



**REQUEST FOR PROPOSAL (RFP)**  
**Measurement and Establishment of Growth & Yield Plots**

**Chinook Comfor Limited Partnership**

Chinook Comfor LP  
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**RFP ID: K4R-G&Y-2022**

Date: May 2, 2022

**REQUEST FOR PROPOSAL**  
**Measurement and Establishment of Growth & Yield Plots**  
**Burns Lake, B.C.**

**RFP ID:** K4R-G&Y-2022

**SUBMISSION DEADLINE:** June 10, 2022, 4:00 pm

**QUESTION SUBMISSION DEADLINE:** May 24, 2022

Questions may be submitted in written form no later than May 24, 2022, to:

**RFP Contact Name:** Ken Nielsen  
**Contact Address:** Box 969, Burns Lake, V0J 1E0  
**Email Address:** Ken.Nielsen@chinookcomfor.ca

**INTRODUCTION**

Chinook Comfor LP invites and welcomes proposals for re-measurement of Growth & Yield Monitoring Plots for their Community Forest. Please take the time to carefully read and become familiar with the proposal requirements. All proposals submitted for consideration must be received by the time as specified above under the "SUBMISSION DEADLINE."

*BIDDERS SHOULD NOTE THAT ANY AND ALL WORK INTENDED TO BE SUBCONTRACTED AS PART OF THE BID SUBMITTAL MUST BE ACCOMPANIED BY BACKGROUND MATERIALS AND REFERENCES FOR PROPOSED SUBCONTRACTOR(S) – NO EXCEPTIONS.*

**PROJECT AND LOCATION**

The bid proposal is being requested for Chinook Community Forest located in the Lakes TSA, specifically surrounding Burns Lake, BC.

**PROJECT MANAGER CONTACT INFORMATION**

For questions or information regarding Planning, contact the following individual(s):

**Name:** Ken Nielsen  
**Title:** General Manager  
**Phone:** 1-250-692-0630  
**Email:** Ken.Nielsen@chinookcomfor.ca

**OR**

**Name:** Dwight Crouse  
**Title:** Project/Operations Manager

**Phone:** 250-469-9757 ext 1088  
**Email:** dwight.crouse@ecora.ca

**PROJECT OBJECTIVE**

The objective and ultimate goal for this project is to re-measure ground plots that in turn can be used to monitor growth & yield on the community forest in light of climate change, disturbances (natural and anthropogenic), update the forest inventory, potentially develop localized growth & yield curves and treatment response data. This data will be instrumental to ensure future forest management decisions are being carried out with the utmost care, due-diligence, and attention to detail to correctly assess multiple values across the landscape.

**PROJECT SCOPE AND SPECIFICATIONS**

Project Scope and Specifications are outlined in attached documents (Schedule A and Schedule B). Generally, there are 93 plots that require remeasurement over the next 2 to 3 years.

**SCHEDULED TIMELINE**

The following timeline has been established to ensure that our project objective is achieved; however, the following project timeline shall be subject to change when deemed necessary by management.

<b>MILESTONE</b>	<b>DATE</b>
<b>Start :</b>	August 8, 2022
<b>Monthly Updates each month where work is actively being performed on the project. Goal of getting ½ plots done in 2022 and remaining plots done in 2023.</b>	
<b>Completion Date:</b>	November 2023

If the above dates do not work for you, please suggest alternative dates and we can discuss/evaluate the alternative timelines.

**PROPOSAL BIDDING REQUIREMENTS**

**PROJECT PROPOSAL EXPECTATIONS**

Chinook Comfor LP shall award the contract to the proposal that best accommodates the various project requirements. Chinook Comfor LP reserves the right to award any contract prior to the proposal deadline stated within the "Scheduled Timeline" or prior to the receipt of all proposals, award the contract to more than one Bidder, and refuse any proposal or contract without obligation to either Chinook Comfor LP or to any Bidder offering or submitting a proposal.

**INTENT TO SUBMIT PROPOSAL**

All invited Bidders are required to submit a "Letter of Intent" no later than May 13, 2022, informing Chinook Comfor LP of their intent to either submit or decline to submit a proposal.



## **DEADLINE TO SUBMIT PROPOSAL**

All proposals must be sent via email to Ken Nielsen at Chinook Comfor LP ([ken.nielsen@chinookcomfor.com](mailto:ken.nielsen@chinookcomfor.com)) no later than 4:00 pm on June 10, 2022. Proposals must be sent in pdf format and have the content outlined in the "Proposal Submission Format" below.

## **PROPOSAL SELECTION CRITERIA**

Only those proposals received by the stated deadline will be considered. All proposals submitted by the deadline will be reviewed and evaluated based upon information provided. In addition, consideration will be given to cost and performance projections. Furthermore, the following criteria will be given considerable weight in the proposal selection process:

- Proposals received by the stipulated deadline in the correct format;
- Bidder's asserted performance and effectiveness regarding re-measurement and establishment of plot data;
- Bidder's performance history and asserted ability to timely deliver proposed services;
- Bidder's ability to provide and deliver qualified personnel who have the knowledge and skills required to effectively and efficiently execute proposed services;
- Overall cost effectiveness of the proposal; and
- Local contractors.

Chinook Comfor LP shall reserve the right to cancel, suspend, and/or discontinue the tendering process at any time they deem necessary without obligation or notice to the proposing bidder/contractor.

## **PROPOSAL SUBMISSION FORMAT**

The following is a list of information that the Bidder should include in their proposal submission:

### **Summary of Bidder Background**

- Bidder's Name(s);
- Bidder's Address;
- Bidder's Contact Information (and preferred method of communication);
- Description of Bidder's company in terms of size, range, and clientele as well as the types of services offered
- Evidence of established track record for providing services and/or deliverables that are the subject of this tender;
- Outlining expertise of the key personnel who would provide services to Chinook Comfor LP.
- How will your company contribute to the local economy

## **Financial Information**

- State whether the Bidder, or its parent company (if any), has ever filed for bankruptcy or any form of reorganization under the Bankruptcy Code;
- State whether the Bidder, or its parent company (if any), has ever received any sanctions or is currently under investigation by any regulatory or governmental body.

## **Proposed Outcome**

- Summary of timeline and work to be completed.

## **Equipment or Service**

- List any and all equipment or services required for this proposed project and the quantity of each.
- Detailed estimated cost for each piece of equipment or service.
- List any equipment or services required of a subcontractor, along with a brief explanation.
- List any accommodation, services, or space required from Chinook Comfor LP, along with a brief explanation.
- Bidders will also be expected to provide tree tags for this project and include a line item and description of the tree tags in proposal.
- Bidders should provide information on the GPS system they plan to use, be adequately trained in their use, and document/demonstrate how they will achieve the desired positional accuracy.
- If bidder, plans on using subconsultants, the subconsultants must be listed in the proposal and approved by the client before work commences.
- If any Camps will be set-up to reduce travel, they must be set-up in accordance with Schedule C.

## **Cost Proposal Summary and Breakdown**

- An inclusive price per plot; including travel, room and board, utility vehicles, etc.
- A detailed list of any and all expected costs and expenses related to the proposed project; Expenses are to be built into proposal costs. Chinook will not be responsible for paying expenses outside of the project bid price. A 10% holdback may be applied to the project. This holdback can be paid out in installments after data passes quality assurance tests.
- Year 1 and Year 2 Breakdown and Payment Schedules, assuming plots north of Francios Lake are remeasured in year 1 and south of Francios Lake in year 2.

## **Licensing and Bonding**

- Provide details of licenses and bonds (if any) for any proposed services that the bidder/contractor may plan on providing for this project. Proponents need to be registered with WorkSafeBC and provide proof of certification.

## **Insurance**

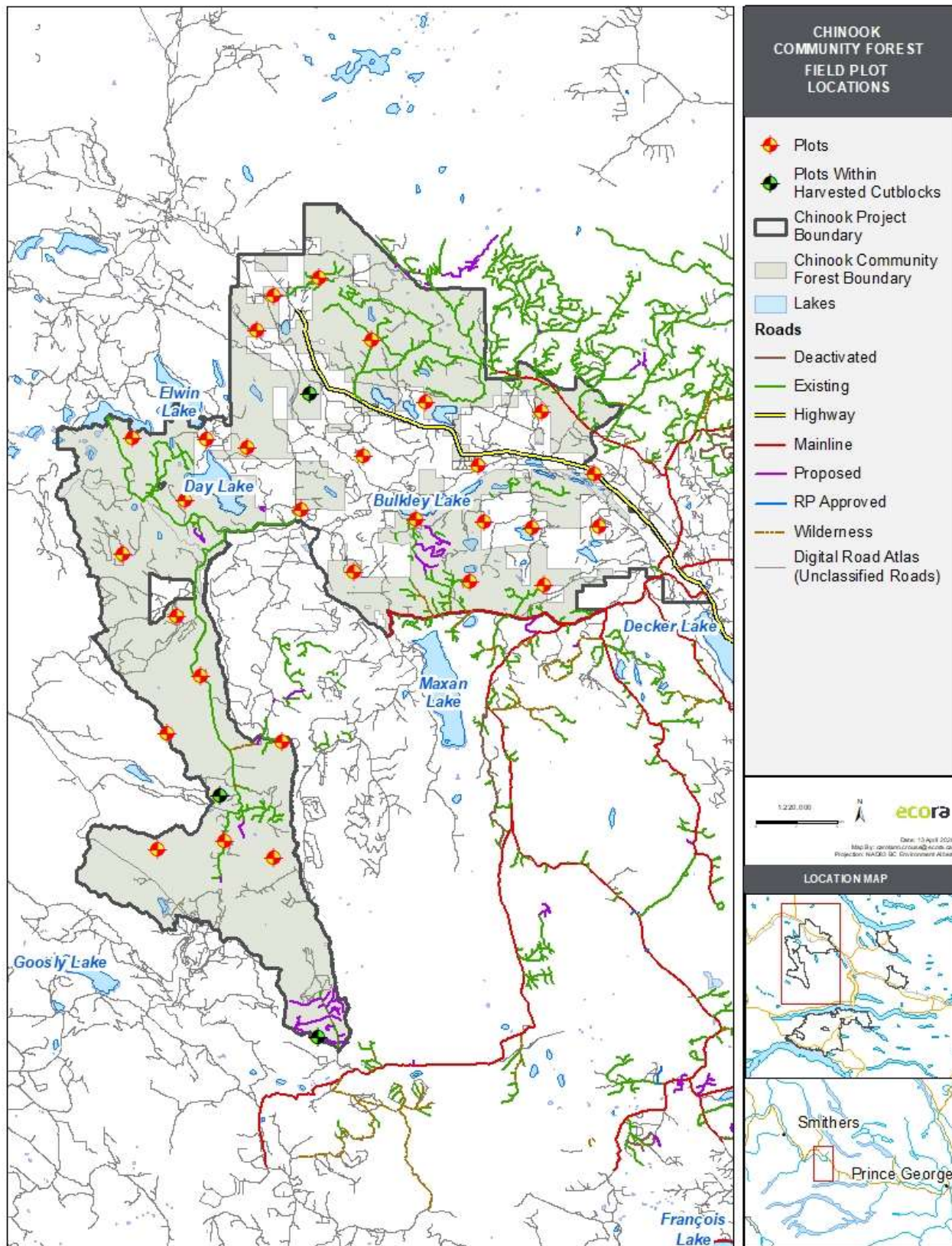
- Details of any liability or other insurance provided with regard to the personnel or the project. The Insurance requirements to work on this project are listed in Schedule D.

## References

- Provide 3 references. References must also be provided for any subconsultants.
- Bidder agrees that Chinook Comfor LP may contact all submitted references to obtain any and all information regarding Bidder's performance.

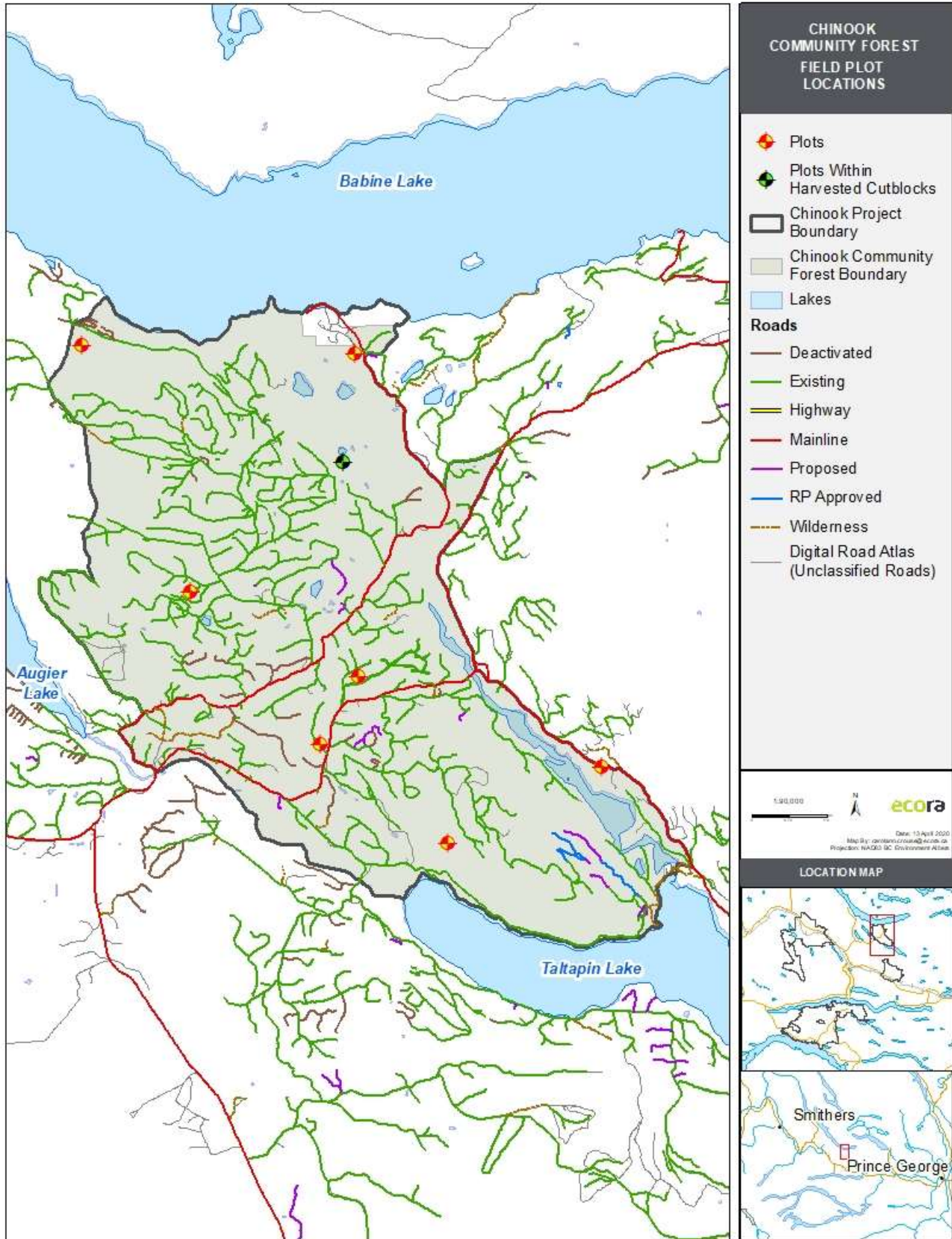


Schedule A – Location Maps (1 of 4)



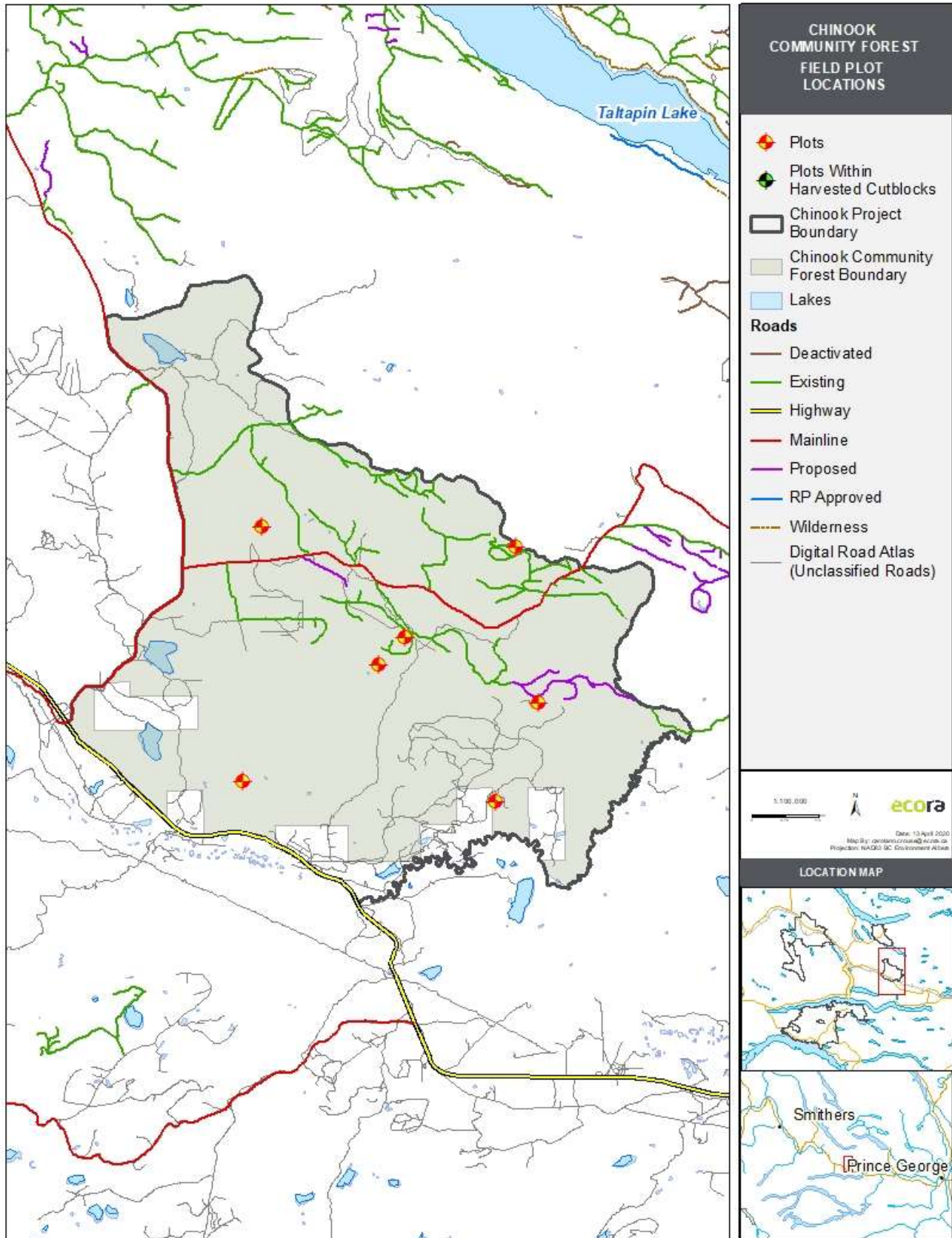


Schedule A – Location Maps (2 of 4)

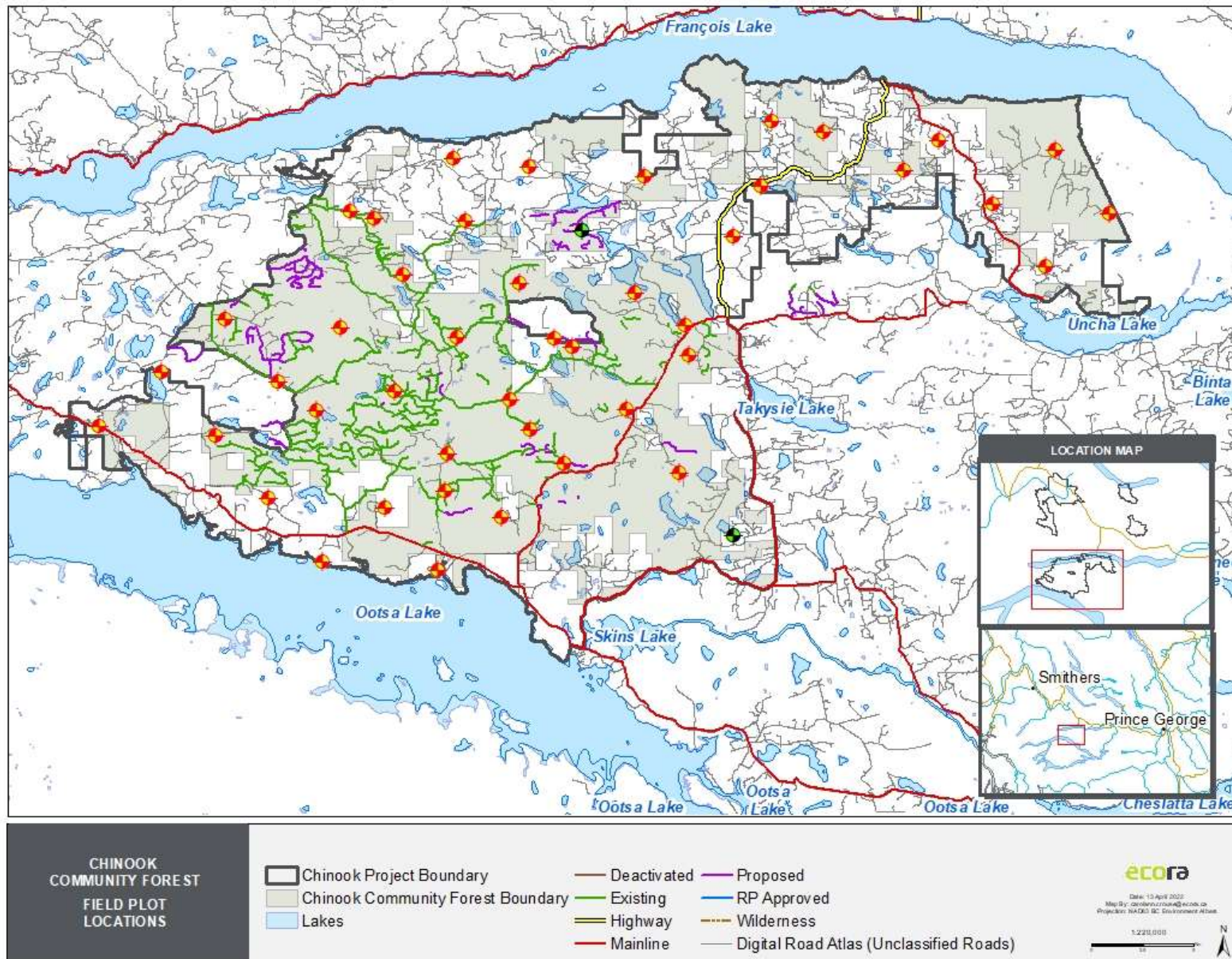




Schedule A – Location Maps (3 of 4)



Schedule A – Location Maps (4 of 4)



*Schedule B – CCForest Permanent Sample Plot Establishment Manual 2021-12-11*

*Schedule C – Camp Standards*

*Schedule D – Insurance Requirements*



# CHINOOK

Community Forest



## Chinook Community Forest Permanent Sample Plot Establishment Manual

Dated: December 08, 2021

Originators  
**ecora**  
**ForesTree Dynamics Ltd**

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## Contributors

This manual has been adapted from the original that was developed by Mosaic Forest Management on Vancouver Island to support their forest inventory initiatives. The protocol draws heavily on the Provincial Change Monitoring Inventory or CMI process.

This protocol was developed by Ian Moss, PhD, RPF of Forestree Dynamics Ltd. located at 619 Goldie Avenue, Victoria, BC.

Processes relating to Coarse Woody Debris were developed by Dave Brown, RPF and Trevor de Zeeuw, FIT of Zimmfor Management Services Ltd.

### Version Control and Revision History

Version	Date	Prepared By	Reviewed By	Notes/Revisions
1.0	14 September 2021	Ian Moss		Chinook Adapted from Mosaic
1.1	08 December 2021	Ian Moss	Dwight Crouse	Responses to Ecora comments

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# 1. Introduction

## 1.1 Background

This manual focusses on plot establishment and measurement for the purpose of initiating a long-term monitoring program for the Chinook Community Forest. In 2019 Chinook completed a forest inventory with the support of Tesera Systems Inc. and in Partnership with Fraser Lake Community Forest and the Stellat'en First Nations (Woodland License) covering approximately 150 thousand hectares. Over the entire area (across all licenses) 86 plots were established on grid to be representative of the Vegetated-Treed population. These are referred to as Population Based Samples (PBS) below. These plots were established with a 10m radius Main Plot with measurement down to a minimum of 4cm dbh, to better account for smaller size trees following from the extensive Mountain Pine Beetle attack starting in 1998 and continuing until 2015 (approximately). While these plots were established with consideration that they might one day become permanent monitoring plots, that decision was to be left for another day. Accordingly, none of the trees were tagged in the process of plot establishment.

Within the context of this plan the focus is converting these plots to permanent monitoring plots, and in so doing extending the plot boundaries to 11.28m radius, maintaining the minimum 4 cm dbh, and tagging trees. It is proposed that the original grid be maintained to track growth and mortality since the last measurement. The other option is to establish completely new plots building on the CMI/NFI grid. The focus is also restricted to only those plots that are within the Chinook Community Forest License area. It is also proposed that the currently established plots start to be remeasured such that all the plots are visited within a 5-year cycle. One technique for doing this is to organize the plots into 5-plot panels such that there is good geographic coverage with each cycle of measurement.

It is also recommended that new plots be established at random using a fixed sampling intensity in areas that are scheduled for harvest. One preharvest measurement is recommended (without tree tagging) to provide a benchmark for changes in long term site productivity. One of the main reasons for this is that grid-based sampling tends to degrade with time with respect to development of young stands that are influenced differentially by many factors, including for example choice of stock types, planting dates, nursery and nursery regimes, seed source, site preparation, and climatic events to name but a few. This decision can be partly offset by abandoning "permanent" plots after they are harvested (with one final measurement just before harvest). This last decision is aimed at trying to maintain a plot count that is more or less constant with time. It is to be noted that this latter endeavor has commonalities with the Provincial Young Stand Monitoring program, albeit it is not strictly tied to the Provincial Grid for reasons that have just been presented. This does not preclude using a grid to select random samples in stands that are scheduled for harvesting in combination with a predefined sampling intensity. (This number is to remain constant with time as is the sample grid intensity.)

Finally, this proposal is designed to underwrite future forest inventory updates that may use a combination of growth and yield forecasting relative to the previous forest inventory, ground plot remeasurements and growth and yield forecasting of those plots that were not remeasured as of the (re)inventory year, along with the use of remote sensing data. Increasingly the focus is on inventory updates that rely on several different sources of information by way of weighting their influence in inverse proportion to their errors of estimation.

This protocol has been extended to include sampling for Coarse Woody Debris (CWD) using the Line Intersect method but is not the central focus of this plan.

Some further explanation for this manual is required. The manual was first developed with reference to only Provincial CMI documents that included descriptions of plot cards. The Province itself uses handheld devices and associated software to manage data collection. When it became apparent that the Provincial system did not include the flexibility needed to obtain the desired information, a decision was made to develop new forms in EXCEL (with pick lists for ease of use and Quality Assurances). These can be deployed on small (7 inch) tablets

in the field. Additional processes have subsequently been developed to extract information from these EXCEL workbooks and put them into a standard tabular format for initial review. After review and if found acceptable the next step is to transfer them into a database format for easy storage and retrieval. The final step is to then compile the data for purposes of underwriting the desired applications. To date, these developments reside outside of the Provincial system.

Note that this manual uses the word “cruising” to refer to plot establishment particularly as it relates to the measurement of trees and “cruiser” as the person(s) doing (and most often trained to do) the work. This manual does not draw on the Provincial Cruise Protocol in any way, including with reference to the recording of tree loss or damage agents. In the original Chinook plot establishment referred to above loss indicators were recorded in a manner consistent with the “Method of Thirds” and so too the data were compiled using the Industrial Forestry Service Cruise Comp software. The protocol herein with respect to damage and loss indicators is consistent with that of the Provincial CMI protocol.<sup>1</sup>

## 1.2 Types of Plots

There are two types of ground plots to be described in this context<sup>2</sup> :

- Population Based Sample (PBS): Those established as being representative of the population of trees in the inventory area of interest.
- Strata Based Samples (SBS): Those established to ensure that there is an adequate number of samples to represent the entire range of variation in stand types and structures. These are primarily designated as temporary plots (without tagging of trees) but they may be made permanent (with the recommendation that the trees are tagged).

Excluded from the PBS are areas of excessively steep ground, or that otherwise fall completely outside of the treed portion of the landscape (e.g., grid points may fall on roads such that no part of the ground plot intersects with a treed portion of the landscape; these kinds of plots will not have tree measurements). These plots will be identified by Sample Plot manager in advance to avoid dispatching crews there.

Plot establishment and measurement protocols are derived from the BC Change Monitoring Inventory (CMI; Version 2.5, March 2018) protocol.<sup>3</sup> The minimum PBS main plot (11.28 m radius) tree diameter may vary starting with inclusion of only those trees greater than 9 cm dbh within an 11.28m radius, or the minimums may be lowered to 7.5 cm dbh or 4 cm dbh. With respect to the 5.64 m radius subplot the minimum is set to 4 cm dbh, and hence is redundant if the minimum corresponds with that of the main plot (other than for selection of site trees).

## 1.3 Plot Establishment Scenarios

The overall goal of this section is to provide some guidance when the establishment of plots at the intended locations does not go as planned and rendering the plots unavailable for either safety reasons (there is no safe way to get to the plot) or for logistical reasons (the plot centre is in a middle of a road or recent clearcut and as a result there are no trees to measure). Perhaps more commonly there will be marginal situations where the decision to establish the plot, or not, is uncertain, for example where part of the plot intersects with a treed portion of the landscape while the remaining portion is non treed. Population Based Samples (PBS) are to be treated differently from Strata Based Samples (SBS) in this case. A couple of scenarios along these lines are presented

<sup>1</sup> See Vegetation Resources Inventory Sample Data Compilation Process, Version 4.1., March 2009.

<sup>2</sup> Note that as much of the material as possible has been retained from the original Mosaic manual to maintain a comprehensive protocol that can be utilized for different purposes.

<sup>3</sup> <https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/ground-sample-inventories/provincial-monitoring/standards>



below to provide some guidance as to what a crew would do in these situations, while ultimately leaving the final decision to the crew's discretion.

### 1.3.1 Population Based Samples (PBS)

The PBS are initially established on a grid for the purpose of being representative of the population of stands throughout the inventory area of interest. The Sample Plot Manager is asked to remove plots (i.e., not send crews to those locations for the purpose of measuring trees) when they are outside of the treed portion of the landscape. However, it is envisioned that some plots will be located such that the Vegetated Treed versus Non-Treed (including Vegetated, Non-Treed, Non-Vegetated Land, and Non-Vegetated-Water land cover classifications) portions of the landscape will occur within plot boundaries. The two options are to abandon the plot (the Integrated Plot Centre or IPC cannot be accessed) or to establish the plot and map out the boundary between the Vegetated Treed and Non-Treed portions of the landcover. There exists a separate, non CMI plot card in EXCEL (VT\_Land\_Cover spreadsheet) to assist with mapping the boundary locations between the Treed and Non-Treed portion of the plot, based on a recording several bearings and distances from the IPC (or potentially from another reference point) to points along the boundary, with the goal of enabling the calculation of area within the Treed portion of the landscape. The PBS IPC locations can never be moved. It is preferred that the plot be measured if the crew has access to the IPC and it has been indicated that the plot should be measured. However, if measuring the plot is not feasible for safety or other reasons, then the plot may be abandoned, and a new SBS may be established within the same vicinity, preferably in the same strata (polygon) as the original PBS plot. This is to be done when the new plot can be reasonably be expected as close approximation of what was observed or likely to have been observed in the original plot. Crews are to be provided with additional SBS plot numbers that they can utilize for this purpose.

### 1.3.2 Strata Based Samples (SBS)

For Strata Based Samples (SBS) if the IPC's are located outside of the Vegetated Treed portion of the landscape then they may be moved. One option is to pick a random bearing that points into the same polygon that was assigned to a given strata, and then move 25 metres in that direction for the purpose of establishing a plot that is reasonably representative. If the area in the non-treed portion of the plot is relatively small, a best option would be to follow the procedure for PBS plots. Ultimately, if none of these options are available then the last option would be to look for establishing another plot preferably close by and in a similar stratum, once again with a chosen access point and a (somewhat) random bearing and distance to an IPC (via a Reference Point) to avoid any particular bias in establishment of the plot locations.

### 1.3.3 Use of Plot Cards

The sampling protocol as described below refers to the original CMI plot cards that have largely been replaced with electronic data entry. Some of the plot cards below indicate the need for diagrams. These diagrams may still be required and can be completed using standard (write-in-the-rain) survey paper along with the following fields:

- Project ID
- Plot Sample #
- Plot Type
- Date
- Crew Initials

## 1.3.4 Coarse Woody Debris

- For areas designated as requiring Coarse Woody Debris estimates the following plot-card information is recommended:
- Header Card
- Compass Card
- Cluster Layout Card
- Inventory Cruising: Tree Details
- Tree Loss Indicators
- Site Tree Heights and Ages
- Stump Card
- Coarse Woody Debris Line Transect

AREAS HIGHLIGHTED IN GREY BELOW MAY BE IGNORED AND/OR HAVE BEEN DROPPED FROM THE PROTOCOL

## 2. Header Card (CH)

Note that there may be extenuating circumstances that make it physically impossible to establish a population-based sample (PBS). Note that every reasonable effort should be made to reach the PBS plots without jeopardizing safety first. If the plot cannot be reached or established at a particular location, crews are asked to complete the Header Card (HC) and the Compass Card (CP) along with a GPS location (for the point that was obtained before abandoning the plot; it does not have to be within +/- 1 m) for that Plot Sample # to explain why the plot could not be established. Subject to approval by the Sample Plot Manager, the crew may be provided with additional SBS plot numbers for a nearby location that is in a stratum similar to the original PBS plot and establish a new SBS plot at that location. The point here is that PBS plot locations cannot be moved under any circumstances.

With respect to SBS plots the crew is generally asked to establish the plot at the identified location. However, if the plot is difficult to reach, the crew may move the location of the plot with the overall objective of remaining in the same or similar strata.

Any new plot location must still be established to within +/- 1m 95% of the time.


With respect to photos of plots, the following items are to be considered:

1. Take a photo generally without a use of a flash.
2. Take a photo of the access point in a way that can assist with relocation.
3. Take a photo of the reference point in a way that can assist with relocation.
4. Take a close-up of the Integrated Plot Centre pin.
5. Take a representative photo of the sample vegetation and structure at IPC.
6. Take a representative photo of the main plot.
7. Take a photo of the forest canopy above the IPC.
8. Take a photo of the soil profile that was described in the soil pit (Note it is often helpful to include a ruler or measuring tape in the pit to indicate scale).
9. Photograph any other outstanding features associated with the establishment of plot(s).


It is preferred that the plot number, date, time (and location) of the photo (and type of photo) can be recorded on the photo at the time when it is taken; otherwise please keep track of the photo numbers, plot locations, and photo type.

Project ID *	ID relating to field crew: Contour (C1), Hatch (H1), and Kerley (K1).
Plot Sample # *	Plot sample number is the operation zone (e.g., CU, AS) and "plot number" (e.g., 46, 69).
Plot Type *	First Letter F = Forest Inventory Population Based Sample (PBS) M = Model (Strata) Based Sample (SBS) Second Letter O = Original R = Remeasurement A = Audit M = Matching Third Letter – measurement number 1 = First Measurement 2 = Second Measurement
Measurement Date	YYYY/MON/DD

Project ID *	ID relating to field crew: Contour (C1), Hatch (H1), and Kerley (K1).
Crew Initials	Person 1 is the crew leader
Sample Tag No.	IPC Plaque: This is typically an Aluminum Tag nailed to a tree indicating sample type (PBS, SBS), Plot Number (Crew ID – Sample ID), Date Established, and “IPC.”
Stand Disturbance	<p>Columns S9 and S10</p> <p>Disturbance Codes Include:</p> <p>NB – Fire (Natural Burn)</p> <p>NW – Windthrow</p> <p>DD – Heartrots (Disease – Decay)</p> <p>DF – Disease-Foliage</p> <p>D – Disease (unknown)</p> <p>IB – Insect Bark Beetles</p> <p>A – Animal</p> <p>L – Logging, thinning, clearing, brushing, and weeding (add details in comments)</p> <p>X – Other known (add details in comments)</p> <p>U – Other (Unknown)</p> <p>O – No significant damage</p> <p>Indicate most significant cause and if two successive causes indicate most recent one.</p>
Field Responsibility	Full first and last name of person responsible for <b>Tree Data</b> and <b>Ecological Data</b>
<b>Plot Cluster Record</b>	
Integrated	Check N(o) if sample was inaccessible or unsafe and explain why in notes; otherwise check Y(es)
N, S, E, W	Check Yes or No for measurement of Trees in 11.28m radius plots in North, South, East, and West Quadrants
Range, Ecological, CWD	Not Required (Optional due to time to collect and cost)
Typical: Trees Ecology	Indicate that these plots have been completed.
Number of Photos	Record number of photos taken (see commentary above). Note cruisers may choose to follow the 2018 CMI manual procedures under section 3.2, Pp. 21 – 23 that are more rigorous than the requirements specified above.
Notes	Enter notes regarding conditions/weather affecting measurements; unusual conditions associated with plot conditions; special details to consider with reference to the photographs; etc.
Access Notes	Complete access notes and sketch map on back of card.



**BRITISH COLUMBIA**



# VEGETATION RESOURCES INVENTORY HEADER CARD (CH)

PAGE	OF
1	1

1

Data ID			PL	PLOT TYPE	Measurement Date			Crew (Initials)														
Project ID	Plot Sample #				Y	E	A	R	M	O	N	D	D	Person #1	Person #2	Person #3	Person #4					
DCKI	28	I	FOI	1	9	9	A	U	G	2	2	J	W	T	A	L	C	J	B	L		

Polygon Identifier														Sample Tag No. (Reference Tree)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14			
														6	7	2

A	Field Responsibility (print)	Field Check By	Date			Office Check By	Date												
			Y	E	A		R	M	O	N	D	D							
Tree Data	John Travers	Mike Smith	1	9	9	A	U	G	2	6	Tom Brown	1	9	9	A	U	G	2	3
Ecological	Alice Curtis	Brian Johnson	1	9	9	A	U	G	2	6	B. Johnson	1	9	9	A	U	G	2	4

**Plot Cluster Record**

(✓) Data Collected (Yes or No)

Y N

Integrated

North

East

South

West

Range

Ecological

CWD

**Typical:**

Trees

Ecology

# of Photos

Notes \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Ground Photos		Yes	No
Plot Pin	PIN.	✓	
Random Azimuth	RAN.	✓	
Representative	REP.	✓	

- sunny and warm.

Consider: Weather, photo notes, procedure problems.

Figure 1 Figure 1 Header Card (CH) Front



Data ID		PL	PLOT TYPE
Project ID	Plot Sample #		
D   C   K   1	1   2   8	I	F   O   1

**CARD CH**

Access Notes (For Example, Start Junction Hwy. 3 & 97, South 2.7 km on Hwy. 3, Turn Right, 10.6 km on East Main Road then Turn Left, etc.)

*Commence at junction of Chilliwack River Bridge on Vedder Road.*

*- east on Chilliwack River road for 26.5 km to second crossing over Chilliwack River.*

*- thence 1.7 km on same road to junction of logging spur road & Chilliwack main road.*

*- Junction of roads is tie point.*

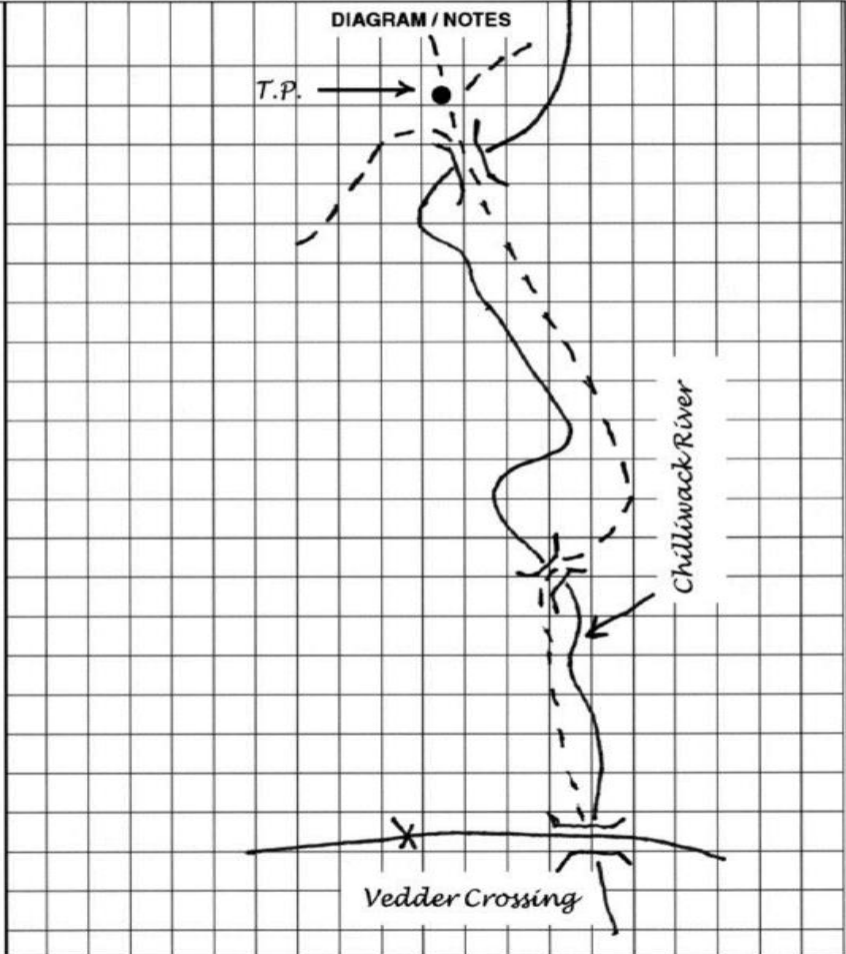


Figure 2 Header Card (CH) Back

### 3. Compass Card (CP)

Project ID *	As per Header Card (CH)
Plot Sample # *	As per Header Card (CH)
Plot Type *	As per Header Card (CH)
Access Point Details	Record the access point details following Chapter 2 of CMI Ground Sampling Procedures 2018 edition (including physical description of the location at the back of the compass card, GPS coordinate of the access point). The access point involves identifying the uncorrected GPS UTM position using a recreation grade GPS. It does not require that a Geo7x GPS file be kept for this location.
Tie Point / Reference Point Details	The reference point is 15 m away from the IPC. Determine the intended Reference Point coordinates and navigate to it. Record distance and bearing to the tie point /reference point from the reference tree, and distances (meters) and offset of reference pin (from reference point) where applicable following Chapter 2 of CMI Ground Sampling Procedures 2018 edition <sup>1</sup> . In some cases, the crew may choose a feature for reference point other than a tree, say a rock (record ROC in the species box) or other (OTH; e.g., telephone pole; hydro tower) and specify the feature in the comments section.
Straight Line Bearing and Distance to IPC	Record the appropriate azimuth and distance for the straight line bearing and distance from the reference point to IPC (IPC GPS point offset) following Chapter 2 of CMI Ground Sampling Procedures 2018 edition <sup>1</sup> .
Comments	Record any special features of all the tree tie/reference points. Record other features of the tie point. If there is no tie point tree describe the tie point (e.g., junction of Loss Creek Main Branch 300; northeast corner of Cutblock 11 on Branch 302; northeasterly edge of snow slide track).
GPS File ID	Record GPS Tie Point ( <b>Plot Centre</b> ) File ID and offset from Tie Point ( <b>Plot Centre</b> ); Two GPS files are required: the Reference Point GPS file and the IPC GPS file.

<sup>1</sup> No need to place a steel or iron bolt in the end of a plot center pin.

Note that GPS File ID associated with the plot centre is accommodated using the Vegetated Resources Inventory Cluster Layout (CL) Card.

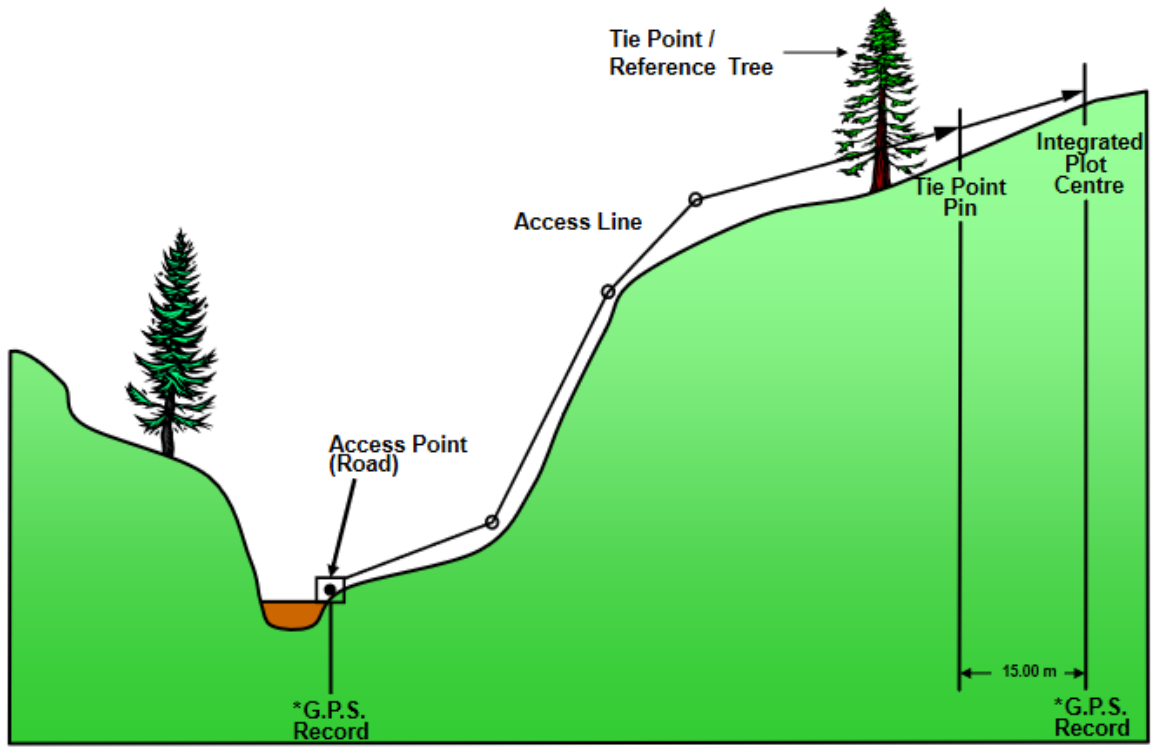




Figure 3 Components of Field Orientation and Navigation



**BRITISH COLUMBIA**



## VEGETATION RESOURCES INVENTORY COMPASS CARD (CP)

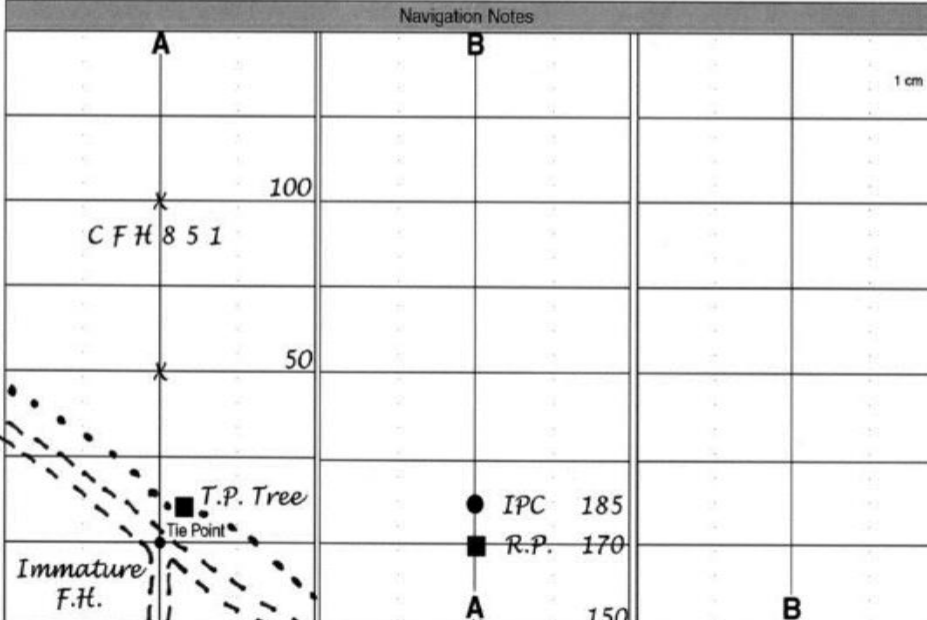
PAGE	OF
1	1

2

Data ID		PL	PLOT TYPE	Map No.	Polygon No.	Flight Line	Photo No.
Project ID	Plot Sample #						
D <sub>1</sub> C <sub>1</sub> K <sub>1</sub> I	28	I	F <sub>1</sub> O <sub>1</sub> I	9,2 H 0,0,3	4	3,0 B C B 9,3,0,2,6	1,4,8
Integrated Plot Centre				9,2 H 0,0,3	4	3,0 B C B 9,3,0,2,6	1,4,8

Tie Point Reference Details X (Tie Point)		15 m Reference Point Tree details X (Reference Pin)		Offset Reference Pin	
Species	Diameter (cm)	Species	Diameter (cm)	Azimuth (0 - 359°) from pin to ref. point	
F, D, C	2, 6, 2	C, W, 1	3, 1, 6		
Azimuth Tree to Tie Point	Distance (m)	Azimuth Tree to R. pin	Distance (m)	Distance (metres)	
1, 9, 6	1, 7, 2, 5	1, 7, 6	1, 3, 7	0, 0, 0	

Straight Line Bearing and Distance to I.P.C.				Tie Point Tag No.	
Azimuth (0 - 359°)	Distance to Integrated Plot	Declination used	Scale of Sketch 1 cm =		
2, 8, 8	1, 8, 5 m	1, 9, 5°	2, 5 m	7, 6, 1	

Navigation Notes		
<p><b>A</b></p>  <p style="text-align: right;">1 cm</p>	<p><b>B</b></p> <p>● IPC 185</p> <p>■ R.P. 170</p> <p>● A 150</p> <p>● B</p>	<p>Comments <i>centre line of two roads is tie point.</i></p>

G.P.S. Tie Point	
File I.D.	F 0 8   1 9   1 8   A
UTM Zone	
Corrected UTM (NAD 83)	
Northing	
Easting	
Elevation	
Offset G.P.S. Location	
Azimuth (0 - 359°) From Point to Tie Point	
Distance (metres)	
Access Point Location	
Descrip.	
G.P.S. Access Point	
File I.D.	
Corrected UTM (NAD 83)	
Northing	
Easting	
Elevation	

FS 505N HRI 99/3

Figure 4 Compass Card (CP) Front

Data ID		PL	PLOT TYPE
Project ID	Plot Sample #		
D <sub>1</sub> C <sub>1</sub> K <sub>1</sub> I	1 2 8	I	F <sub>0</sub> I

**CARD CP**

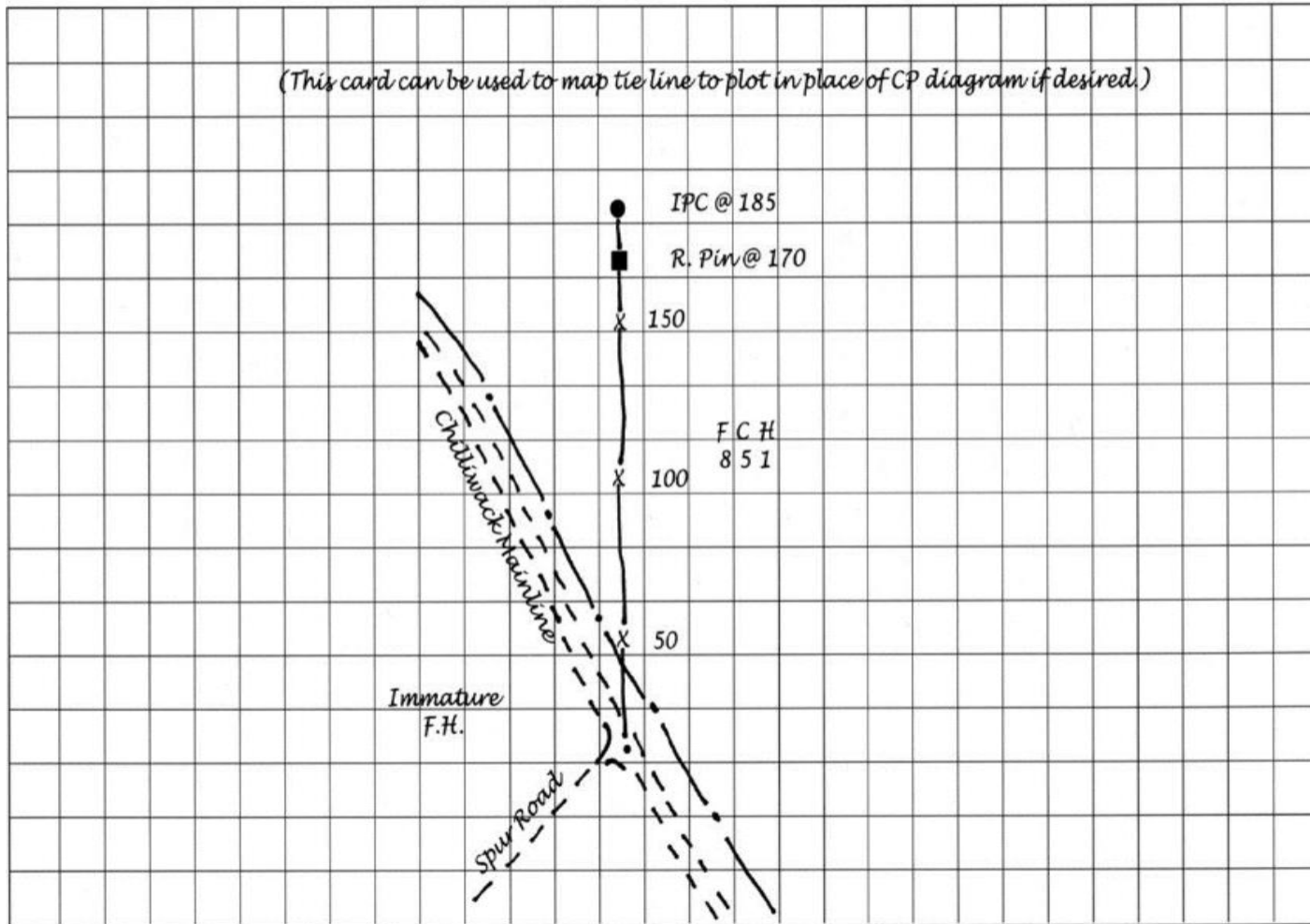


Figure 5 Compass Card (CP) Back



## 4. Cluster Layout Card (CL)

Project ID *	As per Header Card (CH)
Plot Sample # *	As per Header Card (CH)
Plot Type *	As per Header Card (CH)
GPS (Integrated) Plot Centre	Record the file number in the GPS Integrated Plot Centre field. Record the GPS reading (see GPS positioning procedure in Section 5 for detail). A GPS reading with reference to the plot center is required with precision levels of +/- 1 m 95% of the time. <b>This standard also applies with respect to any audit where the original plot-based GPS coordinates are within +/- 1m of the Auditor's GPS coordinates (assuming that the Auditor GPS coordinates also meet or exceed the +/- 1m standard 95% of the time).</b>
Slope Profile	Sketch the cross section including (integrated) Plot Centre that best describes the local topography.
Integrated Plot Details	Map distinctive features within the plot such as water bodies, rock outcrops, site series boundaries, BC Land Cover Classification boundaries.
Sample Cluster Details	Map distinctive features within the sample area that may aid in plot relocation, such as creek locations, road locations, etc. Map the reference pin location and the tie point location if close to (integrated) Plot Centre.
Back of Card Comments	Record the targeted UTM coordinates in the comments section on the back of the CL Card. This may already be accommodated in the digital data entry system. Record any comments that may aid in relocation of the plot or other items of interest.

## VEGETATION RESOURCES INVENTORY CLUSTER LAYOUT (CL)

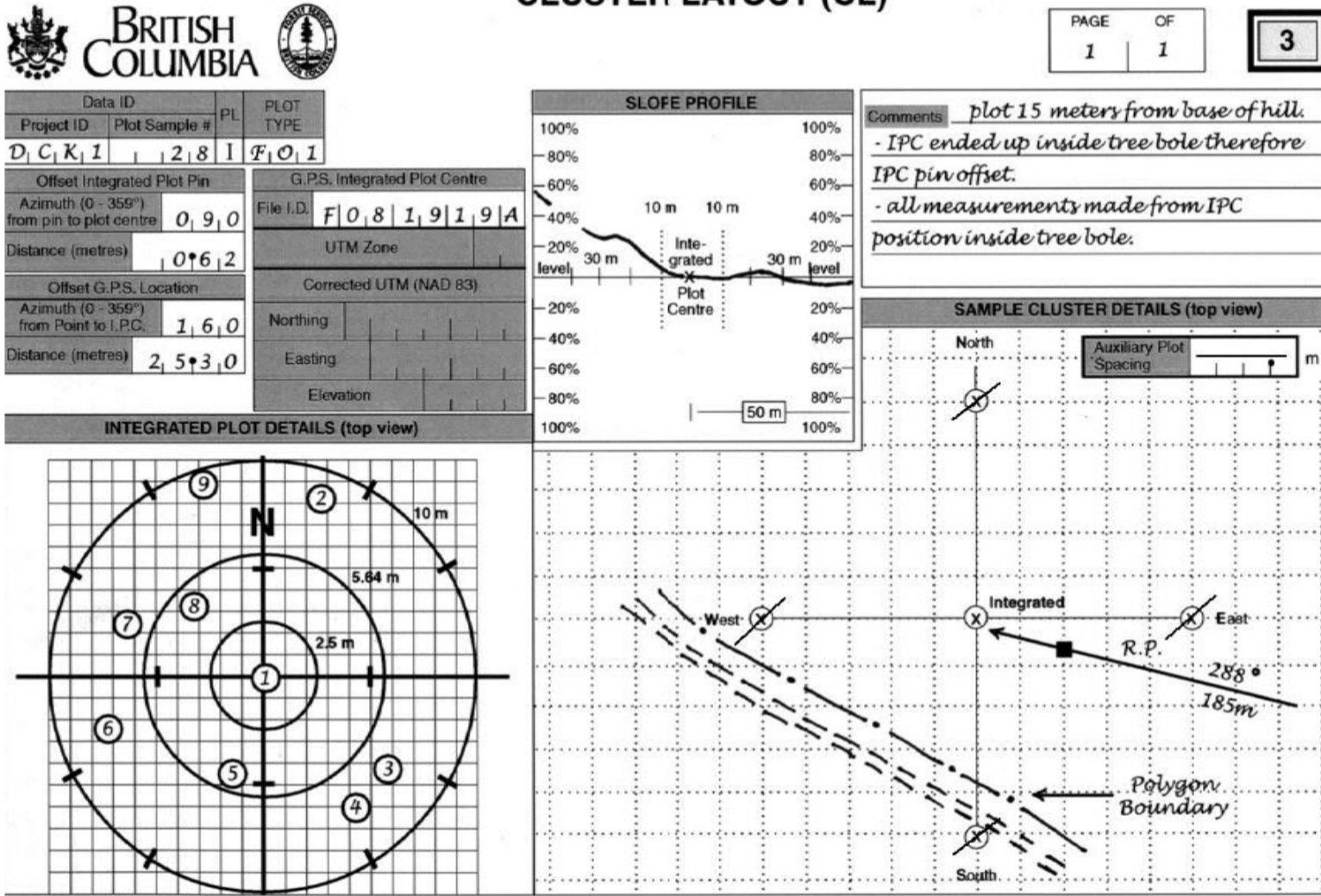


Figure 6 Cluster Layout Card (CL) Front



## 5. GPS Positioning Procedure at the IPC

### 5.1 Equipment

Trimble Geo 7X handheld with Terrasync and Rangefinder (H-Star, Floodlight, NMEA), Trimble Tornado antenna or similar equipment with the same or better capabilities/accuracy as below.

### 5.2 GPS Receiver Settings

The Trimble Geo7X receiver can be configured several ways to modify potential productivity and accuracy. The follow settings were used to maximize feature accuracy while maintain a reasonable degree of productivity.

#### Logging Settings – Accuracy Settings

- Use Accuracy-based Logging                      Yes
- Accuracy Settings                                      1m – Horizontal – Postprocessed

#### GNSS Settings

- GNSS Receiver Port                                      COM3: CNSS Serial Port
- Use SMART Settings:                                      Yes
- NMEA Output    On

#### Real-time Settings

Use uncorrected GNSS

In difficult areas with limited reception, the following progressive procedure will be used:

- Attempt capturing data using 1 m accuracy-based logging for 5 minutes.
- If unsuccessful, reduce the accuracy-based logging to 2m and attempt seeking position fixes for another 10 minutes.
- If still unsuccessful, turn off the accuracy-based logging and collect 1,200 position fixes.

### 5.3 Collection Process

At the access point, collect GPS reading using recreational GPS.

At both the reference point and IPC:

- Collect 5 minutes of GPS data at reference point
- Collect 15 minutes of GPS data at IPC (or up to 900 fixes)
- When GPS data cannot be collected at the plot center, move to an area where data can be collected (such as an opening): navigate to a location with an even distance (5/10/15/20m) and cardinal direction (north/south/east/west) of the pre-determined Plot Center. Measure the distance and bearing from the point where data was collected back to the IPC. Record these measurements in the appropriate section on the Cluster Layout card.
- Turn the trail tracing function on to record the path to reference point.

## 5.4 Post-Correction

If the contractors prefer, the Sample Plot Manager will handle the post-correction with Pathfinder software with the appropriate (Cansel) network of base stations.

## 5.5 Application

The general procedure for use of this equipment is as follows. Start at a recognizable access point usually from a road, albeit this may not be the case when using helicopter access. Run a straight line, if possible, toward the IPC (Integrated Plot Centre) stopping at the Reference Point located 15m way from the IPC. Check the location using the Trimble Geo7X to locate the Reference Point 15m from the (known location of the) IPC along the straight line bearing from the original Access Point. Establish and mark the location of the Reference Point (using an iron pin, with a bearing and distance to a reference tree). Collect a resource grade GPS file at the reference point. The GPS should be SBAS ENABLED unless collecting resource grade GPS using the Trimble Geo7X referred to above, in which case the smart setting is recommended for use.

Use an Elson or logger's tape (not a Vertex) to measure the intervening 15m to the IPC along the indicated bearing to that point. When arriving at that point mark the IPC with a metal pin; provide a stem map (bearing and distance) to three of the largest diameter trees within close proximity of the centre. Place the Trimble Geo7X directly above the plot centre and record the GPS (SBAS disabled) at the IPC subject to post processing. Follow the instructions above with respect to "difficult areas."

There may be conditions where a straight-line bearing from the access point, through the reference point to the IPC is difficult to achieve. In general, the use of a recreational grade GPS can be used to get you close to the reference point (GPS Coordinates), at which point the Trimble Geo7X can be used to better define where the "exact" point is located based on calculated reference point coordinates. Once located, the goal is to obtain a reasonably reliable indication of where the point is, along with bearings and distances to reference trees to help ensure that the point can be relocated at a later date. The use of the Elson or loggers' tape is recommended instead of the vertex, in particular for traversing the distance from the Reference point to that of the IPC, but also for checking as to whether borderline trees are in or out of the plot. Lastly it is most critical that the IPC be located with a precision of  $< \pm 1\text{m}$  95% of the time.

The IPC (and associated plot boundary location) data collected in this project are to be co-registered (aligned) with that of the LiDAR and Colour Infrared (CIR) data that are also being collected in the 2022 field season. When the error of co-registration increases beyond the  $\pm 1\text{m}$  95% of the time the errors of estimation associated with forest attributes (e.g., heights, volumes, basal areas, etc.) start to also increase significantly based on previous studies. In this context the IPC and the plot boundaries are to be established using the best instruments and procedures available to complete the process with the highest degree of accuracy. At the end of this program Chinook would like to make the following claim: "The plot locations were all found to be accurate within  $\pm 1\text{m}$  95% of the time," using a Trimble Geo 7X handheld with Terrasync and Rangefinder (H-Star, Floodlight, NMEA), Trimble Tornado antenna.



## 6. Inventory Cruising: Tree Details (TD)

See the CMI Ground Sampling Procedures (Version 2.5; March 2018) Pp. 17 to 23 for detailed procedures for plot establishment. Figure 3.2 (reproduced below) is also provided herein with a summary of the establishment of plot for measuring trees.

At the time of establishment, the chief cruiser will determine the minimum diameter limit associated with the main (11.28m radius) plot. The minimum diameter is to be 4cm, 7.5cm, or 9 cm dbh.<sup>4</sup> The minimum diameter associated with the 5.64m radius plot is 4cm; this plot does not apply if the minimum diameter of 4cm is used in association with the main plot, but otherwise does apply and includes all trees below the minimum diameter established for the main plot.<sup>5</sup>

The small tree plot (2.52m in radius) will apply if there are trees in the Intermediate or larger crown classes that are < 4 cm dbh (see Table 5 for crown class definitions below).

The following guidelines are to be applied in determining the minimum diameter for the main plot:

The intent of assigning a variable minimum DBH within the 11.28m radius plot is to capture as much information (data) as a possible at each plot location with 1 (one) day of work.

The default minimum diameter for the main plot is 9 cm dbh. If there are less than 100 trees in the (main) plot the minimum diameter should be reduced to either 7.5 cm or 4 cm dbh if the resultant number of trees in the main plot is less than or equal to 125 trees per plot. If there are < 20 trees in the main plot, the minimum diameter should be reduced regardless of the resultant number of trees. The remaining trees that are above 4 cm dbh and below the main plot minimum, are to be measured within the 5.64m radius plot. If the 4cm minimum dbh measurement limit was used for the main plot, then no additional trees need to be measured in the 5.64m radius plot). The small tree plot (2.52m in radius) will apply only if there are trees in the Intermediate or larger size classes that are < 4 cm dbh.

Crews should follow the procedures outlined above. If it is clear (in young dense stands) that the only way to measure any trees is to drop to 4cm dbh but dropping to 4cm will also yield an unreasonable number of trees in the main plot (i.e., well over 100), then the main plot size can be reduced to 5.64m radius.

If the main plot size is reduced, ensure that this is recorded correctly on the plot card and the Sample Plot Manager is notified immediately of the plot size change.

Project ID *	As per Header Card (CH)
Plot Sample # *	As per Header Card (CH)
Plot Type *	As per Header Card (CH)
PLOT TYPE (VARIABLE or FIXED)	Plot Radius <b>11.28m</b> . Plots will generally be <b>FULL</b> . There may be circumstances where the plot is split across a land cover class (Level 4 for Treed Areas; No Walkthrough as per YSM). In these circumstances the decision to use a half or quarter plot depends on whether the plot centre is inside or outside the forested area. If the latter (outside) then the boundary separating the treed area should be carefully mapped out on the Cluster Layout (CL) card so that the proportion of area inside the treed part of the plot (up to the dripline) can be estimated. Note that this area can/will also be checked using LiDAR and imagery data.
Tree Number (+Sector Number)	Enter the tree number (same as tag number) and sector number (RHS of card; S1; column 55)
Tree Species	Assign a valid BC Species Code. (See Appendix A).
Live/Dead	Enter L or D
Standing/Fallen	Enter S (tree is self-supporting) or F (tree is not self-supporting)
DBH	Enter DBH (in cm to 1 decimal point) from High Side of contact with ground (see Pp. 37 and 38 of the CMI Manual for examples).

<sup>4</sup> Note that the Sample Plot Manager may alter the minimum diameter specifications as required for any given program.

<sup>5</sup> Note that the 5.64m radius plot does apply for the purpose of selecting Top Height trees as described below.

M or E (DBH)	Enter M (measured) or E (estimated) DBH. The latter may occur when it is not possible to produce a measurement using a diameter tape at 1.3m above the high side of contact with the ground.
Tree length	Measure the length of the tree starting from 1.3m to the top of the tree (and include 1.3m in the total). If the tree is "Standing" and there is a dead or broken top estimate the diameter diameter (cm) at the break or the height to the original height of the tree had the break not occurred.
M or E (Tree Length)	The tree is to be measured unless (1) the top of the tree is difficult to find; or (2) the entire tree has a severe lean/sweep/bend then the length is to be estimated. Trees that have a broken top must have either the top diameter estimated (columns 50 to 52) or what would be the incremental distance (projected height; columns 53 and 54) to the top of the tree.
Crown Class Codes	<b>D</b> (ominant); <b>C</b> (odominant); <b>I</b> (ntermediate); <b>S</b> (uppressed); A dash (-) if tree is dead. Note that the tree may also be declared as a <b>R</b> (esidual) tree (in the S2 Column; Column number 56) from the previous stand if it is of an older age and there are fewer than 25 per hectare.
Height to Live Crown	Distance along the bole from the high side ground level to the crown base (located where live branches occupy ¾ or more of the stem circumference). Two dashes (- -) if tree is dead.
Tree Details – Back of Card	This portion of the card is to assist in the field and is intended as an aid to producing the information on the front of the card.

## 7. Crown Class Definitions

Code	Description
D	<p><b>Dominant</b></p> <p>Trees with crowns that extend above the general level of the crown canopy (may include trees, shrubs or other obstructions) immediately around the measured trees. They are somewhat taller than the codominant trees and have well-developed crowns, which may be somewhat crowded on the sides, receiving full light from above and partly from the side.</p>
C	<p><b>Codominant</b></p> <p>Trees with crowns forming the general level of the crown canopy (may include trees, shrubs or other obstructions) immediately around measured trees. The crown is generally smaller than those of dominant trees and is usually more crowded on the sides, receiving full light from above and little from the sides.</p>
I	<p><b>Intermediate</b></p> <p>Trees with crowns below but extending into the general level of the canopy (may include trees, shrubs, or other obstructions) immediately around the measured trees. The crowns are generally small and quite crowded on the sides, receiving little direct light from above but none on the sides.</p>
S	<p><b>Suppressed</b></p> <p>Trees with crowns entirely below the general level of the canopy (may include trees, shrubs, or other obstructions) around the measured trees. The crowns are usually small and quite crowded on the sides, receiving little direct light from above but none from the sides.</p>



Figure 8 Crown class examples.

Source: <https://openoregon.pressbooks.pub/forestmeasurements/chapter/5-3-crown-classes/>

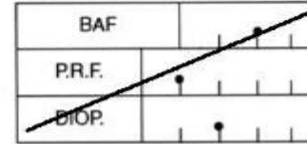




Data ID		PL	PLOT TYPE
Project ID	Plot Sample #		
D1	C1	K1	I1
		2	8
		I	F1
		O	I

# WORKSHEET

**Data Will not Be Keypunched**  
**BORDERLINE TREE & TREE LENGTH CALCULATIONS**  
**IN/OUT Trees For Audit Are Measured To Tree Face**



**CARD TD**

\* Center or Face

TREE NO.	DBH (cm)	1/2 DBH (cm)	SLOPE DISTANCE (m)	C/F*	% SLOPE	HORIZ. DIST. (m)	CRITICAL DIST. OR DIAMETER	G/F	I/O	+/-	TOP %	+/-	BTM %	TOTAL %	COR	LENGTH (m)
<i>This area is for the convenience of the field crew ONLY and may or may not be used by the field crew. The data on the TD card is the final data entered for the sample.</i>																
<i>Below are some suggestions for using this work area.</i>																
6			36.0				Top			+	82	-	12	94	1.3	35.1
6							CRK			+	71	-	12	83	1.3	31.2
5			27.2				BRK Top			+	27	-	31	58	0.0	15.8

Diagrams / Notes																
<i>- sketch any unusual trees or make comments as appropriate.</i>																

LEADING SPECIES CALCULATION (Live trees only)				
PLOT	SPECIES			
I				
N				
E				
S				
W				
Total **				

\*\* Note: 1/2 and 1/4 plots multiple by 2 or 4 respectively

Figure 10 Tree Details Card (TD) Back



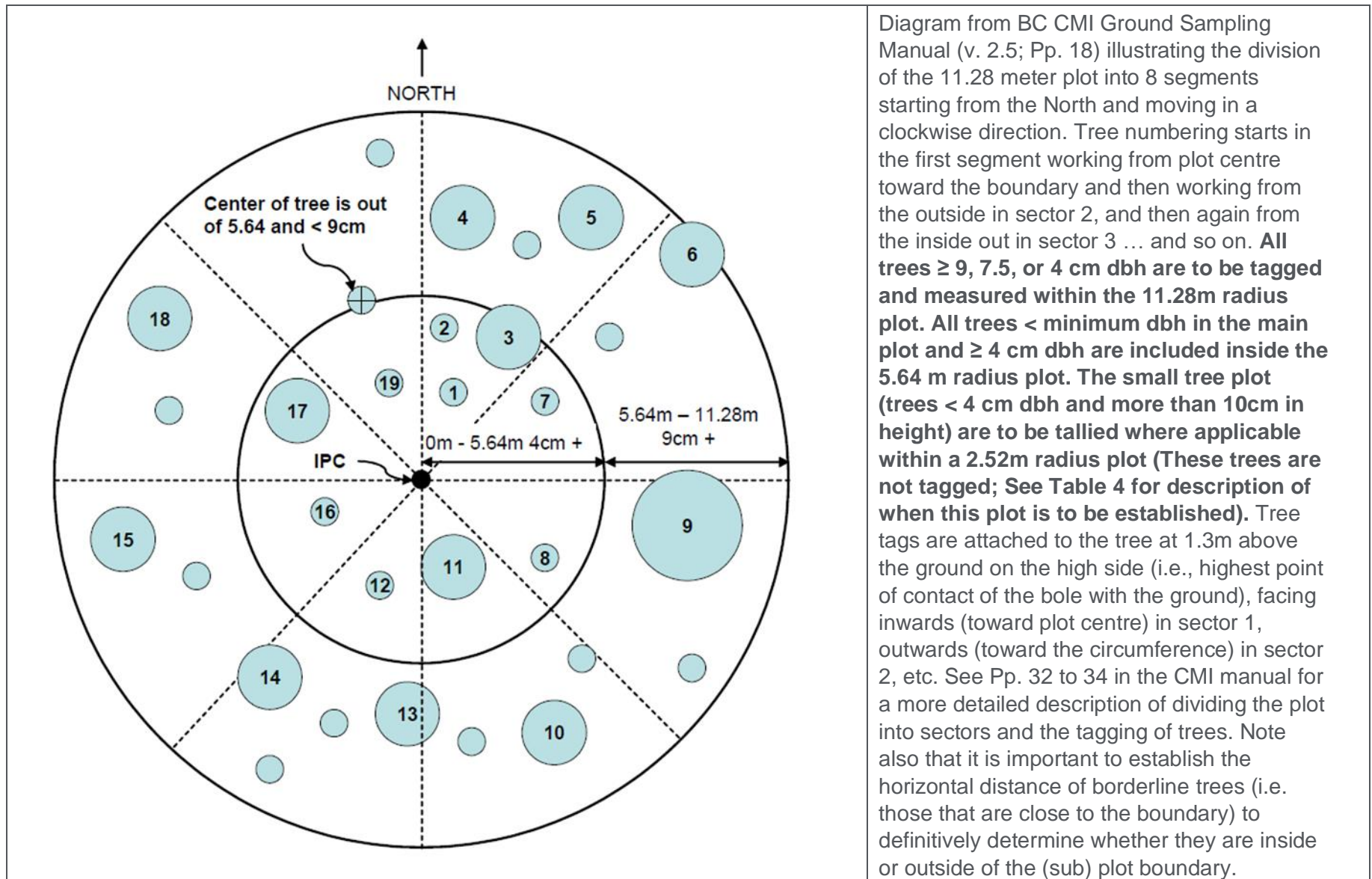


Figure 11 5.64 m and 11.28 m fixed-radius plot layout example

## 8. Tree Loss Indicators Card (TL)

This card is to be completed for the population-based samples (PBS), and not the strata-based samples (SBS); the latter being temporary plots.

Project ID *	As per Header Card (CH)
Plot Sample # *	As per Header Card (CH)
Plot Type *	As per Header Card (CH)
Tree Number	As per Tree Details Card (TD)
Damage Agent Code <sup>1</sup>	See footnote (See Appendix B)
Severity <sup>2</sup>	See footnote
Loss Indicator Code	DD_ (Unknown stem decay; enter first letter of Genera if known instead of “_”); DR_ (unknown root decay); BNK (Blind Conk); NGC (frost Crack); SCA (Scar); FRK (Fork); CRO (crook); LRB (Large Rotten Branch); DTP (Dead Top); BTP (Broken Top); SNG (Sounding); OTH (cause is known but not appropriate code); DIR (Decay or missing wood without cause).
Location <sup>3</sup>	<b>Measure</b> the position of each loss indicator on the stem of each numbered tree from ground level on the highest side of the tree to the nearest 0.1m. Record the lower and upper extents as “From” – “To”. If the indicator is a point feature such as a singular conk, record the location once under the “From” column with a frequency of “1.” If the indicator occurs more than once and is best described as a series, record the frequency as the number of times the loss indicator occurred in a particular interval. If there are more than 9 occurrences; enter 9. If necessary (a lot of different indicators) use multiple lines for a single tree.
Stem Mapping	This is required for the confirmed site trees and would be useful for any reference trees that would be useful in confirming ground plot locations within the context of the imagery. Three (3) tagged trees close to the plot pin should also be stem mapped for relocation purposes. Otherwise, it is not required.
Azimuth to Tree	Bearing in degrees
Distance to tree Face	Horizontal distance to centre of tree (at point of germination)

1. Pp. 50 to 56 in Change Monitoring Inventory Ground Sampling Procedures (Version 2.5, March 2018) and Appendix D in Change Monitoring Inventory Appendices to Ground Sampling Procedures (Version 2.4; March 2018; Pp. 49-54).  
<https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/ground-sample-inventories/provincial-monitoring/standards>
2. Damage Severity Codes: Appendix D in Change Monitoring Inventory Appendices to Ground Sampling Procedures (Version 2.4; March 2018; Pp. 55-56).
3. Section 4.5 (Assessing Tree Loss Indicators), Pp. 50 to 56 in Change Monitoring Inventory Ground Sampling Procedures (Version 2.5, March 2018).



## 9. Small Tree, Stump, and Site Tree Tally

### 9.1 Small Tree Plots

The small tree tally should be completed on all the PBS (as opposed to SBS-based) samples using a 2.52m radius plot when the dominant-codominant and/or intermediate tree layer (1) includes trees less than 4cm dbh, or (2) in otherwise young stands where most of the trees are less than 4 cm dbh and greater than 10 cm in height. For reference purposes this plot size produces a per hectare multiplier for each tree of approximately 500 trees per hectare.

Project ID *	As per Header Card (CH)
Plot Sample # *	As per Header Card (CH)
Plot Type *	As per Header Card (CH)
Fixed Small Tree Plot	
Plot Radius	2.52 m
Plot	<p>Full, Half, or Quarter and Split?</p> <p>Crews may choose to split the 2.52m radius plot along cardinal directions if there are a large number of seedlings to be tallied. As a rough guideline when there are more than 50 stems in the small tree category this procedure may be invoked. The following procedure is to be used (Following the March 2017 VRI Ground Sampling Procedures):</p> <ol style="list-style-type: none"> <li>1. If the preliminary estimate of trees is &gt; 50 for the plot as a whole, then:             <ol style="list-style-type: none"> <li>1.1. If plot number EVEN measure EAST half;</li> <li>1.2. Otherwise, ODD; measure WEST half.</li> </ol> <p>Place an X in the HALF box and an X in the SPLIT box if the tree count is ≤ 50; otherwise go to 2:</p> </li> <li>2. If the half plot tree count &gt; 50 then:             <ol style="list-style-type: none"> <li>2.1. If plot number EVEN measure NE quadrant.</li> <li>2.2. Otherwise, ODD; measure SW quadrant.</li> </ol> <p>Place an X in the Quarter (QRTR) box and an X in the SPLIT box.</p> </li> </ol>
Small Live Tree	Tally the number of trees in the 2.52m radius plot by species and size class (10 to 29 cm in height; 30 cm to 1.3m in height; > 1.3m in height and < 4 cm dbh).

### 9.2 Sample or Site Trees

Sample trees are to be measured on all plots using a central 5.64m radius for selection of top height trees (Type = T), using the 11.28m radius quadrats for leading species (Type = L), secondary species (Type = S > 20% of the basal area) and other species (Type = O > 20% of the basal area).

See Appendix C for the definition of what constitutes a suitable site tree. The following lays out the general intent of identifying suitable Top Height and Site Trees.

1. If the largest diameter tree in the dominant and codominant layer in the 5.64m radius plot is not deemed suitable as a Top Height tree (of any species) due to either defect or obvious suppression, then there is no Top Height tree.

2. Site trees associated with each of the first two species are to be identified in each quadrant. The same rules as described in 1 above apply to the selection of site trees in each of the quadrants, i.e. If the largest diameter tree associated with the primary and/or secondary species in the dominant and codominant layer in a given quadrant is not deemed suitable as site tree due to either defect or obvious suppression, then there is (are) no site tree(s) in that quadrant.

The procedures below do not specifically identify trees that were selected as candidate site trees but then rejected as be unsuitable due to either defect or suppression.

See Pp. 57 to 69 in Change Monitoring Inventory Ground Sampling Procedures (Version 2.5, March 2018): <https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/ground-sample-inventories/provincial-monitoring/standards>

**AREAS HIGHLIGHTED IN GREY ARE EXCLUDED FROM PROTOCOL**

Project ID *	As per Header Card (CH)
Plot Sample # *	As per Header Card (CH)
Plot Type *	As per Header Card (CH)
Small Live Tree	Tally the number of trees in the 2.52m radius plot by species and size class (10 to 29 cm in height; 30 cm to 1.3m in height; > 1.3m in height and < 4 cm dbh). This is only required when trees in one or more of these size classes may be considered in the dominant, codominant, or intermediate crown classes, i.e., in young stands.
Sample Tree Height and Age	Separate Field Cards are used for each quadrant. Note that sample trees should not have major defects such as significant broken top; significant dead top; fork or crook that has affected height growth or any other feature that indicates that the resultant heights and ages are not indicative of the height growth potential of a tree species on a given site. Be sure to indicate whether the selected sample tree has a suitable height (S/H) for estimating site index (Y/N). See figure 12. If the largest diameter tree associated with a given species is identified as being unsuitable, the next best alternative may be selected (see Appendix C).
Plot Type 5.64	Identify the Top Height (largest diameter tree) tree (Type = T) in the dominant/codominant tree layer and record the tree number, height, age, and growth information. After completing field age counts put the core in a straw container with a suitable label to complete an age assessment using a microscope in the office.
Plot Type Quad (Leading Species)	In each quadrant identify the Leading Species (largest diameter tree) tree (Type = L) in the dominant/codominant tree layer and record the tree number, height, age, bark thickness, and growth information. After completing field age counts put the core in a straw container with a suitable label to complete an age assessment using a microscope in the office.
Plot Type Quad (Secondary Species)	In each quadrant identify the Secondary Species (largest diameter tree; basal area > 20%) tree (Type = S) in the dominant/codominant tree layer and record the tree number, height, age, bark thickness, and growth information. After completing field age counts put the core in a straw container with a suitable label to complete an age assessment using a microscope in the office.
Plot Type Quad (Other Species)	In each quadrant identify the Other Major Species (largest diameter tree; basal area > 20%) tree (Type = O) in the dominant/codominant tree layer and record the tree number, height, age, bark thickness, and growth information. After completing field age counts put the core in a straw container with a suitable label to complete an age assessment using a microscope in the office.
11.28m Residual Tree	In the main plot identify a representative Residual tree (Type = V) and record the tree number, height, age, bark thickness, and growth information. After completing field age counts put the core in a straw container with a suitable label to complete an age assessment using a microscope in the office.
Non-standard tree <sup>1</sup>	Identify a representative tree (Type = X) either inside or outside of the plot if there are problems with selecting trees inside the plot as per above recommendations; record the tree number, height, age, bark thickness, and growth information. After completing field age counts put the core in a straw container with a suitable label to complete an age assessment using a microscope in the office.

3. Sample tree coding has been replaced with the use of “Mode” coding (pers. comm. Peter Hatch, Hatch Woodlands, April 22, 2021). This needs to be further clarified.




## 10. Height and Age Details

All individual trees are measured to determine height +/- an adjustment for dead and broken tops (see section 6, Inventory Cruising: Tree Details above). Top Height and Site trees are measured to determine age and height for the major species by basal area in the sample for the purpose of estimating site index. These trees must be classified as being suitable for this purpose or otherwise indicated as being unsuitable based on the criteria provided in Appendix C.

See the CMI Ground Sampling Procedures (Version 2.5; March 2018) Pp. 60 to 69 for detailed procedures. Only "Suitable" Top Height and Site Trees are to be cored for the purpose of counting ages. Trees may be identified as being unsuitable after they have been cored if there are clear zones of suppression followed by release in the increment core.

Project ID	As per Header Card (CH)
Plot Sample #	As per Header Card (CH)
Plot Type	As per Header Card (CH)
Tree No	As per Tree Details Card (TD)
Type	T = top height tree, L = leading species, S = secondary species, O = other major species, V = residual tree, X = additional tree (outside of plot)
Species	Tree species code
Crown Class	<b>D</b> (ominant), <b>C</b> (odominant), <b>I</b> (ntermediate), <b>S</b> (uppressed), <b>O</b> (ther) if the tree is dead or outside of the plot.
Boring (OB) Diameter (cm)	Diameter outside bark at location of increment boring. The cruiser may select any side of the tree for extracting the core. There is NO requirement that the core be extracted from the side that faces the IPC.
Tree Length (m)	Measured length of the tree to 0.1m
Bark Thickness (mm)	This is not required.
Suitable Height	Record a "Y" (i.e., yes) if the tree height has <i>not been</i> significantly affected and is suitable for calculating a reliable site index estimate; otherwise record "N" (i.e. no).
Bored Height (m)	Height above high side ground level where boring was made.
Measure Code	If pith was not part of the increment core indicate one of the following: ROT = core of tree was rotten or missing; WHO = total age determined from whorl count rather than boring; CRC increment bore not long enough – could not reach centre; OUT = age and increments determined from similar tree outside of plot; all other measurements for the tree within the plot; PHY = Physiological age recorded or calculated for tree (usually due to atypical growth ring patterns).
Field Age Count	Repeat the Tree No. For each Type record the actual age (number of rings) at boring height in the lower left of the card.
Office Bored Height Age	Increment cores are recounted in the office under magnification. Enter the recounted age in this data field.
Growth (mm)	This is not required.
Prorate Data	Used when a full boring of the tree is not possible
<ul style="list-style-type: none"> <li>Length (cm)</li> </ul>	Length of increment core from outer edge inward (inside bark) upon which the ring count was made
<ul style="list-style-type: none"> <li>Ring Count</li> </ul>	Actual or representative count of tree rings along core length
Direct Age Correction	Number of full years of tree growth below boring height, if it can be determined directly on that tree
Physiological Age	Age at the bored height as determined by crew accompanied by Measure Code PHY.
Suitable Age	If top height tree is residual, then record "N" for not suitable, otherwise record a "Y". All other sample trees must have a "Y" entered for suitable height, except for an X tree that must follow the convention of the tree Type it is representing, including the "V" tree where suitable age must be recorded as "N".



**BRITISH COLUMBIA**

**VEGETATION RESOURCES INVENTORY —  
SMALL TREE, STUMP AND SITE TREE DATA (TS)**

10

Data ID			
Project ID	Plot Sample #	PL	PLOT TYPE
D1C1K1	128	I	F01

Fixed Small Tree Plot					
Plot Radius (m)		Plot			
2.5	0	X	FULL	HALF	DRY

Fixed Stump Plot					
Plot Radius (m)		Plot			
2.5	0	X	FULL	HALF	DRY

PAGE	OF
1	1

SMALL LIVE TREE (< 4 cm @ DBH) - BY LENGTH CLASSES																
Species	10 - 29 cm				30 cm - 1.3 m				Length > 1.3 m				51	52	53	54
	Tally	Total	Tally	Total	Tally	Total	Tally	Total	10	11	12	13				
D1C1			2				3									
C.W1			2													
H.W1			7													

STUMPS ≥ 4 cm @ DIB AND LENGTH ≤ 1.3 m																																	
Species	Freq.	DIB (cm)	Length (m)	% Sound	Wid. Codes	Wild-life Use	Root Rot Sp. DR*	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52			
																															14	15	16
X1C1	1	1	7	0																													

\* T = Top Height, L = Leading Species, S = Second Species, O = Other Leading, V = Resid.

HEIGHT AND AGE INFORMATION																															
Plot Type	Tree No.	TYPE	Species	Cr. Boring (OB) Diam. (cm)	Tree Length (m)	S/H	Bark Thickness (mm)	Bored Height (m)	Measure Code	Office Bored Height Age				Growth (mm)				Prorate Data				Direct Age Corr.		Total Age		Phy Age		S/A			
										5 Yr.	10 Yr.	20 Yr.	Length (cm)	Off. Count	Age	Corr.	Total	Phy	Age	Age	Age	Age									
5.64 m	1	T	C.W1	9	2.7	Y	1	1	1.3					4	7	1	5														Y
Quad	2	L	S.W1	4	4.8	Y		5	1.3	R.O.T				6	1	0	2	0		9	2									Y	
Quad	1	S	H.W1	4	9.2	N		1	3	1.3				3	7	1	3													Y	
Quad	1	O	C.W1	9	2.7	Y		1	1	1.3				4	7	1	5													Y	
11.28 m		V	None available																												

FIELD AGE COUNT		
Tree No.	TYPE	BORED HEIGHT AGE
1	T	19/4
2	L	19/4
	S	
	O	
	V	

Comments: Quadrant 1

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Quadrant 1 HEIGHT AND AGE INFORMATION																															
Plot Type	Tree No.	TYPE	Species	Cr. Boring (OB) Diam. (cm)	Tree Length (m)	S/H	Bark Thickness (mm)	Bored Height (m)	Measure Code	Office Bored Height Age				Growth (mm)				Prorate Data				Direct Age Corr.		Total Age		Phy Age		S/A			
										5 Yr.	10 Yr.	20 Yr.	Length (cm)	Off. Count	Age	Corr.	Total	Phy	Age	Age	Age	Age									
5.64 m	1	T	C.W1	9	2.7	Y	1	1	1.3					4	7	1	5													Y	
Quad	2	L	S.W1	4	4.8	Y		5	1.3	R.O.T				6	1	0	2	0		9	2								Y		
Quad	1	S	H.W1	4	9.2	N		1	3	1.3				3	7	1	3												Y		
Quad	1	O	C.W1	9	2.7	Y		1	1	1.3				4	7	1	5												Y		
11.28 m		V	None available																												

Figure 13 Small tree, stump, and site tree data (TS)

## 11. Ecological Description 1 (ED1) Card (Number 12)

Chinook requires the proper identification and recording of ecological information at all population-based sample locations as per the standards and information outlined within:

1. Banner, A., MacKenzie, W., Haeussler, S., Thomson, J., Pojar, J., and Trowbridge, R. 1993. A field guide to site identification and interpretation for the Prince Rupert Forest Region. Ministry of Forests Research Program. Land Management Handbook No. 26. <https://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh26/Lmh26part1.pdf> [Part 1: accessed Sept. 10, 2021] <https://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh26/Lmh26part2.pdf> [Part 2] <https://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh26/Lmh26Sup1.pdf> [2002; Supplement No. 1]
2. See BC Ministry of Environment, BC Ministry of Forests and Range. 2010. Field manual for describing terrestrial ecosystems. 2<sup>nd</sup> Edition. Land Management Handbook, 0299-1622;25. [https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/conservation-data-centre/field\\_manual\\_describing\\_terrestrial\\_ecosystems\\_2nd.pdf](https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/conservation-data-centre/field_manual_describing_terrestrial_ecosystems_2nd.pdf) [accessed April 19 2020]
3. Change Monitoring Inventory Ground Sampling Procedures (Version 2.5, March 2018): <https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/ground-sample-inventories/provincial-monitoring/standards>

The main plot is 11.28 m radius centered on the Integrated plot Centre.<sup>6</sup>

Project ID *	As per Header Card (CH)
Plot Sample # *	As per Header Card (CH)
Plot Type *	As per Header Card (CH)
Polygon Identifier	Not Required
Measurement Date	YYYYMONDD
Crew (Initials)	
Site Classification	
Uniformity	1: > 98% of the plot in one homogeneous (site series and structural stage) ecosystem or site series; 2: > 90% of plot in homogeneous ecosystem or site series; 3: > 70% of plot in one homogeneous ecosystem or site series; 4 > 50% of plot in one homogeneous ecosystem or site series; 5: ≤ 50% of plot in one homogenous ecosystem or site series. Starting with 1 and ending with 5; find the first statement that applies and record the associated integer with a check (✓) mark.
Biogeoclimatic Unit <sup>1</sup>	Zone; Subzone; Variant; Phase (Enter - - if no phase)
Ecosystem Description Plot Centre Site Two Site Three	Refer to site series and land cover class below.
SMR <sup>2</sup>	Soil Moisture Regime: 0: Very Xeric; 1: Xeric; 2: Subxeric; 3: Submesic; 4: Mesic; 5: Subhygric; 6: Hygric; 7: Subhydric; 8: Hydric.
SNR <sup>2</sup>	Soil Nutrient Regime: A: Very Poor; B: Poor; C: Medium; D: Rich; E: Very Rich; F: Ultra Rich or Saline

<sup>6</sup> Note this has been changed from 10m in the original CMI protocol to be consistent with the main CMI Tree Detail plot size.

Site Series & Coverage	Enter site series number and percentage of the plot area for the ecosystem associated with the IPC. If more than one site series is present, then record the site series number and applicable percentage of the plot area.
Land Cover Class	Record for each applicable ecosystem present within the 10 m radius plot. e.g., <b>Vegetated; Treed; Upland, Lowland, or Wetland; Conifer, Broadleaf or Mixed; Dense, Open, or Sparse.</b> See Table 7.4, pp. 140 in CMI Ground Sampling procedures. <sup>3</sup>
Site Features	
Slope (%), Aspect (°), Elevation (m ASL)	Record slope in % and aspect in degrees. Note if slope is less than 2% then enter 999 for aspect.
Mesoslope Position	Check one
Microtopography	Smooth: few or no mounds; if present, less than 0.3 m high and more than 7 m apart; Moderately Mounded: mounds 0.3 to 1m high and 3 to 7m apart; Strongly Mounded: Mounds 0.3 to 1m high and less than 3m apart; Extremely Mounded: Mounds more than 1m high.
Rocky Substrates	Estimate the percentage of the within-site ground surface covered by rocky substrate
Slope failures	Note any evidence of recent or past slope failure greater than 100m <sup>2</sup> surface area in the plot or intercepted by a portion of the 11.28m plot. Evidence includes landslides, slumps, debris flows, debris torrents, and bedrock failures. Record if present in plot (Y) or not (N)
Gullies	Gullies are long, linear depressions incised into the landscape by active erosion processes, mainly running water in places accompanied by mass movement and/or snow avalanching. Where the stream channel is confined in a narrow ravine with banks usually higher than 3 m. The longitudinal profile may range from gentle to steep, and uniform to irregular (benched). The cross-section profile may be V-shaped to U-shaped with moderate to steep sidewalls (50% or greater slope). Dry draws (gully shaped features without a stream) with long established vegetation and soils, and stream channels with none of the above active or potentially active sidewall erosion features are not included. Record if present in plot (Y) or not (N).
Flood Hazard	Frequent: Subject to annual flooding; Occasional: Occasional flooding; Rare: Subject to flooding at high stage; Not Applicable: Flooding does not occur.
Open Water	Estimate the within-site area covered by either <b>Flowing</b> or <b>Standing</b> water. Record as percentage.
Soil Features for Pin Location	A soil pit is required at every plot location. Establish the soil pit within the ecosystem that represents the plot location and is associated with the site trees. The soil pit should be located as close to the IPC as practical, but at the very least within the 10m plot radius.  Ensure soil pit is at least 30cm in mineral soil depth (starting from bottom of LFH or Organic layer, this being the top of the mineral soil layer in most cases) or until reaching a root restricting layer, whichever is less in an area that is close to plot centre. If a soil pit cannot be excavated on the plot draw a line through the soil features section of the card and note the reason in the comments. Upon completion of the sample, refill the soil pit.
Surficial Material	Anthropogenic (A_), Colluvium (C_), Eolian (E_), Fluvial (F_), Glaciofluvial (FG), Lacustrine (L_), Morainal "Till" (M_), Organic (O_), Bedrock (R_), Volcanic (V_), Marine (W_).
Depth to (cm):	<b>Water table, Mottles (or seepage), Root-Restricting pan, Bedrock, Frozen layer, Carbonates, Not observable</b>
Humus Form	Mor (MO); Mormoder (MM); Moder (MD); Mullmoder (MR); Mull (MU); Not Applicable (NA)
Soil Colour	<b>Dark, Medium, Light, Not Applicable</b>
Soil Description for Pin Location	See Soil Features for Pin Location above

Horizon	Litter (L__), Fermentation (F__), Humus (H__); Ah_ (top mineral horizon enriched with organic matter); Ae_ (Eluviated top mineral horizon); B__ (B horizon- may be enriched with organic matter, iron, aluminum, or clay or otherwise affected by a change in structure or colour; e.g. gleying); C__ (lowest horizon unaffected by pedogenic processes); Organic with relatively undecomposed organic matter that is identifiable as to origin (e.g. peat; Of_); Organic with partly decomposed organic matter (Om_); Organic with well decomposed organic matter (Oh); Bedrock (R__)
Depth	Record the depth to the bottom each horizon where zero (0) starts at the top of the LFH layer, and then starts again at the top of the mineral soil horizons (usually an A or an O horizon).
Texture	Particles ≤ 2mm consisting of sand, silt, and clay; See texture triangle below. Codes are combinations of Sand (S), Clay (C), Loam (L) and Silt (Si) e.g., Silty Loam (SiL). Record texture for each mineral soil layer (e.g., for each of Ae, Bf, C)
Coarse Fragments	Particles > 2mm in size. Enter total percentage of coarse fragments (by surface area or volume) and then allocate that percentage to gravel < 7.5cm and/or cobbles and stones (≥ 7.5 cm).
Back of Card	There is room for comments.





# VEGETATION RESOURCES INVENTORY ECOLOGICAL DESCRIPTION 1 (EP)

Data ID		PL	PLOT TYPE	Polygon Identifier													Measurement Date				Crew (Initials)					
Project ID	Plot Sample #			1	2	3	4	5	6	7	8	9	10	11	12	13	14	Y	E	A	R	M	O	N	D	D
DCK1	28	I	F	O	1											1	9	9	9	A	U	G	2	2	ALC	JBL

SITE CLASSIFICATION (10m plot)										SITE FEATURES FOR PIN LOCATION																
1. Uniformity (enter one ✓) ← Uniform to Variable →					2. Biogeoclimatic Unit					7. Slope %	8. Aspect °	9. Elevation (m)	12. Microtopography (enter one ✓)			Enter one ✓ per row (NV = Not Visited)										
					Zone	Subzone				V	P	5	2	2	0	3	4	0	Smooth	SM	<input checked="" type="checkbox"/>					
1	2	3	4	5	C	W	H	D	S	1	-	-	10. Surface Shape (enter one ✓)	13. Rocky Substrates (% cover)			16. Flood Hazard (enter one ✓)									
Ecosystem Description										S1	S2	S3	S4	S5	Concave	CV	Cobbles / Stones			CS	0	Frequent				F
Location		4. SMR	5. SNR	3. Site Series and Coverage		6. Land Cover Classification					Convex	CX	Bedrock			BR	0	Occasional				O				
Plot Centre	P	5	D	7	9	5	V	T	U	T	C	D	E	Straight	ST	Enter one ✓ per row (NV = Not Visited)			Rare				R			
Site Two	2	5	D	7	5	V	N	U	S	L	O	P	11. Meso Slope (enter one ✓)	14. Slope Failure			Y	N	NV	Not Applicable				N		
Site Three	3												Crest	C	Within Integrated Plot			<input checked="" type="checkbox"/>			Standing				S	0
Comments										Upper			U	Between Plots			<input checked="" type="checkbox"/>									
										Middle			M	Toe			T	Depression			D					
										Lower			L	Flat			F									

SOIL FEATURES FOR PIN LOCATION										SOIL DESCRIPTION FOR PIN LOCATION															
18. Surficial Material. Enter appropriate code(s)					20. Humus Form (enter one ✓)					22. Horizon	23. Depth (cm) Distance from Zero			24. Texture ≤ 2 mm			25. Coarse Fragments %				S6	S7	S8	S9	
F					Mor	MO	1	2	3	4	5	6	7	% Total	Gravel < 7.5 cm	Cobbles & Stones ≥ 7.5 cm									
19. Depth to (cm):					Mormoder	MM	ZERO																		
Water Table	W	21. Soil Colour (enter one ✓)			Moder	MD	L F																		
Mottles	M	Dark			D	Mullmoder	MR	A H																	
Root Rest. Pan	R	Medium			M	Mull	MU	B 1																	
Bedrock	B	Light			L	Not Applicable	NA	C 1																	
Frozen Layer	F	Not Applicable			N	B 1																			
Carbonates	C				D O P																				
R1					6																				
R2					5																				
Not Applicable (✓)	N				0																				

DOP = Depth of Pit (distance from zero)

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Figure 14 Figure 14: Ecological Description 1 (ED1) Card

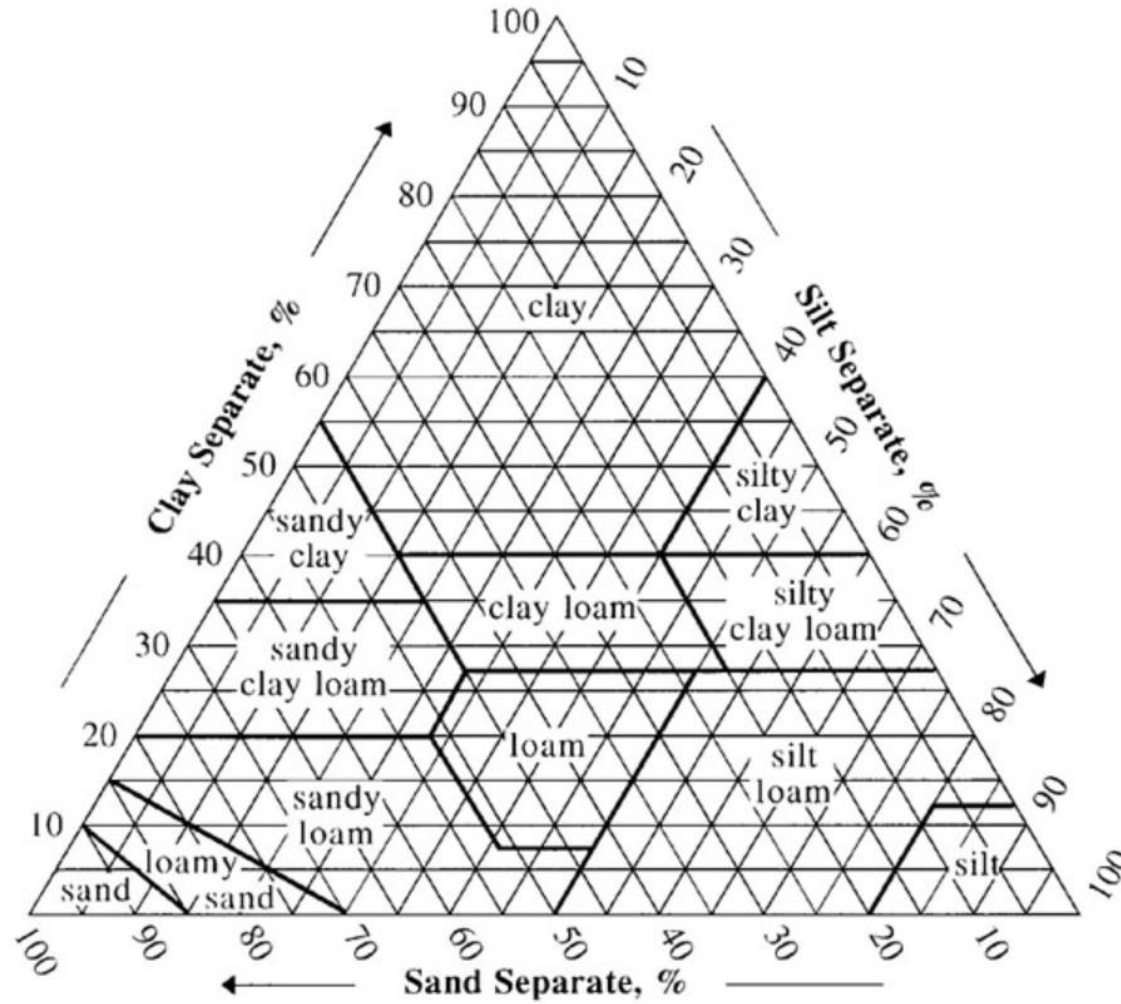


Figure 15 Soil texture triangle

Source: [https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2\\_054167](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_054167) )

## 12. Vegetation Tree and Shrub Layers Card (ET)

Identify tree and shrub layer coverage, identify species, and individual species coverage (%) within a 10m plot radius, centered on the IPC.

For this project, the emphasis in describing ground vegetation is to record all indicator species to properly identify and support Biogeoclimatic-Ecosystem Classification and the correct site series classification for the plot location. The indicator species are listed in the 1994 Vancouver Regional Guide, Pp. 76 to 127. Particular attention should be paid to those species in the same Biogeoclimatic variants as well as adjacent the variants that may be within close proximity to the plot being sampled.

Project ID *	As per Header Card (CH)
Plot Sample # *	As per Header Card (CH)
Plot Type *	As per Header Card (CH)
Measurement Date	YYYYMONDD
Crew (Initials)	
Overall Cover	Enter the total percent cover in the A (> 10m), B1 (2-10m) and B2(<2m) for trees and shrubs and seedlings (> 2 years of age) and record the average height of plants in each of the B1 and B2 layers.
Species	Record all of the dominant tree, shrub, and seedling (> 2 years of age) species in the A, B1, and B2 layers.
Back of Card	Enter Comments





## VEGETATION RESOURCES INVENTORY — TREE AND SHRUB LAYERS (ET)

14

Data ID		PL	PLOT TYPE	Measurement Date						Crew (Initials)		PAGE	OF										
Project ID	Plot Sample #			Y	E	A	R	M	O	N	D			D	Person #1	Person #2	I	I					
DCKI			I	F	O	I	1	9	9	9	A	U	I	G	2	2	A	L	C				

Overall Cover Estimate by Layer (%) (10.0 m Plot)										Seedlings < 2 yrs. old (5.64 m Plot)			S1	S2	S3	Recording species coverage less than 1/10%. 10 m radius: 1H = 1/100% = 18 x 18 cm (approx.) 1T = 1/1000% = 6 x 6 cm (approx.) 5.64 m radius: 1H = 1/100% = 10 x 10 cm 1T = 1/1000% = 3 x 3 cm (approx.)												
9.8% 3% 1.5%																												
Item No.	26. Species (enter codes) Genus/species/subsp.										27. Avg. Ht. B1 (m)			27. Avg. Ht. B2 (m)			Cover			36	37	38	Comments (species-specific, preface with Item Number)					
											% Cover A layer > 10 m			% Cover B1 layer 2 - 10 m			% Cover B2 layer < 2 m							Dh (soil)	Dw (wood)	Dr (rock)		
01	T	H	U	J	P	L	I					9	2	0														
02	P	S	E	U	M	E	N					2	0	0														
03	A	C	E	R	M	A	C											1	0	1	0	6						
04																												
05																												
06	A	C	E	R	C	I	R					3	0	2	8	1	0	0	1	5								
07	O	P	L	O	H	O	R											5	0	1	4							
08	S	A	M	B	R	A	C											2	0	1	2							
09	R	U	B	U	S	P	E											1	0	0	8							
10	R	I	B	E	L	A	C											6	4	0	4							
11	R	O	S	A	G	Y	M											0	1	0	4							
12																												
13																												
14																												
15																												
16																												
17																												
18																												
19																												
20																												

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Other comments on reverse? (  for yes)

Figure 16 Vegetation Tree and Shrub Layers card using plot 10m in radius

## 13. Vegetation Herb and Moss Layer Card (EH)

Identify herb, bryoids, and lichens layer coverage, identify species, and individual species coverage (%) within a 5.64m plot radius, centered on the IPC. For important indicator species that may be present but less than 1%, enter a “+”.

Note that the emphasis in describing ground vegetation is to record all indicator species to properly identify and support Biogeoclimatic-Ecosystem Classification and the correct site series classification for the plot location. The indicator species are listed in the 1994 Vancouver Regional Guide, Pp. 76 to 127. Particular attention should be paid to those species in the same Biogeoclimatic variants as well as adjacent the variants that may be within close proximity to the plot being sampled.

Project ID *	As per Header Card (CH)
Plot Sample # *	As per Header Card (CH)
Plot Type *	As per Header Card (CH)
Measurement Date	YYYYMONDD
Crew (Initials)	
Overall Cover	Enter the total percent cover in the C (Herb) layer and D (Bryophyte and lichen) layers by substrate: Dh (forest floor or mineral soil), Dr (rock), Dw (decayed wood)
Species	Record all the dominant herb species the C layer, and D layers by substrate. Record dominant indicator bryophytes and lichens in the D-layer in the dominant soil substrate; see XLSX plot card. Note that the dominant use of these data is as indicators of site productivity. As such bryophytes and lichens growing on rock and coarse woody debris are of less significance.
Back of Card	Enter Comments





# VEGETATION RESOURCES INVENTORY — HERB AND MOSS LAYERS (EH)

15

Data ID		PL	PLOT TYPE
Project ID	Plot Sample #		
D C K I	2 8 I	I	F O I

Overall Cover Estimate by Layer			
Percent Coverage			
4 0	6 5	1 0	

**PLOT RADIUS = 5.64 m**  
 Recording species coverage less than 1/10%.  
 1H = 1/100% = 10 x 10 cm  
 1T = 1/1000% = 3 x 3 cm (approx.)

Measurement Date			
Y	E	A	R
1	9	9	
M	O	N	D
A	U	G	2
2	2		

PAGE	OF
1	1

ITEM NUMBER	26. Species (enter codes) Genus/species/subsp.										Herb Layer	Bryoids				S1	S2	S3							
												(soil)	(wood)	(rock)											
												C	Dh	Dw	Dr										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
2	1	A	I	H	Y	F	I	L																	
2	2	P	O	L	Y	M	U	N																	
2	3	L	A	C	T	M	U	R																	
2	4	A	D	I	A	P	E	D																	
2	5	D	R	Y	O	E	X	P																	
2	6	T	I	A	R	E	X	P																	
2	7	T	I	A	R	U	N	I																	
2	8	G	A	L	I	T	R	O																	
2	9	D	I	C	E	F	O	R																	
3	0																								
3	1	F	E	R	N	I																			
3	2																								
3	3																								
3	4																								
3	5																								

ITEM NUMBER	26. Species (enter codes) Genus/species/subsp.										Herb Layer	Bryoids				S4	S5	S6							
												(soil)	(wood)	(rock)											
												C	Dh	Dw	Dr										
3	6	P	L	A	G	I	N	S																	
3	7	K	I	N	D	O	R	E																	
3	8	L	E	U	C	M	E	N																	
3	9	R	H	Y	T	L	O	R																	
4	0	I	S	O	T	M	Y	O																	
4	1	N	E	C	K	D	O	U																	
4	2	B	R	A	C	H	Y	T																	
4	3	H	Y	L	O	S	I	P	L																
4	4	R	H	Y	T	T	R	I																	
4	5	R	H	I	Z	G	L	A																	
4	6	S	C	A	P	B	O	L																	
4	7	H	Y	P	N	C	I	R																	
4	8	K	I	N	D	P	I	A																	
4	9																								
5	0	M	O	S	S	I																			

Comments (species-specific, preface with Item Number) \_\_\_\_\_  
*Optional data collected on this sample:*  
 - species with less 1% cover collected.  
 - detailed cover values on wood substrate also tallied.

*Sample adjacent to road therefore dust on most plants.*

Other comments on reverse? (  for yes )

FS 505D HRI 99/3

Figure 17 Vegetation Resources Inventory Herb and Moss Layer

## 14. Succession Interpretations (EO)

Assess the successional status of each plot within a 25m radius centered on the IPC.

Project ID *	As per Header Card (CH)
Plot Sample # *	As per Header Card (CH)
Plot Type *	As per Header Card (CH)
Measurement Date	YYYYMONDD
Crew (Initials)	
Factors Influencing Vegetation Establishment	Record the major observable factors that are relevant to development of the current vegetation and soil characteristics. The time frame is (approximately) the past 500 years. Use from one to a maximum of four of the categories shown in Table 7.19. Only record factors for which direct evidence can be observed. Pp. 169 to 172 in the 2018 CMI ground sampling manual (Version 2.5). This involves using a 2-letter code.
Tree Species Succession by Basal Area	Look for signs of previous dominant species and record current species in order of dominance.
Stand Structure Features	Evidence for decision as to whether the stand has some old growth structural characteristics. For each item (30 to 37) check (✓) those that apply
Tree Harvesting	Clearcut, Partial, None
Snags > 25cm dbh	None (0), Some, (1-5), Common (>5)
Snags/CWD	<b>No:</b> No snags within minimum size criteria or all snags are within a narrow range (1 or 2) of decay classes; <b>Some:</b> Snags meet minimum size criteria but are limited to 3 consecutive decay classes; <b>Yes:</b> Snags meet the minimum size criteria and represent most decay stages.
Canopy Gaps	<b>None:</b> No apparent natural gaps; <b>Some:</b> Smaller gaps amounting to < 10% of crown area in 25m radius area; <b>Common:</b> One or more larger gaps occupying 10% or more of the potential canopy area.
Vertical Structure	<b>Simple:</b> Tends to be even-height with limited coverage in up to two other strata -A1 (Dominant Trees), A2 (Main Canopy), A3 (Trees), B1 (Tall Shrubs > 2m), B2 Low Shrubs); Tends to be uneven height with > 10% of the total coverage in each of 3 strata; Stand is uneven-height with >10% of total coverage in each of four or five strata.
Successional Stability	<b>Unstable:</b> Change in dominant species is imminent; <b>Intermediate:</b> Change in species composition has and will continue to take place in the dominant vegetation; <b>Stable:</b> Persistence in dominant species is apparent from factors such as advanced structural stage, occupation by shade-tolerant species, or when the change in the dominant species composition is relatively slow.
Tree age for species and site series	<b>Young:</b> Characteristic of even-height forests in the young forest or earlier structural stage. <b>Intermediate:</b> Species may have attained near-maximum height, but there is little mortality in the main to upper canopy as the species are only in the mature forest stage. <b>Old:</b> Trees in the upper canopy have been established for a relatively long time. Some upper canopy trees appear to have reached their physiological maximum age. Others may have already died
Tree Size for Species and Site	<b>Small, Intermediate, or Large</b>
Structural Stages	Non-Vegetated ( <b>NV</b> ); Non-Vegetated or Sparse ( <b>SP</b> ); Herb ( <b>H</b> ); Low Shrub ( <b>LS</b> ); Tall Shrub ( <b>TS</b> ); Pole/Sapling ( <b>PS</b> ); Young Forest ( <b>YF</b> ); Mature Forest ( <b>MF</b> ); Old Forest ( <b>OF</b> ). Pp. 176 to 178 of 2018 CMI Manual (Version 2.5)
% of old trees still alive	#Old Trees Alive/ (#Old Trees + #Old Tree Snags + #Fallen old Trees + #Stumps of Old Trees) Old Trees must be > 240 years old.
Old Growth Forest	Check (✓) One
Back of Card	Comments



## 15. Coarse Woody Debris Line Intersect

The Line Intersect method is used to sample Coarse Woody Debris (CWD). There are four transects starting from the Integrated Plot Centre (IPC), with the first transect starting with a random azimuth between 0 and 90 degrees, and each of the 3 remaining transects established at 90, 180, and 270 degrees from the first one. All transects are 25m long (horizontal distance).

CWD is defined as dead woody material located above the soil in various stages of decomposition. There are three size classes with respect to the diameter (D) of pieces at the point of intersection with each of the transects. Each size class is to be sampled along the transect as follows:

- I.  $D \geq 5$  cm to be measured within a 0 m to 5.64 m radius.
- II.  $D \geq 12$  cm to be measured within a 0 m to 11.28 m radius.
- III.  $D \geq 30$ cm to be measured within a 0 m to 25 m radius.

Each of the transects should be laid out in straight line with a ribbon or paint mark to indicate the transition between size classes and the end of the transect. Apply paint marks in locations where there is an intersection point with the CWD. At the point of intersection with the CWD the species, diameter, and decay class are recorded, where the latter (decay classes, 1 & 2, 3, and 4 & 5) are defined as follows<sup>7</sup>:

**1 & 2: Sound wood** – will deflect a knife when struck by a strong, sharp blade; equivalent to CMI classes 1 (intact, hard) & 2 (intact, hard to partly decaying).

**3: Intermediate** – will be left with a slight mark when struck by the same kind of blade; equivalent to CMI class 3 (hard, large pieces, partly decaying).

**4 & 5: Rotten** – will cause the wood to fall apart when struck by the same kind of blade; equivalent to CMI class 4 (small, blocky pieces) and 5 (many small pieces, soft portions).

It is recommended that bearings (BRG) and distances (DISTANCE) along the transect be recorded, particularly where there are unusual features (noted in the comments), and that the 5.64, 11.28, and 25 m thresholds be entered on the plot card with respect to each transect even if there is no CWD at these points of intersection.

Dead standing trees are included as part of the Tree Details (> 4 cm dbh). Stumps (< 1.3 m tall) that remain in the ground are to be recorded using the stump card within the 2.52 m radius plot (> 4 cm dbh; in the Live/Dead/Stump column enter "S"). Note that stumps are required to be measured in a separate form albeit as part of accounting for CWD. Stumps > 1.3m and 4 cm dbh are to be recorded in the Tree Details card. Smaller stumps are to be measured in the 2.52m radius plot. Stumps with roots detached from the ground (i.e., up-turned roots) are treated as CWD as are downed trees with upturned roots that have not be included in the Tree Details data collection process (i.e., avoid double-counting).

There are several scenarios that the cruiser must consider:

1. Simple case: The transect line crosses a single log lying at angle from the line. Record the diameter of the log (using a ruler) at the mid-point of intersection.
2. Trees not self-supported but have not fallen to the ground. Estimate the diameter at the point of intersection.
3. The line crosses the same piece of CWD at two points both of which are greater than 5 cm in diameter (or greater than the minimum threshold for that portion of the transect) at the points of intersection. Include both diameters at the points of intersection.

<sup>7</sup> See Table 8.1. Page 190 of the March 2018CMI ground sampling manual.



4. The log is split open but is still partially held together; record the equivalent diameter as if the piece were a whole (remember that the estimated dbh must be greater than minimum threshold for that portion of the transect if it is to be included). If a stem is shattered into distinct unconnected pieces, at the point of sampling, record each of these larger than the minimum diameter for that portion of the transect.
5. The piece is an odd shape. Estimate the average diameter of the piece at the point of transect.
6. The transect runs into a substantial change in forest conditions (with the plot centre located within the forest): In this scenario stop at the forest type boundary and follow the original line back towards plot centre to complete the 25m distance recording each CWD piece a second time. Keep going through the IPC if necessary. This is referred to as the “Bounce-Back Method.”
7. There is a large accumulation of CWD. Estimate the total cross-sectional area of all of the pieces (given the diameters for all pieces > 5 cm dbh) as a rectangle excluding air. It is recommended that you also record the distance along the transect where each accumulation starts and ends and enter associated comments to that effect.<sup>8</sup> The cross-sectional area is proportional to this area multiplied by a depth (XS-AREA in the CWD .xlsx data entry workbook.)
8. The line-transect tracks along a log for a long distance. Find the point of intersection at the midpoint and record the associated diameter and decay class at that point.

## 15.1 Data Entry

The Coarse Woody Debris (CWD) form (Figure 19) is described as follows

Field name	Description
BRG	Enter the bearing of the transect at the start of each new transect when starting from plot centre.
DIST	Record the distances for important features along the transect, e.g., for start and end of large accumulations of slash or for start of Bounce-Back procedures, etc.
SPECIES	For each log that intersects with a given line record the species. If it cannot be identified use other hardwood (XH), other conifer (XC) or one of the open field names (e.g., O1) for something completely unrecognizable.
DIAMETER	Enter the diameter of the log at the point of intersection.
DECAY	Enter the decay class: Sound, Intermediate, or Rotten
XS-AREA	This is the cross-section area that is only required for data entry when there are large accumulations of debris. See scenario 7 as described above.
COMMENTS	Provide comments as required. For example, it would be useful to record the BRG and DISTANCE (0) at the start of each transect (from the IPC). You may wish to enter the Transect number in the comments (e.g., T1) or just START, etc. This is intended to help with data interpretation, reconstruction of the transect in the future, and to indicate unusual or difficult circumstances (e.g., large accumulations of debris or use of Bounce-Back).
Bounce-Back	An additional comment field is provided in the CWD form to further describe the situation under which Bounce-Back procedures were deployed at a given plot.

<sup>8</sup> The suggestion to estimate the cross-section area is from: Marshall, P.L., Davis, G., and LeMay, V.M. 2000. Using line intersect sampling for coarse woody debris. Forest Research Technical Report TR-003, BC Ministry of Forests, Vancouver Forest Region, Nanaimo, BC. [https://www.webpages.uidaho.edu/for373new/pdfs/for373/lineintersectsampling\\_tr003.pdf](https://www.webpages.uidaho.edu/for373new/pdfs/for373/lineintersectsampling_tr003.pdf) [accessed June 23, 2021]



<b>Project ID</b>		0											
<b>Plot Sample #</b>		0											
<b>Plot Type</b>		OP											
<b>ID</b>	<b>BRG</b>	<b>DISTANCE</b>	<b>SPECIES</b>	<b>DIAMETER</b>	<b>DECAY</b>	<b>XS-AREA</b>	<b>COMMENT</b>						
1													
2													
3													
4													
5													
6													

Figure 19 The Coarse Woody Debris Form

The IPC Header has been amended to include a more complete plot establishment checklist.

Field name	Description
SmallTree	Did you complete the Small Tree Card (Y/N)
Lcover	Did you complete the Land Cover Card? (Y/N)
Mplot	Did you complete the Main and Sub-Plot installments? (Y/N)
Stump	Did you complete the stump card? (Y/N)
Cwd	Did you complete the coarse woody debris line transects? (Y/N)
Tags	Did you remember to tag the trees in the main plot and associated sub-plot? (Y/N)

<b>Plot Card Checklist</b>					
<b>SmallTree</b>	<b>Lcover</b>	<b>Mplot</b>	<b>Stump</b>	<b>Cwd</b>	<b>Tags</b>

Figure 20 The Plot Establishment and Remeasurement Checklist in IPC HEADER form.

## 16. Audit Procedures

These procedures are adapted from the Change Monitoring Inventory Quality Assurance Procedures and Standards for Ground Sampling (March 2018; Version 3.4).

This audit process is primarily aimed toward evaluating the overall quality of the measurements and assessments completed in the field (and office in terms of site tree ring counting). It is predicated on the idea that field crews are well versed on completing the requirements either by way of experience and/or by way of training at the start of the project along with follow-up informal auditing (preferably while the persons are doing the work) in the start-up phase of the project to ensure that problems are recognized and fixed before becoming routinely embedded in the project. This process is not aimed at detecting willful negligence or lack of integrity with attention to detail on the part of those doing the work, such that the preferred response is to either stop the work altogether or to require that a large batch of work be completely redone. The onus is on all parties to ensure that these kinds of problems are circumvented before they cause failure in terms of achieving the desired outcomes. The best way to achieve this kind of outcome is to invoke routine office and field checks on one hand, and to invite conversation where there is uncertainty as to how to execute a given procedure or otherwise better describe what is required to succeed.

The general audit process is described in Figure 21.

### 16.1 Office Review

The primary purpose of the office review is to look for incomplete data entry and any anomalies (e.g., heights versus diameters that do not make sense, species that have been identified but are unlikely to occur at that location, etc.) that would suggest that the data is not of good quality. The recommended remedies for these kinds of issues are a function of their severity and extent. Office checks should be done routinely with the aim of detecting and fixing errors within a short time after the data has been collected in the field.

1. A batch of samples are submitted to the Sample Plot Manager when completed by the Contractor.
2. These are reviewed for completeness and for any data entry errors. These include the following details:
  - a. Access Header Card: This card is complete, and a diagram is provided indicating the route and prime features located between the access point and the reference point. This card and accompanying diagram are required for PBS, SBS, and CWD sampling.
  - b. IPC Header Card: The location of each plot is within close proximity to its intended location (particularly the PBS plots) or if not (for SBS plots) the decision to move them is explained in the comments. All of the fields are complete. This card is required for PBS, SBS, and Coarse Woody Debris sampling.

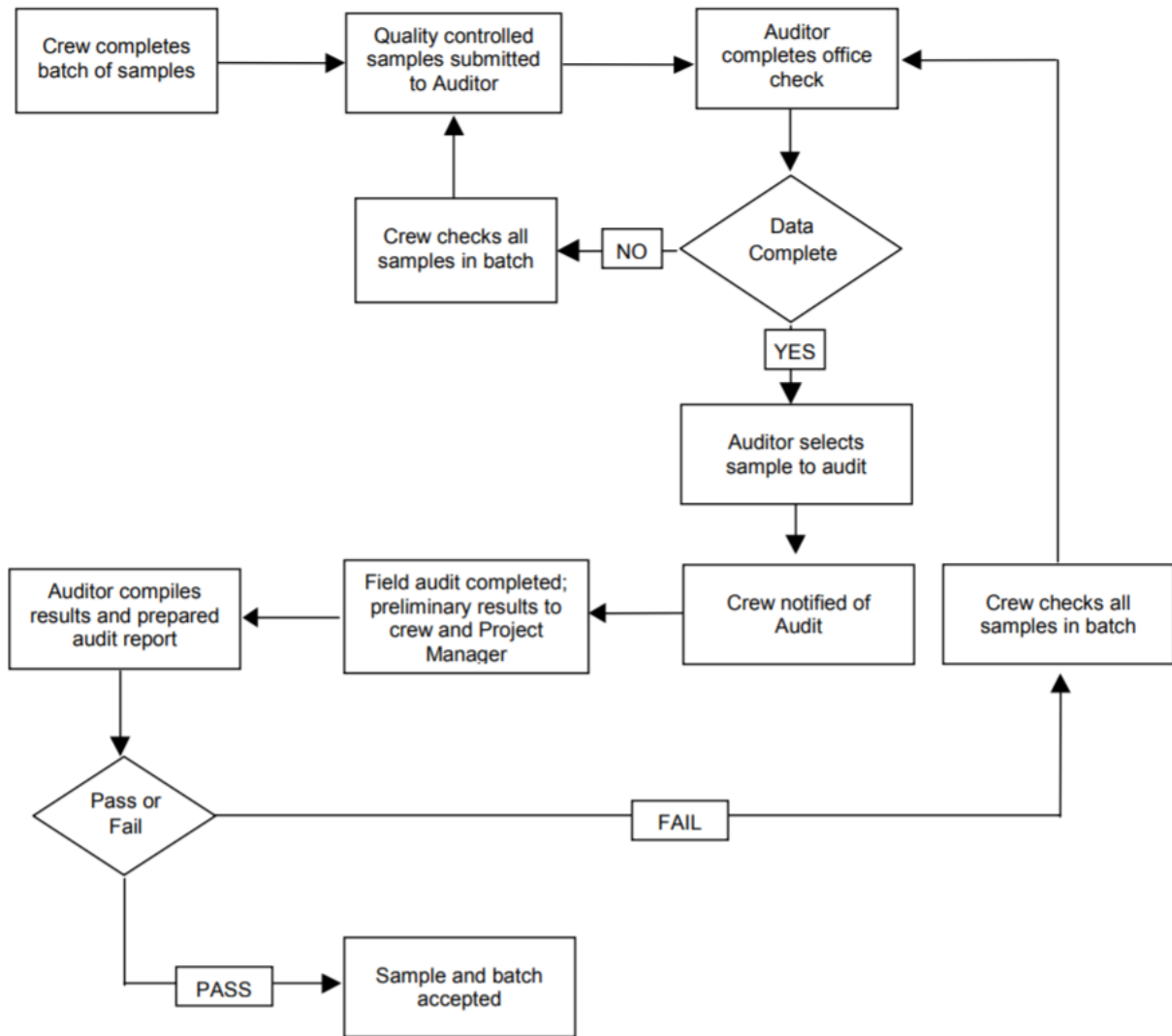


Figure 21 The standard (2018) CMI audit process.

- c. Land Cover: The Land Cover Class has been properly identified (VT, VN, NL, NW) at the IPC and in surrounding areas within the plot if they are different from the IPC with an associated IPC. If the area has more than one of the 4 classes bearings and distances from the IPC to the boundary separating the VT from the others are provided. A sketch map showing the plot and the approximate location of the VT versus other land cover classes is also provided. This card and accompanying diagram are required.
- d. Main+Sub Plot Data:
  - i. This card is required for PBS, SBS, and generally along with CWD sampling.
  - ii. Project ID, Plot Sample # and Plot Type are correctly indicated.
  - iii. Main plot characteristics are indicated (Full, Half, Quarter).
  - iv. Minimum (main plot) DBH is indicated (4, 7.5, or 9 cm).
  - v. Date of plot establishment has been properly recorded.

- vi. The Quadrat, Species, Status, Diameter, Height, Crown, Broken top, and Sector fields are complete and with valid entries.
- vii. Damaging agent codes and severities are reasonable.
- viii. Loss indicators are identified.
- ix. Site trees and reference trees for IPC are stem mapped.
- x. Site trees are identified (central IPC and by sector) with ages (ring counts) properly recorded.
- e. Small Tree and Stump Card (when required)
  - i. Project ID, Plot Sample # and Plot Type are correctly indicated.
  - ii. Measurement date is correct.
  - iii. Plot dimensions (Full, Half, Quarter) are indicated.
  - iv. The small tree card is completed for young stands.
  - v. The stump card is completed for CWD accounting (i.e., when CWD plot card is also required).
- f. Ecology 1, Vegetation-Shrub, Vegetation-Herb, and Succession Cards
  - i. These cards are completed for all PBS samples.
  - ii. Review the card for completeness and accuracy.
- g. Coarse Woody Debris (CWD) Card.
  - i. This card is required as directed by the Sample Plot Manager.
  - ii. Distances (25m) and bearings (each bearing is at 90 degrees from two adjacent bearings) along with diameters and indicated decay classes are appropriate.
- h. Note that cruisers/ecologists/surveyors may have adjusted the codes associated with any given plot due to special circumstances. It is important to review the codes relative to the standard list for any new codes that have been added and to include these in a master list. Also, care must be taken to ensure that there are no duplicate codes indicating different things. This task along with many of the other tasks referred to above are best accomplished by way of compiling data into a database format and checking for errors in that kind of a process. It is recommended that cards also be scanned visually to see if there are any other issues that might have been missed in a standard compilation process.

In the above-mentioned process if errors are found there are four potential courses of action that may be invoked:

1. There are no significant errors in the data submitted. The errors that did occur were easily recorded as were the adjustments to fix them and the data was accepted for entry into a database.
2. There were errors in the data submitted that can be fixed in the office but are best fixed by the crew that established the plot. The data is returned to the contractor for review along with a list of errors that require attention. If the crew cannot resolve the issue in the office then they are asked to do so by returning to the plot and fixing the problem.
3. There are errors, the nature and/or extent of which indicate that the crew must return to the plot with a view toward redoing certain portions of the protocol wherein the errors have occurred.

4. Under either scenario 2 or 3 the Sample Plot Manager may invoke additional formal or informal audits depending on the degree of severity in terms of their impact on plot compilations and project objectives (i.e., discretion applies). A formal audit requires that a random sample of plots be selected for auditing and that specific ground sampling procedures be followed as further outlined below. An informal audit involves selecting specific plots and specific portions of the protocol for review and assessment by the auditor.

## 16.2 Formal Field Audit

### 16.2.1 Plot Selection

It is envisioned that samples will be selected from batches of plots submitted by each field crew. A batch of plots includes maps, sketches, and completed field cards or forms. The general guideline is to audit 1 out of every 10 plots with plots selected at random. If there is a large batch of plots consideration may be given to use of stratified random sampling and/or the use of sorted lists to sample across a broader range of (geographic) conditions. Additional, informal audits may be carried out as described in the previous section.

### 16.2.2 Field Audit Procedures

#### Audit for Timber Attributes

Large Trees (> 4cm dbh)	Randomly select one quadrant to re-measure. If < 20 trees are encountered in the quadrant then continue re-measuring trees sequentially until 20 trees have been re-measured. The full suite of measurements is taken on selected trees plus the determination of missing or extra trees within the selected quadrant(s).
Small Tree Plot	If required tally the trees by size class. Note that this information is for the purpose of characterizing measurement error.
Stumps	For coarse wood debris sampling measure all stump attributes.
Site Trees	Confirm selection of site trees in all quadrants. Identify tree number and species. Measure heights, diameters. Obtain cores for tree ring counting using a microscope.
Stem Mapping	Re-measure bearings and distances for stem mapped trees.
Reference Pin to IPC	Re-measure bearings and distances. Re-establish IPC location using survey grade GPS.

#### Coarse Woody Debris

Coarse Woody Debris	Randomly select one transect. For round pieces collect species, diameter, and decay class for the piece. For accumulations and/or odd shaped pieces, collect species, horizontal length, and vertical depth on transect, and decay class for the (modal) piece.
---------------------	---

#### Ecological, Vegetation, and Succession

Ecological Data	Complete the assessments as required in the standard procedures.
-----------------	--

## 16.3 Plot Standards

#### Plot Location

IPC Location	± 1m following the procedures outlined above with respect to the actual plot location.
--------------	--



**Tree Attributes**

Tree Count (> 4 cm dbh)	1 error allowed per 40 trees. No errors on samples with less than 20 trees. Missed and added trees do not cancel each other out.
Tree Species or Genus	1 error allowed.
Live/Dead	1 error allowed.
DBH	Absolute variation within $\pm 2\%$ calculated as the (sum of individual differences in dbh)/(sum of audit dbh)
Tree Length	Absolute variation within $\pm 3\%$ calculated as: (sum of individual height differences)/(sum of audit heights)
Site Trees	No error in leading and second species. One error allowed with respect to selection of sample trees (leading species, second species, and top height trees).

**Coarse Woody Debris**

CWD Gross volume ( $m^3ha^{-1}$ )	The estimated volume is within $\pm 15\%$ of that derived for the same transect installed by the field crew.
-----------------------------------	--

**Vegetation and Soil Attributes**

Tree/shrub species identification	Dominant 4 indicator species are correct.
Herb/bryoid species identification	Dominant 4 indicator species are correct
Soil Pit Depth	This is at least 30 cm deep or has reached an impermeable layer, whichever is less, and the total depth is properly recorded (+/- 5 cm).
Type of impermeable layer	If present the type or kind of impermeable layer is correctly identified.
Humus Form	Mor, Mormoder, Moder, Mullmoder, or Mull are correctly assigned.
Horizon Types	L, F, H, A, B, and C horizons are properly identified. Horizon modifiers are consistent with the associated soil order (e.g., Brunisol, Podsol, Luvisol, Organic).
Horizon Boundaries	The depths to each horizon (including organic layers) are within $\pm 2\%$ .
Soil Textures	These are correct $\pm 1$ class for marginal cases.
Coarse Fragment Percentages	The total percentage is correct within $\pm 5\%$

## 16.4 Individual Attribute Standards

The CMI Ground Sampling Quality Assurance Procedures & Standards (v. 3.4; 2018) include a detailed list of measurement and/or assessment tolerances for each attribute assigned to each object of interest (e.g., an individual tree) that if exceeded (e.g., tree dbh may be within +/- 3% or 0.3 cm, whichever is greater) are assigned penalty points that vary by attribute. If the penalty points are more than 10% of the total points possible, the sample is rejected. If it is found that a particular attribute is repeatedly in error, then the field crew may be required to remeasure an entire batch of plots from which the sample is drawn and asked to remeasure all of the plots (with respect to one or more attributes) prior to repeating the audit. The applicable standards are reproduced below.

**Plot Cluster Location**

Attribute	Standard	Points
Distance: reference pin to IPC	$\pm 0.2m$	1
Azimuth: reference pin to IPC	$\pm 20$	1

**Tree Attributes**

Attribute	Standard	Points
Stand/fall	Correctly identified	1
Diameter (Excluding sample trees)	± 3% or 0.3cm whichever is greater	1
Tree length	± 5% or 0.2m, whichever is greater	2
Crown class	In correct class	½
Broken top diameter	± 20%	1
Projected height	± 10% of (auditors) length	1
Damage agents	± 1 damage agent	½
Loss indicators	± 1 indicator identified	1

**Sample Tree Attributes**

Attribute	Standard	Points
Sample tree selection	No error (in contrast to Plot Standard)	1
Tree length	± 3% or 0.2m, whichever is less	2
Diameter	± 3% or 0.3cm whichever is greater	1
Office counted age	± 3% or 3 years, whichever is greater	1
Pro-rate Core Length	± 1.0 cm	½

**Small Tree Attributes**

Attribute	Standard	Points
Small tree species	90% correctly identified	½
Total trees	± 10%	½

## 16.5 Supporting Information Attributes

In contrast to the Individual Tree Attribute Standards these attributes have thresholds established for identifying when errors have occurred but have no penalty points assigned if such errors do occur. Instead, it is stated that if errors do occur frequently then this may result in a requirement for a plot to be remeasured. Perhaps more importantly, it is useful to have some record of what the potential for measurement errors are with respect to these attributes.

This section has yet to be completed. In the meantime, these requirements can be found on pages 13 to 17 of the CMI Ground Sampling Quality Assurance Procedures & Standards (v. 3.4; 2018).<sup>9</sup>

<sup>9</sup> [https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/cmi\\_ground\\_sampling\\_qa\\_procs\\_standards\\_2018.pdf](https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/cmi_ground_sampling_qa_procs_standards_2018.pdf)

# Appendix A

## BC Tree Species Codes

Code	Tree species	Acceptable Site Tree
AT	Trembling Aspen	TRUE
BL	Subalpine Fir	TRUE
FD	Douglas Fir	TRUE
PL	Lodgepole Pine	TRUE
SB	Black Spruce	TRUE
SW	White Spruce	TRUE
SX	Spruce Hybrid	TRUE
All other species		FALSE

# Appendix B

## Damage Agent Codes

From: Damage Severity Codes: Appendix D in Change Monitoring Inventory Appendices to Ground Sampling Procedures (Version 2.4; March 2018; Pp. 55-56).

Damage Agent Codes			
Field Codes		Description	
O	NO detectable abiotic or biotic damage		
U	UNKNOWN (Damage evident but causal agent unknown)		
	UBT	Unknown Broken Top	
	UCR	Unknown Crook	
	UF	Unknown Fork Damage	
	USW	Unknown Sweep	
N	NON-BIOLOGICAL (ABIOTIC) INJURIES		
	NAV	Avalanche or Snow Slide	
*	NB	Fire	
	NBP	Post Burn Mortality	
	NCA	Aspen (At) Decline	
	NCB	Birch (E) Decline	
	NCY	Yellow cedar (Yc) Decline	
*	ND	Drought	
	NF	Flooding	
*	NG	Frost	
*	NGC	Frost Crack	
	NGH	Frost Heaved	
	NGK	Shoot/Bud Frost Kill	
	NH	Hail	
	NK	Fumekill	
	NL	Lightning	
	NN	Road Salt	
	NR	Redbelt	
	NS	Slide	
*	NW	Windthrow	
	NWS	Windthrow - Soil Failure	
	NWT	Windthrow - Treatment or Harvest-related	
*	NX	Wind scarring or rubbing	
	NY	Snow or Ice (includes snow press)	
*	NZ	Sunscald	
D	DISEASES		
	DB	Broom Rusts	
	DBF	Fir Broom Rust	<i>(Melampsorella caryophyllacearum)</i>
	DBS	Spruce Broom Rust	<i>(Chrysomyxa arctostaphyli)</i>
*	DD**	Stem Decay	

		DDA	White Mottled Rot	<i>(Ganoderma applanatum)</i>
*		DDB	Birch Trunk Rot	<i>(Fomes fomentarius)</i>
		DDC	Brown Cubical Rot of Birch	<i>(Piptoporus betulinus)</i>
*		DDD	Sulfur Fungus	<i>(Laetiporus sulphureus)</i>
*		DDE	Rust Red Stringy Rot	<i>(Echindontium tinctorium)</i>
*		DDF	Brown Crumbly Rot	<i>(Fomitopsis pinicola)</i>
		DDG	Sterile Conk Trunk Rot of Birch	<i>(Monotus obliquus)</i>
*		DDH	Hardwood Trunk Rot	<i>(Phellinus ignarius)</i>
*		DDO	Cedar Brown Pocket Rot	<i>(Poria sericeomollis)</i>
*		DDP	Red Ring Rot	<i>(Phellinus pini)</i>
*		DDQ	Quinine Conk Rot	<i>(Fomitopsis officinalis)</i>
*		DDT	Aspen Trunk Rot	<i>(Phellinus tremulae)</i>

\*\* NOTE: Schweinitzii Butt Rot is no longer treated as a stem decay, it is now treated as a root disease (DRS).

*	DF		Foliage Diseases	
		DFA	Western pine Aster Rust	<i>(Coleosporium asterum)</i>
		DFB	Delphinella Tip Blight	<i>(Delphinella spp.)</i>
		DFC	Large-spore Spruce-Labrador tea Rust	<i>(Chrysomyxa ledicola)</i>
		DFD	Spruce Needle Cast	<i>(Lirula macrospora)</i>
		DFE	Elytroderma Needle Cast	<i>(Elytroderma deformans)</i>
		DFF	Marssonina Leaf Blights	<i>(Marssonina spp.)</i>
		DFG	Cottonwood Leaf Rust	<i>(Melampsora occidentalis)</i>
		DFH	Larch Needle Blight	<i>(Hypodermella laricis)</i>
		DFI	Linospora Leaf Blotch	<i>(Linospora tetraspora)</i>
		DFJ	Phaeoseptoria Needle Cast	<i>(Phaeoseptoria contortae)</i>
		DFK	Septoria Leaf Spot	<i>(Septoria populicola)</i>
		DFL	Pine Needle Cast	<i>(Lophodermella concolor)</i>
		DFM	Larch Needle Cast	<i>(Meria laricis)</i>
		DFN	Leptomelanconium Needle Blight	<i>(Leptomelanconium pinicola)</i>
		DFO	Lophodermium Needle Cast	<i>(Lophodermium seditiosum)</i>
		DFP	Fir Fireweed Rust	<i>(Pucciniastrum epilobi)</i>
		DFQ	Alpine Fir Needle Cast	<i>(Isthmiella quadrispora)</i>
		DFR	Douglas-fir needle cast	<i>(Rhabdocline pseudotsugae)</i>
		DFS	Dothistroma Needle Blight	<i>(Dothistroma septosporium)</i>
		DFT	Sirococcus Tip Blight	<i>(Sirococcus conigenus)</i>
		DFU	Cedar Leaf Blight	<i>(Didymascella thujina)</i>
		DFW	Swiss Needle Cast	<i>(Phaeocryptopus gaumanni)</i>
		DFX	Brown Felt Blight	<i>(Herpotrichia spp.)</i>
		DFY	Hendersonia Needle Cast	<i>(Hendersonia pinicola)</i>
		DFZ	Rhizosphaera Needle Cast	<i>(Rhizosphaera kalkhoffii)</i>
	DL		Disease Caused Dieback	
		DLD	Dermea Canker	<i>(Dermea pseudotsugae)</i>
		DLF	Red Flag Disease	<i>(Potebniamyces balsamicola)</i>
		DLK	Conifer Cytospora Canker	<i>(Leucostoma kunzei)</i>
		DLP	Phomopsis Canker	<i>(Phomopsis lokoyae)</i>
		DLS	Sydowia (Sclerophoma) Tip Dieback	<i>(Sclerophoma pithyophila)</i>
		DLV	Aspen-Poplar Twig Blight	<i>(Venturia spp.)</i>
	DM		Dwarf Mistletoe	
		DMF	Douglas-fir Dwarf Mistletoe	<i>(Arceuthobium douglasii)</i>
		DMH	Hemlock Dwarf Mistletoe	<i>(Arceuthobium tsugense)</i>
		DML	Larch Dwarf Mistletoe	<i>(Arceuthobium laricis)</i>
		DMP	Lodgepole pine Dwarf Mistletoe	<i>(Arceuthobium americanum)</i>
	DR		Root Disease	
		DRA	Armillaria Root Disease	<i>(Armillaria ostoyae)</i>
		DRB	Black Stain Root Disease	<i>(Leptographium wageneri)</i>



	DRC	Laminated Root Rot (cedar strain)	<i>(Phellinus weirii)</i>
	DRL	Laminated Root Rot (Fd form)	<i>(Inonotus sulphurascens)</i>
	DRN	Annosus Root Disease	<i>(Heterobasidion annosum)</i>
	DRR	Rhizina Root Disease	<i>(Rhizina undulata)</i>
**	DRS	Schweinitzii Butt Rot	<i>(Phaeolus schweinitzii)</i>
	DRT	Tomentosus Root Rot	<i>(Inonotus tomentosus)</i>

\*\* NOTE: Schweinitzii Butt Rot is no longer treated as a stem decay, it is now treated as a root disease (DRS).

DS		Stem Diseases (Cankers and Rusts)	
	DSA	Atropellis Canker (Lodgepole pine)	<i>(Atropellis piniphila)</i>
	DSB	White pine Blister Rust	<i>(Cronartium ribicola)</i>
	DSC	Comandra Blister Rust	<i>(Cronartium comandrae)</i>
	DSE	Sooty Bark Canker	<i>(Encoelia pruinosa)</i>
	DSG	Western Gall Rust	<i>(Endocronartium harknessii)</i>
	DSH	Hypoxylon Canker	<i>(Entoleuca (Hypoxylon) mammatum)</i>
	DSP	Cryptosphaeria Canker	<i>(Cryptosphaeria populina)</i>
	DSR	Ceratocystis Canker	<i>(Ceratocystis fimbriata)</i>
	DSS	Stalactiform Blister Rust	<i>(Cronartium coleosporioides)</i>
	DST	Target Canker	<i>(Nectria galligena)</i>
	DSY	Cytospora Canker	<i>(Cytospora chrysosperma)</i>

I	INSECTS		
IA		Aphids	
	IAB	Balsam Woolly Adelgid	<i>(Adelges piceae)</i>
	IAC	Giant Conifer Aphid	<i>(Cinara spp.)</i>
	IAG	Cooley Spruce Gall Adelgid	<i>(Adelges cooleyi)</i>
	IAL	Larch (Lw) Cone Woolly Aphid	<i>(Adelges lariciatus)</i>
	IAS	Green Spruce Aphid	<i>(Elatobium abietinum)</i>
IB		Bark Beetles	
	IBB	Western Balsam Bark Beetle	<i>(Dryocoetes confusus)</i>
	IBD	Douglas-fir Beetle	<i>(Dendroctonus pseudotsugae)</i>
	IBE	Silver Fir Beetle	<i>(Pseudohylesinus sericeus)</i>
	IBF	Fir Engraver Beetle	<i>(Scolytus ventralis)</i>
	IBH	Hylurgops Beetle	<i>(Hylurgops rugipennis)</i>
	IBI	Engraver Beetles	<i>(Ips spp.)</i>
	IBL	Lodgepole Pine Beetle	<i>(Dendroctonus murryanae)</i>
	IBM	Mountain Pine Beetle	<i>(Dendroctonus ponderosae)</i>
	IBP	Twig Beetles	<i>(Pityogenes, Pityophthorus spp.)</i>
	IBR	Fir Root Bark Beetle	<i>(Pseudohylesinus granulatus)</i>
	IBS	Spruce Beetle	<i>(Dendroctonus rufipennis)</i>
	IBT	Red Turpentine Beetle	<i>(Dendroctonus valens)</i>
	IBW	Western Pine Beetle	<i>(Dendroctonus brevicomis)</i>
ID		Defoliators	
	ID1	Leaf Beetles	<i>(Chrysomela spp.)</i>
	ID2	Bruce Spanworm	<i>(Operophtera bruceata)</i>
	ID3	Winter Moth	<i>(Operophtera brumata)</i>
	ID4	Cottonwood Sawfly	<i>(Nematus currani)</i>
	ID5	Fall Webworm	<i>(Hyphantria cunea)</i>
	ID6	Aspen Leaf Miner	<i>(Phyllocristis populiella)</i>
	ID7	Woolly Alder Sawfly	<i>(Eriocampa ovata)</i>
	ID8	Aspen Leaf Roller	<i>(Pseudexentera oregonana)</i>
	ID9	Birch Leaf Skeletonizer	<i>(Buccatrix spp.)</i>
	IDA	Black Army Cutworm	<i>(Actebia fennica)</i>
	IDB	Two-year Budworm	<i>(Choristoneura biennis)</i>
	IDC	Larch Casebearer	<i>(Coleophora laricella)</i>
	IDD	Western Winter Moth	<i>(Erranis tiliaria vancouverensis)</i>

	IDE	Eastern Spruce Budworm	<i>(Choristoneura fumiferana)</i>
	IDF	Forest Tent Caterpillar	<i>(Malacosoma disstria)</i>
	IDG	Greenstriped Forest Looper	<i>(Melanolophia imitata)</i>
	IDH	Western Blackheaded Budworm	<i>(Acleris gloverana)</i>
	IDI	Pine Needle Sheath Miner	<i>(Zellaria haimbachi)</i>
	IDJ	Gray Forest Looper	<i>(Caripeta divista)</i>
	IDK	Northern Tent Caterpillar	<i>(Malacosoma californicum)</i>
	IDL	Western Hemlock Looper	<i>(Lambdina fiscellaria lugubrosa)</i>
	IDM	Gypsy Moth	<i>(Lymantria dispar)</i>
	IDN	Birch Leaf Miner	<i>(Fenusa pusilla)</i>
	IDO	Filament Bearer	<i>(Nematocampa filamentaria)</i>
	IDP	Larch Sawfly	<i>(Pristiphora erichsoni)</i>
	IDQ	Hemlock Needle Miner	<i>(Epinotia tsugana)</i>
	IDR	Alder Sawfly	<i>(Eriocampa ovata)</i>
	IDS	Balsam Fir Sawfly	<i>(Neodiprion abietis)</i>
	IDT	Douglas-fir Tussock Moth	<i>(Orgyia pseudotsugata)</i>
	IDU	Satin Moth	<i>(Leucoma salicis)</i>
	IDV	Variiegated Cutworm	<i>(Peridroma saucia)</i>
	IDW	Western Spruce Budworm	<i>(Choristoneura occidentalis)</i>
	IDX	Large Aspen Tortrix	<i>(Choristoneura conflictana)</i>
	IDY	Birch-Aspen Leafroller	<i>(Epinotia solandriana (Linnaeus))</i>
	IDZ	Western False Hemlock Looper	<i>(Nepytia freemani)</i>
	IEA	Unidentified Aspen Defoliation	
	IEB	Hemlock Sawfly	<i>(Neodiprion tsugae)</i>
	IEC	Larch Budmoth	<i>(Zairaphera improbana)</i>
	IED	Larch Looper	<i>(Semiothis sexmaculata)</i>
	IEF	Cottonwood Leaf Skeletonizer	<i>(Phyllonoryctes apparella)</i>
	IEG	Lodgepole pine Sawfly	<i>(Neodiprion burkei)</i>
	IEH	Phantom Hemlock Looper	<i>(Nepytia phantasmaria)</i>
	IEI	Saddleback Looper	<i>(Ectropis crepuscularia)</i>
	IEJ	Willow Leafminer	<i>(Microrapteryx salicifoliella)</i>
	IEK	Rusty Tussock Moth	<i>(Orgyia antiqua)</i>
IS		Shoot Insects	
	ISA	Bronze Birch Borer	<i>(Agrilus anxius)</i>
	ISB	Western Cedar Borer	<i>(Trachykele blondeli)</i>
	ISC	Poplar Borer	<i>(Saperda calcarata)</i>
	ISE	European Pine Shoot Moth	<i>(Rhyacionia buoliana)</i>
	ISG	Gouty Pitch Midge	<i>(Cecidomyia piniinopsis)</i>
	ISP	Pitch Nodule Moths	<i>(Petrova spp.)</i>
	ISQ	Sequoia Pitch Moth	<i>(Vespa mima sequoiae)</i>
	ISS	Western Pine Shoot Borer	<i>(Eucosma sonomana)</i>
	ISW	Poplar and Willow Borer	<i>(Cryptorhynchus lapathi)</i>
IW		Weevils	
	IWC	Conifer Seedling Weevil	<i>(Steremnius carinatus)</i>
	IWM	Magdalis Species	<i>(Magdalis spp.)</i>
	IWP	Lodgepole pine Terminal Weevil	<i>(Pissodes terminalis)</i>
	IWS	White pine Weevil (on Spruce)	<i>(Pissodes strobi)</i>
	IWW	Warren's Root Collar Weevil	<i>(Hylobius warreni)</i>
	IWY	Cylindrocopturus Weevil	<i>(Cylindrocopturus spp.)</i>
	IWZ	Yosemite Bark Weevil	<i>(Pissodes schwartzii)</i>
M	MITE DAMAGE		<i>(Trisetacus spp.)</i>
P	CONE and SEEDLING PATHOGENS		
	PAX	<i>Alternaria</i> spp.	<i>(Alternaria spp.)</i>

	PBC	Gray Mould	<i>(Botrytris cinerea)</i>
	PCD	<i>Neonectria radiculicola</i>	<i>(Neonectria radiculicola)</i>
	PCF	Seed or Cold Fungus	<i>(Caloscypha fulgens)</i>
	PCP	Inland Spruce Cone Rust	<i>(Chrysomyxa pirolata)</i>
	PDT	Cedar Leaf Blight	<i>(Didymascella thujina)</i>
	PFX	<i>Fusarium</i> spp.	<i>(Fusarium spp.)</i>
	PPG	Damping-off Disease	<i>(Phoma glomerata)</i>
	PPX	<i>Penicillium</i> spp.	<i>(Penicillium spp.)</i>
	PSS	Sirococcus Blight	<i>(Sirococcus strobilinus)</i>
	PTX	<i>Trichothecium</i> spp.	<i>(Trichothecium spp.)</i>
<b>C</b>	<b>CONE and SEED INSECTS</b>		
	CAH	Cone Resin Midge	<i>(Asynapta hopkinsi)</i>
	CBC	Fir (Fd) Cone Moth	<i>(Barbara colfaxiana)</i>
	CBX	Fir Cone Moth	<i>(Barbara spp.)</i>
	CCP	Douglas-fir Cone Scale Midge	<i>(Camptomyia pseudotsugae)</i>
	CDC	Spruce (Sx) Cone Gall Midge	<i>(Kaltenbachiola (Dasineura) canadensis)</i>
	CDD	Fir Seed Midge	<i>(Kaltenbachiola (Dasineura) abiesemia)</i>
	CDR	Spruce (Sx) Cone Axis Midge	<i>(Kaltenbachiola (Dasineura) rachiphaga)</i>
	CDX	Kaltenbachiola (Dasineura) Midges	<i>(Kaltenbachiola (Dasineura) spp.)</i>
	CEA	Fir Seed Maggot	<i>(Earomyia abietum)</i>
	CEB	Spruce Cone Maggot	<i>(Earomyia barbara)</i>
	CEQ	<i>Earomyia aquilonia</i>	<i>(Earomyia aquilonia)</i>
	CEX	Earomyia Maggots	<i>(Earomyia spp.)</i>
	CFP	Fir (Fd) Cone Beetle	<i>(Ermobius punctulatus)</i>
	CHX	Budworms	<i>(Choristoneura spp.)</i>
	CIA	Fir Coneworm	<i>(Dioryctria abietivorella)</i>
	CIP	Fir (Fd) Coneworm	<i>(Dioryctria pseudotsugella)</i>
	CIR	Spruce (Sx) Coneworm	<i>(Dioryctria reniculelloides)</i>
	CIS	Pine (Py) Coneworm	<i>(Dioryctria rossi)</i>
	CIV	Ponderosa pine (Py) Coneworm	<i>(Dioryctria auranticella)</i>
	CIX	Coneworms	<i>(Dioryctria spp.)</i>
	CLO	Western Conifer Seed Bug	<i>(Leptoglossus occidentalis)</i>
	CMA	Ponderosa pine (Py) Seed Chalcid	<i>(Megastigmus albifrons)</i>
	CMC	Spruce (Sx) Seed Chalcid	<i>(Megastigmus piceae)</i>
	CML	Subalpine fir (Bl) Seed Chalcid	<i>(Megastigmus lasiocarpae)</i>
	CMP	Fir Seed Chalcid	<i>(Megastigmus pinus)</i>
	CMR	<i>Megastigmus rafni</i>	<i>(Megastigmus rafni)</i>
	CMS	Fir (Fd) Seed Chalcid	<i>(Megastigmus spermotrophus)</i>
	CMT	Hemlock Seed Chalcid	<i>(Megastigmus tsugae)</i>
	CMX	Seed Chalcids	<i>(Megastigmus tsugae)</i>
	CNP	Pine Cone Beetle	<i>(Conophthorus ponderosae)</i>
	CPS	Spruce Gall Adelgid	<i>(Pineus similis)</i>
	CRX	Cone Scale Midges	<i>(Resseliella spp.)</i>
	CSN	Spiral Spruce Cone Borer	<i>(Strobilomyia neanthracina)</i>
	CTO	Fir (Fd) Cone Gall Midge	<i>(Contarinia oregonensis)</i>
	CTW	Fir (Fd) Cone Scale Midge	<i>(Contarinia washingtonensis)</i>
	CVP	White pine (Pw) Cone Borer	<i>(Eucosma ponderosa)</i>
	CVR	Lodgepole pine (Pl) Cone Borer	<i>(Eucosma recissoriana)</i>
	CYC	Spruce (Sx) Seed Midge	<i>(Mayetiola carpophaga)</i>
	CYP	Ponderosa pine (Py) Seedworm	<i>(Cydia piperana)</i>
	CYS	Spruce (Sx) Seedworm	<i>(Cydia strobilella)</i>
	CYT	Cedar (Cw) Cone Midge	<i>(Mayetiola thujae)</i>
	CYX	Seedworms	<i>(Cydia spp.)</i>
<b>T</b>	<b>TREATMENT INJURIES</b>		

	TC		Chemical Injury	
	TL		Logging Wounds	
	TM		Other Mechanical Damage (non-logging)	
	TP		Planting (incorrectly planted)	
		TPM	Planting (poor microsite)	
	TR		Pruning Wound	
	TT		Thinning or Spacing Wound	
<b>A</b>	<b>ANIMAL DAMAGE</b>			
	AB		Bear	
	AC		Cattle	
	AD		Deer	
	AE		Elk	
	AH		Hare or Rabbit	
	AM		Moose	
	AO		Pika	<i>(Ochotona spp.)</i>
	AP		Porcupine	
	AS		Squirrel	
	AV		Vole	
	AX		Birds	
	AZ		Beaver	
<b>V</b>	<b>PROBLEM VEGETATION</b>			
	VH		Herbaceous Competition	
	VP		Vegetation Press	
	VS		Shrub Competition	
	VT		Tree Competition	

# Appendix C

## SIBEC Definition of Suitable Site (Index) Tree

A site tree as defined by the criteria below must not be rejected if the criteria are met in a homogenous BEC site series:

- the largest diameter at breast height tree of the target species where breast height is measured on the high side of the tree (note: more than one target species may be sampled within a plot)
- dominant or co-dominant
- free of suppression (above breast height)
- not wolf, open-grown, or veteran
- straight-stemmed, free of disease, rot, insect damage, and other significant damage including forks, scars, and breakage (minor damage is allowed but should not occur over more than 5% of total tree height)
- Temporary exemption: Lodgepole pine and ponderosa pine trees that are in the green- or red-phase of Mountain Pine Beetle (MPB) attack are suitable site trees. However, these trees must be in recently attacked stands (green- or red-phase) and still meet all the other requirements of a site tree. [Note: for these trees, in the FS882 form enter Damage Type=IBM and Damage Severity=S; for the GIF, place checkmark in the "Path" box and include Damage Type=IBM and Damage Severity=S under Notes]
- vigorous with a full crown

### Reference

BC Ministry of Forests and Range, 2009. SIBEC sampling and data standards. Version 5.3. BC Ministry of Forests and Range, Victoria, BC. <https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/ecosystems/sibec-documents/standards.pdf> [accessed May 12, 2021]



# Appendix D

## Field Supplies – Examples

Thanks to Peter Hatch of Hatch Woodlands for these examples.



Photo 1 Example of Aluminum plot stakes for use as Reference Pins and IPC Pins



Photo 2 Example of (thick) plastic tree tags embossed with tree numbers used for tagging trees in the Population Based Samples (PBS).

Additional equipment includes: (1) Aluminum Tags to write the plot # and establishment date on to be attached to one of the stem-mapped trees near plot centre, and (2) Straws for storing increment cores to be taken back to the office for counting ages (without false rings) using a microscope.

Attachment to the Agreement with the successful proponent for K4R-G&Y-2022.

1.01 In this document, the following words have the following meanings:

- (a) "Approved " means approved in writing by a medical health officer or environmental health inspector.
- (b) "Camp " means land or premises on which there are cabins, tents, bunkhouses, or other structures owned, established, operated, or maintained by the Contractor as living quarters for its agents, employees, subcontractors, or others, with or without charge in connection with the Agreement.
- (c) "Contract Representative" means the person who is assigned by the contracting agency (Chinook Community Forest, or Recipient) to administer the contract on that agency's behalf.
- (d) "Food Premises " means food premises in which food is processed, served, or dispensed.
- (e) "Potentially Hazardous Food " any food or ingredient capable of supporting the growth of pathogenic organisms or the production of toxins.
- (f) "Sanitize" means to treat by a process that effectively destroys micro organisms including pathogens. If any of the words in the Agreement are used in this Schedule, they have the same meanings in this document unless the context dictates otherwise.

### **ARTICLE 2: Compliance with the Law**

2.01 Notwithstanding the terms and conditions of the Agreement, the Contractor shall comply with all laws affecting the Work, including the Public Health Act and its Food Premises Regulation , Health Act Communicable Disease Regulation , Sewerage System Regulation , Industrial Camps Health Regulation ; the Water Act ; the Drinking Water Protection Act and its Regulations; and the Tobacco Control Act and its Regulations.

### **ARTICLE 3: Application**

3.01 This Schedule does not apply to camps occupied by less than 5 persons.

### **ARTICLE 4; Accommodation Requirements**

4.01 The Contractor shall ensure that accommodation, which meets the minimum standards stated herein, is provided for their crew. If the Contractor's workers are to be housed in suitable off-site accommodation with safe, effective transportation to and from the worksite provided, an exception from providing a field camp as described may be obtained from the Contract Representative prior to the commencement of the Work.

### **ARTICLE 5: Inspection**

#### **Right to Inspect**

5.01 The Tobacco Enforcement Officer, Health Officer, WorkSafe BC Inspector, or Contract Representative may inspect a camp at any time or in the event of noncompliance with the Contract Documents, action may be taken against the Contractor either under this Agreement, under the Public Health Act or under WorkSafe BC

Regulations. Action may include financial penalties, camp closure, or contract termination as described below.

### **Assessments**

5.02 As per the Agreement and the actions provided by the regulations listed in Article 2 of this Schedule, if, in the opinion of Chinook Community Forest an inspection indicates the Contractor has failed to comply with any standards specified in this Schedule, Chinook Community Forest may in its sole discretion immediately impose upon the Contractor an assessment for re-inspection of two hundred and fifty dollars (\$250) each time Chinook Community Forest is required to re-inspect for compliance. Chinook Community Forest may repeat the assessment each time that a subsequent inspection indicates that the Contractor remains in non-compliance with the standards.

Tobacco Enforcement Officer and WorkSafe BC Inspectors may impose any assessments provided in their respective legislation.

### **Termination**

5.03 Notwithstanding any other rights or remedies available to it, Chinook Community Forest may terminate this Agreement and claim the Performance Security if:

(a) the Contractor does not provide a camp or obtain an exemption as stated in 4.01 above;

(b) the Contractor does not comply with a Notice to Comply;

(c) the camp is ordered "closed" by an official of the Ministry of Health or the Workers' Compensation Board or the Ministry of Forest Lands and Natural Resource Operations, Compliance Branch or any other agency with statutory authority.

### **ARTICLE 6: Standards:**

6.01 To facilitate routine inspection by a Health Officer, WorkSafe BC, and Chinook Community Forest the Contractor must provide the location of all camps and contact information to the local Health Authority, WorkSafe BC, and the Silvicon Services Inc. 72 hours prior to establishment of each and every camp site. The appropriate Health Authority is to be contacted as indicated at <http://www.health.gov.bc.ca/protect/industrial-camps.html> and WorkSafe BC contacted at [http://www.worksafebc.com/contact\\_us/default.asp](http://www.worksafebc.com/contact_us/default.asp).

### **Supervision**

6.02 The Contractor shall:

(a) be responsible for supervision of the camp.

(b) cause a legible copy of these standards to be kept permanently posted in a prominent place in the camp. (c) ensure that a "Silviculture Workers Fact Sheet" is posted in a visible location at each and every camp and that a copy is provided to each and every member of its workforce. The fact sheet is available from the Ministry of Labour, Citizens' Services and Open Government, Employment Standards Branch and from the website location: [http://www.labour.gov.bc.ca/esb/facshts/silviculture\\_workers.htm](http://www.labour.gov.bc.ca/esb/facshts/silviculture_workers.htm).

(d) maintain the camp, its sanitary facilities, appliances and equipment in good repair and in clean, sanitary condition at all times.

(e) accurately inform all employees of camp conditions and personal equipment requirements and ensure that, prior to hiring, employees are adequately equipped, including sleeping gear, where required.

(f) ensure that any domestic animals permitted in camp are properly controlled and not permitted access to food storage, preparation, or serving areas or waste disposal facilities.

## **Water Supply**

- 6.03 As per the *Drinking Water Protection Act*, the Contractor must obtain the approval of the Health Authority and, where provided, a Water System Operating Permit for all camp drinking water systems and the Contractor must comply with the conditions of the Water System Operating Permit.
- 6.04 As per the *Water Act* and its Regulations, the Contractor must obtain approval of the Ministry of Environment - Water Stewardship Division if it will be using or diverting water from stream beds including a lake, river, creek, spring, ravine, swamp or gulch.
- 6.05 In order to verify the safety of the drinking water system, the Contractor must provide bacteriological water samples at regular intervals and in a timely fashion from each camp location to the Health Authority as required by the Water System Operating Permit. Camps supplied with drinking water from sealed bottles purchased from a reputable grocery chain outlet or other suitable retail establishment will not be subject to watersampling.
- 6.06 An adequate supply of potable water shall be provided for drinking and food preparation purposes both at the camp and at the daily worksite.
- 6.07 Where the Health Region determines a permit is not required, the following minimum standard is to be followed in order to ensure that drinking water will be free of pathogenic (disease causing) organisms. Drinking water must be either:
- (a) obtained from a water supply system in accordance with the *Drinking Water Protection Act*; or
  - (b) in exceptional circumstances, otherwise treated by a method which has been authorized in writing by the Health Officer. Any conditions of such an authorization will form an integral part of this contract; or
  - (c) boiled.
- 6.08 All containers used for transporting or storing drinking water shall be used for no other purpose and shall be securely closed, arranged so that water can only be drawn from a tap (no dipping).
- 6.09 All potable water containers including those for personal use shall be maintained clean and free from contamination.
- 6.10 Where a water supply unfit for drinking is used for other purposes there shall be:
- (a) no physical connection with the drinking water supply; and
  - (b) warning signs placed on all outlets of the non-drinkable supply.

## **Campsite**

- 6.11 The general campsite area and specific locations of all camp facilities shall be located so that good natural drainage is provided.
- 6.12 Drainage from the camp shall not contaminate any water supply.
- 6.13 The camp location and boundaries shall be approved by the Contract Representative in charge and be confined to the agreed-to area.

## **Sleeping Accommodations Supplied by the Contractor**

- 6.14 Where the Contractor provides tents or other temporary membrane structures (the "Structures") for sleeping accommodations for the short-term camp, it must ensure the Structures:
- (a) having an area in excess of 18 square meters are inspected by a fire official for approval;

- (b) are not located within 6 meters of buildings, parked vehicles, internal combustion engines, or other tents or temporary membrane structures. For the purpose of determining required distances, support ropes and guy wires shall be considered as part of the Structures;
- (c) are adequately braced and anchored to prevent weather-related collapse, including their appurtenances;
- (d) are, including canopies, composed of flame-resistant material or shall be treated with a flame retardant in an approved manner;
- (e) flammable-liquid-fuel equipment shall not be used in the Structures or canopies;
- (f) flammable and combustible liquids shall be stored outside in an approved manner not less than 15 meters from the Structures or canopies;
- (g) there is sufficient ventilation to prevent the accumulation of disagreeable odours and condensation;
- (h) are enclosed and weatherproof and provide adequate artificial or natural lighting;
- (i) floors are of a smooth, easily cleanable finish and kept clean;
- (j) there is adequate floor space to prevent overcrowding
- (i) any two persons of opposite sex and not being persons living together as common-law or married are not required to sleep in the same room;
- (ii) an unobstructed clearance of at least 0.6 m between beds, and 1.0 m between each bed and the ceiling;
- (k) individual dry storage space for personal possessions and clothing for each employee;
  - (l) no room used for sleeping accommodation is used for drying clothes;
- (m) a moisture barrier (ground sheet) must be used where the bedding is not elevated 30 cm or more above the ground;
- (n) mattresses and pillows that are supplied at a camp must be encapsulated by a waterproof barrier to ensure they remain in a sanitary condition.
- (o) all mattresses, sheets, pillows, pillow cases, blankets and bed covers are kept in a clean and sanitary condition and laundered to keep them sanitary and before each new user.

6.15 Bunkhouses or dwelling houses used for sleeping accommodations must also comply with the Industrial Camps Health Regulation.

### **Communicable Diseases**

6.16 As provided by B.C. Reg. 4/83 of Schedule 'A' of the *Public Health Act*, Communicable Disease Regulation, where a person knows or suspects that an animal or another person is suffering from or has died from a communicable disease, he/she shall, without delay, make a report to the Medical Health Officer. A copy of the report shall be forwarded to the Director, Occupational Health Department, and Workers' Compensation Board.

### **Kitchen and Meals**

6.17 As per the Food Premises Regulation, the Contractor must obtain the approval of the Health Authority and an operating permit for all Food Premises and the Contractor must comply with all conditions of the operating permit.



6.18 The Contractor shall ensure:

- (a) A kitchen or food preparation area shall be provided for that exclusive use and shall be separate from any other room. This room must be constructed so as to deter the entry of insects and vermin. Walls shall be smooth, durable, non-absorbent and maintained in a clean condition. Kitchens shall be supplied with smooth durable, non-absorbent, easily cleanable floors.
- (b) A balanced diet of sufficient quantity shall be provided for the workers by the Contractor.
- (c) Hand basins with hot and cold water, soap and disposable towels shall be provided in a location convenient to the kitchen area for the use of food handlers.
- (d) Eating or drinking utensils shall be thoroughly cleaned and sanitized after each consecutive use. Personal water bottles, supplied by the Contractor, shall be cleaned daily.
- (e) Food preparation and dining surfaces shall be finished with a smooth, durable, non-absorbent surface and shall be kept clean and sanitized.
- (f) Utensils shall be scraped, washed clean and sanitized after each usage as follows:
  - i) first sink - wash in warm water (43°C/110°F) with detergent;
  - ii) second sink - rinse in clear warm water (43°C/110°F);
  - iii) third sink - sanitize by immersion in warm clean water containing 100-ppm chlorine (1 tablespoon of unscented bleach per gallon of water);
  - iv) air dry on clean non-absorbent surface.

### **Dining Room**

6.19 A dining room of sufficient size to effectively accommodate the serving and eating of meals shall be provided. This room shall be separated from the kitchen and kept in a clean and sanitary condition.

6.20 The dining area shall be dry, heated, and constructed so as to deter the entry of insects and vermin. If connected to the kitchen area, dining rooms shall be supplied with smooth, durable, non-absorbent, easily cleanable floors.

### **Food Handlers**

6.21 The Contractor shall ensure:

- (a) No person who is a carrier of, or suffering from, a communicable disease shall perform food handling duties.
- (b) Food handlers shall wash their hands thoroughly, frequently, and always after using the toilet. They shall wear clean clothes, keep hair in place and keep fingernails short and clean.
- (c) All food handlers shall have a valid FOODSAFE certificate indicating their completion of a basic food handler's course recognized by the Ministry of Health.

### **Food**

6.22 The Contractor shall ensure:

- (a) All food supplies shall be from a commercial source and protected from contamination at all times. Special care shall be taken to ensure that hazardous foods, which will not be cooked before eating, are not exposed to contamination from unwashed hands or dirty equipment.
- (b) Ice shall be of drinking water quality.
- (c) Hazardous foods shall be maintained at a temperature below 4.0°C/40°F or above 60°C/140°F at all times. Refrigeration and hot holding temperatures must be monitored and logged at least daily while the camp is operating.

- (d) Refrigeration equipment with sufficient space to store all hazardous foods kept at the camp, shall be provided. Each unit shall contain a thermometer to monitor its operability.
- (e) All food supplies shall be stored off the floor and protected from dirt and contaminants.

### **Food Equipment**

- 6.23 Containers for food storage shall be easily cleaned, durable, non-absorbent, non-toxic, non-corrosive and designed to be tightly closed. Such containers shall be used whenever stored food is at risk from water, insects, vermin, or other sources of contamination.
- 6.24 All food service equipment and utensils shall be of food service quality and free from breaks, corrosion, cracks, open seams and chips and shall be kept clean and sanitized.
- 6.25 When not in use utensils, dishes and kitchenware shall be stored in a cupboard to protect from insects, dirt and contamination. Other items shall be stored off the floor and protected from dirt and contaminants. All kitchen or dining room structures must be constructed so as to be easily cleaned and sanitized.

### **Food Safety Management**

- 6.26 The Contractor must establish a written Food Safety Management Plan and a Sanitation Plan that ensures a health hazard does not occur in the handling of food and the sanitization of the Food Premises. The Plans must be submitted by the Contractor to the Health Authority for its review.

### **Sanitary Facilities**

- 6.27 The Contractor shall provide enclosed, hot water showers, which are screened from view to ensure that employees can conveniently maintain personal hygiene. Each shower shall have an adjacent dressing area. Construction shall include smooth, easily cleanable floors and walls.
- 6.28 Flush toilets shall not be installed unless connected to a public sewage system or an onsite sewage disposal system that has been constructed in compliance with the *Public Health Act Sewerage System Regulation*.
- 6.29 Toilets (privy's) shall be conveniently located and constructed and maintained so that:
  - (a) flies, insects, rodents or other animals are deterred from gaining access to the waste materials in the pit;
  - (b) surface or ground water cannot enter the pit;
  - (c) waste material does not contaminate a water supply;
  - (d) the enclosure is vented;
  - (e) they are located a minimum of 30 metres from any lake or stream and 10 metres from food service areas of the camp;
  - (f) they are enclosed and provide privacy.
- 6.30 Wash basins with an adequate supply of clean water shall be provided for hand washing purposes in the numbers specified in the table below.
- 6.31 The facilities described in 6.27, 6.29 and 6.30 above must not be less than the number as per the following table.

For each group of 6 persons in addition to 100, add 1 wash basin

For each group of 20 persons in addition to 100 add 1 privy and shower.

**Summary Table For Camp Standards**

No. of Persons in Camp for Whom Accommodations is Available at Camp (from/up to and including)	Minimum No. of Privies	Minimum No. of Showers	Minimum No of Wash Basins
1 - 7	1	1	1
8 - 15	2	1	3
16 - 30	3	2	6
31 - 45	4	3	9
46 - 60	5	4	12
61 - 75	6	5	15
76 - 100	7	6	20

6.32 Privy pits no longer in use shall be filled with soil and marked with a durable sign to warn future visitors to the contaminated area.

6.33 Sanitary facilities must be maintained in a clean and sanitary condition

**Garbage and Sewage**

6.34 All sewage generated including but not limited to privy, shower, and kitchen facilities must be disposed of in a manner approved by Health Authority. Permits may be required depending on the camp's facilities and location and the Contractor must comply with any permits issued.

6.35 Any approved infiltration pits shall not be less than 30 meters from any lake or stream and shall not be permitted to overflow or accumulate onto the soil surface.

(a) sewage and wastewater from kitchen or food service areas shall be disposed of in a closed infiltration pit with a closed delivery system that is sealed to the access of flies and vermin (i.e. open ditches are not permissible).

(b) wastewater from bathing or washing shall also be disposed of in a covered infiltration pit.

6.36 Garbage shall be stored in wildlife and insect proof containers conveniently located and in sufficient numbers.

6.37 Garbage shall be hauled to a waste management site every day where there is a bear problem, under all circumstances, no longer than 3 days.

**Dry Room**

6.38 A heated dry room for the exclusive purpose of drying clothes shall be provided separate from the food preparation and serving areas.

6.39 The Contractor will provide Chinook Community Forest a copy of their COVID19 Infection Prevention & Control Plan upon request.

Attachment to the Agreement with the successful proponent for K4R-G&Y-2022

### Insurance requirements:

The contractor shall, without limiting its obligations or liabilities herein and at its own expense, provide and maintain and following insurance's with insurers licensed in British Columbia and in forms and amounts acceptable to Chinook. The Contractor shall provide Chinook Community Forest with evidence of all such required insurance before the commencement of the Work. Such evidence shall be in the form of a completed Certificate of Insurance. When requested by Chinook Community Forest the Contractor shall provide certified copies of required policies.

(a) Comprehensive General Liability in an amount not less than two million dollars (\$2,000,000) inclusive per occurrence against bodily injury and property damage. Chinook Community Forest is to be added as an additional insured under this policy. Such insurance shall include, but not be limited to:

- (i) Products and Completed Operations Liability,
- (ii) Blanket Written Contractual Liability,
- (iii) Contingent Employer's Liability,
- (iv) Personal Injury Liability,
- (v) Non-owned Automobile Liability,
- (vi) Cross Liability,
- (vii) Employees as Additional Insured,
- (viii) Broad Form Property Damage, and
- (ix) Forest Fire Fighting Expense Coverage in an amount of at least one million dollars (\$1,000,000);

(b) Automobile Liability on all vehicles owned, operated or licensed in the name of the Contractor, in an amount not less than one million dollars (\$1,000,000);

(c) all the foregoing insurance shall be primary and not required the sharing of any loss by any insurer of the Chinook Community Forest.

(d) all insurance except ICBC automobile liability insurance shall be endorsed to provide Chinook Community Forest with 30 days advance written notice of cancellation or material change: and

(e) the Contractor hereby waives all rights of recourse against Chinook Community Forest with regard to damage to the Contractor's property.