. Following this initial submission, the Contractor will periodically provide to the Ministry Designated Representative, a list of Openings that have been successfully submitted into RESULTS.

ARTICLE 8: ADDITIONAL TSA STANDARDS

8.1 Additional standards to all of the base standards above, may be requested by specific TSA. **Ministry Designated Representative** These additional standards must be attached to this document.

8.2 These additional standards will be clear as to the Articles of this base standard that are being added to and/or superseded and will contain specific rationale for a variance to this base standard.

ARTICLE 9: INSPECTION

Quality Inspection - General

9.1 The Inspector must inspect the Work in accordance with an Approved Surveys Quality Inspection System in a timely manner to ensure the results of the Work conform to the Standards.

9.2 Unless otherwise specified by a Ministry Designated Representative, the methodology given in this Article shall form the basis for the Approved Surveys Quality Inspection System.

Method of Inspection

9.3 If the Deliverables contain all of the required elements and are deemed satisfactory, the Inspector shall conduct a reconnaissance of the Payment Area to carry out a preliminary assessment of the quality of the Work.

9.4 If, after any reconnaissance, the Inspector and / or Ministry Designated Representative decide, in their discretion, to conduct field inspections of the corresponding Payment Area, they shall inspect 10% or more of the Payment Area to determine compliance with the terms and conditions of this Agreement.

9.5 The Ministry Designated Representative will provide the Contractor with a copy of the inspection of the Deliverables and the preliminary assessment, and/or field inspection within 10 working days of the date of the inspection so that the Contractor is notified in a timely manner as to:

(a) whether to proceed to the next activity or phase of Work; and/or

(b) any deficiencies or non-compliance with the Agreement.

Field Inspection

9.6 The Inspector shall conduct field inspections by checking, at their discretion, the results of all plots and lines established by the Contractor on a portion of the Payment Area or by establishing an independent survey of some of the Strata within the Payment Area.

9.7 Where the Inspector checks the results of actual plots established by the Contractor in an Opening, they shall inspect the greater of ten (10) plots established or 10% of plots established, and the shall assess and compare the data it obtains with that collected by the Contractor for the same plots.

Provision of Field Maps

9.8 The Ministry Designated Representative may request that the Contractor provide them with copies of Survey cards and field maps for any Stratum surveyed, and the Contractor shall supply the copies within a reasonable time period as agreed to by the Ministry Designated Representative.

Satisfactory Work Quality Defined

9.9 The Inspector must examine the data to the extent necessary to determine that the Survey has been undertaken and reported in accordance with this Standard, and specifically may determine a Survey to be **satisfactory** when:

a. an Opening is correctly stratified according to the Stratification Criteria;

b. the Survey correctly identifies for a Stratum:

i. the Biogeoclimatic zone, sub-zone, and site series,

ii. the stocking status (e.g., satisfactorily restocked [SR] vs. not satisfactorily restocked [NSR]); and

iii. the order of the leading and secondary species in the inventory label,

c. the Survey correctly reports:

i. a brush hazard, and

ii. any pest, pest damage, disease, disease damage or other physical damage;

d. a field check finds a difference of no more than 10% between the Survey and the Inspector's tally in any data collected in Article 3, 4 and 5 – except for no more than 20% for total trees;

e. field cards, reports, maps or summaries are legible, and are completed in accordance with this Standard, and;

f. the Deliverables are complete and contain no errors, omissions or false statements.

Approval of Payment from Inspection

9.10 The Ministry Designated Representative shall approve payment for any Payment Area where the Contractor has, in the sole opinion of the Ministry Designated Representative and as recommended by the Inspector, satisfactorily completed and submitted all Deliverables required for the Payment Area to the Standards of this document. The Ministry Designated Representative may approve partial payment for achievement of specified milestones as set out in the Work Progress Plan.

9.11 The Ministry Designated Representative will recommend the following action on a per Opening basis, for Work pertaining to all Surveys that are determined unsatisfactory due to non-compliance of the criteria identified in Article 9.9:

a. the Ministry Designated Representative shall promptly notify the Contractor, and

b. the notice shall:

i. specify the fault, give the Contractor a deadline for compliance, and specify if the Ministry Designated Representative wishes to exercise their option to require the Contractor to rework the unsatisfactory Work; or,

ii. specify the fault, indicate that the Ministry Designated Representative will exercise the option to correct the unsatisfactory Work, and deduct from payment all direct and indirect costs incurred for correcting the unsatisfactory Work.

If the Contractor fails to comply by the specified deadline for compliance, or if any inspection of further Work indicates that Work is again unsatisfactory, the Ministry Designated Representative will recommend no payment per Opening basis, for Work pertaining to all Surveys.