

Foothills Growth and Yield Association

Lodgepole Pine Regeneration Project

FIELD MANUAL

VERSION 2.1

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1. Project Overview

The general purpose of the Project is to forecast and monitor the growth and yield of regenerated lodgepole pine stands in relation to site, early crop performance and stocking, vegetative competition, and density regulation.

The Project is designed to answer the following questions:

- What are the relationships between early stand conditions (stocking, height growth, density, competition) and subsequent growth and yield?
- How does stand growth and yield respond to different levels of initial spacing and pre-commercial thinning?
- How do these responses and relationships vary across sites of primary interest?

The experimental objectives are:

1. Estimate the effects of site and establishment factors on early crop performance.
2. Estimate the effects of site and establishment factors on subsequent stand growth and yield.
3. Estimate the effects of early crop performance and density regulation on subsequent stand growth and yield.

The trial is a three-level split-plot design. It will initially consist of 90 field installations (five ecosites x six spacings x three replications), with each installation split into four plots (vegetation management treatments). The three levels are described below.

Level A:

Installations within each of the five ecosite categories will be blocked into three geographic “groups”, to produce a total of 15 groups. Each group will consist of six installations having the same ecosite and similar climatic, edaphic, and site preparation characteristics.

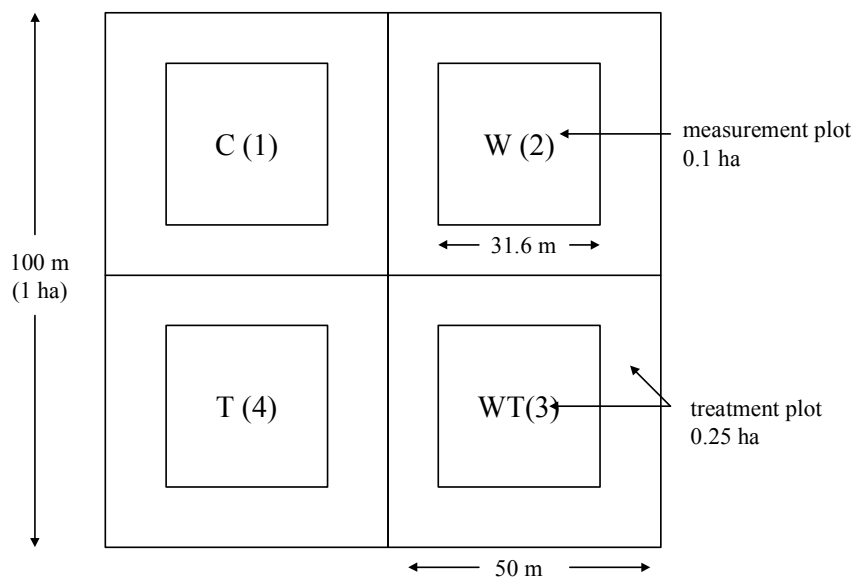
Level B:

Six installations (one for each spacing treatment) in each of the 15 “groups”.

Level C:

Each installation will be split two ways (weeding / no weeding and eventually thinning / no thinning) to produce four management treatment plots.

A diagram representing the preferred layout of an individual installation with four treatment and measurement plots is shown in Figure 1. The entire installation will be planted at one of six densities.



Treatment Plot 1 = C: Control
 Treatment Plot 2 = W: Weeding
 Treatment Plot 3 = WT: Weeding & Thinning
 Treatment Plot 4 = T: Thinning

Figure 1. Installation Diagram.

2. Sites and Treatments

2.1 Ecosite

Table 1 shows the five ecosite categories, and references the associated field guides and natural sub-regions.

Table 1. Five Ecosite Categories.

	Ecosite (and Edatope)	WC	SW	NSR
1	Bearberry/lichen/hairy wild rye <i>(submesic/subxeric, medium-low)</i>	b,c	b	any
2	Labrador tea –mesic <i>(mesic-poor)</i>	d	c	UF LF
3	Billberry/cranberry/sarsaparilla/rhododendron <i>(mesic-medium)</i>	e	d	SA/UF LF
4	Honeysuckle/fern (subhygric-rich)	f	e	UF LF
5	Labrador tea-hygric <i>(hygric-poor)</i>	h	f	any

2.2 Management Treatments

Controlled management treatments include six specified planting densities (including a no planting “control”), and four vegetation management treatments (see Tables 2 & 3).

Table 2. Six Spacing Treatments.

Spacing # Code	Spacing (m ²)	Density (stems/ha)	Trees/plot (0.25/0.1 ha)
1	Control	0	0
2	3.5	816	204/082
3	3.0	1111	278/111
4	2.5	1600	400/160
5	2.0	2500	625/250
6	1.5	4444	1111/444

Table 3. Four Vegetation Management Treatments.

1	C: Control	No vegetation management treatments
2	W: Weeding	Remove competing vegetation
3	WT: Weeding & Thinning	Treatments 2 & 4 are carried out.
4	T: Thinning	Pre-commercially thin to set spacing density

3. Required Supplies and Equipment

The following is a basic list of supplies required for plot installation:

1. 5.0' conduit center post (one per measurement plot plus one for installation center = five per installation). Two holes drilled (one at 5 cm from one end, the second 5 cm down from the first) for attaching plaque.
2. 5.0' lengths of conduit tubing (12 per installation, for outside blue protective buffer).
3. 5.0' lengths of conduit tubing (eight per installation, for orange buffer).
4. 5.0' lengths of conduit tubing (four per measurement plot, 16 per installation - red).
5. 9-gauge, 45 cm pigtails. (Approximately 4200 per group of six installations. The number per installation will vary from about 320 to 1780 (80 to 444 per measurement plot), depending on the spacing treatment). It is optional but suggested that different color pigtails be used for each treatment plot to aid in identifying plots in the field. Suggested colors are 1: Purple, 2: White, 3: Yellow, 4: Black. Marking Treatment plot centers and Establishment plot centers may be done with any type of tags, providing they clearly identify the treatment plots and are hardy enough to withstand weather and animal damage. Flat placards attached to the posts are not recommended because of animal browsing and wind.
6. 1.0 m lengths (longer length optional) of conduit tubing for marking regeneration plot centers (16 per measurement plot, 64 per installation - green).
7. Aluminum tags and wires for numbering seedlings, (approx. 4200 per group of six installations).

8. Paint: Blue, Orange Glo, Green, and Red. Ensure that proper type paint is used if applying to galvanized conduit.

The length of center, corner and boundary posts, and the frequency of posts marking the external (blue) buffer, may be increased if field conditions warrant more visible demarcation i.e., high competition sites.

The following equipment is suggested:

1. Sledgehammer.
2. 50 m steel tape.
3. Laser distance measurement tool or total station (optional).
4. Staff compass (if total station not utilized).
5. Metal clipboard and tally sheets (or data logger).
6. Shovel.
7. Clinometer.
8. Altimeter (calibrated at least once daily).
9. Orange and blue flagging tape.
10. Field Guide to Ecosites of West-central or Southwestern Alberta (depending on location).

4. Selection and Verification of Plot Locations

4.1 Cut Block Selection

Initial selection will be based on sampling from a list of candidate cut-blocks that are available for planting in 2000 or 2001, are to be managed for lodgepole pine, and fall within one (or more) of the five ecosite categories (see Table 1). Sufficient information is required to locate the centroid of the block on the UTM grid, and to identify the most probable ecosite category. Useful additional information includes: pre-harvest assessment, area, natural sub-region, eco district, confirmed ecosite(s), edatope, elevation, latitude, aspect, slope percent, slope position, soil classification, pre-harvest ecosite phase, pre-harvest site index, site preparation method and equipment, and proposed planting stock and season. (All six installations in a “group” should have the same site preparation method and contractor. Planting stock type and time of planting should be homogenous between the six installations as well).

The preliminary selections require field checking to confirm that each cut-block within a group contains a minimum of one square hectare and meets the following conditions common to all other cut-blocks within the group:

1. Same ecosite category and position on edatopic grid.
2. Similar soil texture, drainage, and parent material.
3. Within 100 m elevation.
4. Slope less than 10%. (If slopes are greater than 10%, all slopes will be within a 5% variance).

5. Similar slope position: upper, mid, lower (if lower slope position, take particular care to ensure similar soil drainage and nutrient regime).
6. Similar aspect. Ensure commonality with respect to N versus S, and wind exposure, preferably within 45 degrees.
7. No evidence of significant differences in brush hazard.
8. Same method and time (season and calendar year) of site preparation, and preferably (but not necessarily) the same site preparation contractor.
9. Maintain a minimum buffer distance of 20 m from the treatment plots to block edges, roads, or other disturbances likely to create edge effects. No burning of slash piles should have occurred, or be scheduled, anywhere within the installation or (blue) protective buffer. If a suitable block is selected but has slash piles or residual timber, the option exists to move the slash and/or eradicate the residual timber.

In the event that candidate locations fail to meet these criteria, that access costs are prohibitive for some blocks, and/or that some blocks are geographically distant from the rest of the group, alternative blocks may be substituted for the candidate ones providing that the substitute blocks meet the above criteria. Where large cut blocks are available, and difficulty is encountered in identifying six blocks with common criteria, consideration may be given to locating more than one installation in a single cut block.

Typical, square, four treatment plot installations are often not possible to establish due to discontinuities in ecosites or one or more of the conditions listed above. In such situations the installation may be reconfigured so that the four treatment plots are in a line, staggered, or separated. Note that the requirement for buffering described in point 9. above continues to apply. In split installations it is essential that treatment plots are carefully and clearly marked so that there is no confusion in the future as to what treatment should occur on what site. The treatment plots should be numbered clockwise from one to four starting with the most Northwesterly plot as “Control” or Plot one.

Determination of whether a block is sufficiently accessible will be left to the individual member. Although it is desirable to constrain allocation of plots as little as possible, it should be borne in mind that establishment of the installation creates a commitment to continual monitoring. Plots should be located only where the member is willing to pay for subsequent re-measurement.

4.2 Locating the Plot Installation within the Cut Block

1. Prepare a map of the cut block, delineating stand edges, roads, potential tie points, and boundaries of ecosite groups if available. Prepare a 50 m numbered dot grid that coincides with the scale of the map (1:5000 suggested).
2. Place the dot grid on the map, aligning the grid with the cardinal directions. Using a list of random numbers provided, match the first available number from the list with the same number on the dot grid that falls within the block and the desired ecosite group. Note the selected point.

3. Using a chain/tape and compass, locate the selected point on the ground. Verify whether the selected point lies within a homogenous 1 ha area meeting the nine criteria listed in the previous section by going to all four corners of the installation and doing a reconnaissance of the whole installation. Initially attempt to use the selected point as the installation center. It is preferred, but not essential, that the installation be aligned with the cardinal directions.
4. If the location does not meet the nine criteria, the installation center may be moved to fit the installation into a homogenous area of the cutblock that will accommodate an installation. Invariably, instances will occur where installations will have to be “split” into two or more pieces to fit into homogenous areas.

4.3 Soil Assessment

Soils will be assessed and data collected at each treatment plot center once the installation has been deemed to be a viable location. When trying to locate a suitable establishment/treatment plot location, dig or auger soil pits next to treatment plot centers (leave room for plot center posts if not already in place). Assess the soil moisture and nutrient regime classes, following the procedures and keys provided in the ecosite guide for each geographic area. Ensure that the soil characteristics meet the requirements for the eco-site targeted as well as having similar characteristics as other installations from the same group. Additional checks may be located where required to ensure homogeneity of the site with respect to soil moisture and nutrient regime class. If an installation/treatment plot is to be installed in this location, the soil data may be collected at this time or left to collect on a subsequent site visit.

5. Installation Layout

5.1 Treatment Plots and the Installation Boundary

The following procedure applies to a normal installation aligned with the cardinal directions (see Figure 2). The procedure will need to be adjusted for installations not orientated in the cardinal directions, and for split installations. This layout method is optional, as many contractors will be using Total Stations for their installations. Any method is acceptable as long as the plot layout is within the acceptable tolerances.

1. Locate the installation center.
2. From the installation center, establish a line @ 315 Az for 13.01 m. Establish this point with conduit pipe and paint **red**. This is the SE corner of measurement plot 1.
3. Continue from step 1, and measuring from the installation center, establish a line @ 315 Az for 35.35 m. Establish this point with a conduit center post. This is the center of treatment and measurement plot 1.
4. Extend the line created in step 2 @ 315 Az from the installation plot center for 57.70 m. Establish this point as the NW corner of measurement plot 1 and paint **red**.
5. Extend the line created in step 1 @ 315 Az from the installation plot center for 70.71 m. Establish this point as the NW corner of treatment plot 1 and paint **orange**.
6. Extend the line created in step 1 @ 315 Az from the installation plot center for 99 m. Establish this point as the NW corner of the protection buffer and paint **blue**.

7. Repeat steps 2-6, substituting 45 Az for 315 Az, this will establish plot 2 and the NE portion of the installation.
8. Repeat steps 2-6, substituting 135 Az for 315 Az, this will establish plot 3 and the SE portion of the installation.
9. Repeat steps 2-6, substituting 225 Az for 315 Az, this will establish plot 4 and the SW portion of the installation.
10. From the installation center establish lines for 50 m north, south, east and west. Establish conduit posts at these points and paint **orange**.
11. Using the 5.0' conduit pole fill in the **blue** protective boundary by establishing poles less than or equal to 45 m apart.

Note: Check that the orange boundary is at least 20 m clear of any disturbance or edge that could effect the treatment plots.

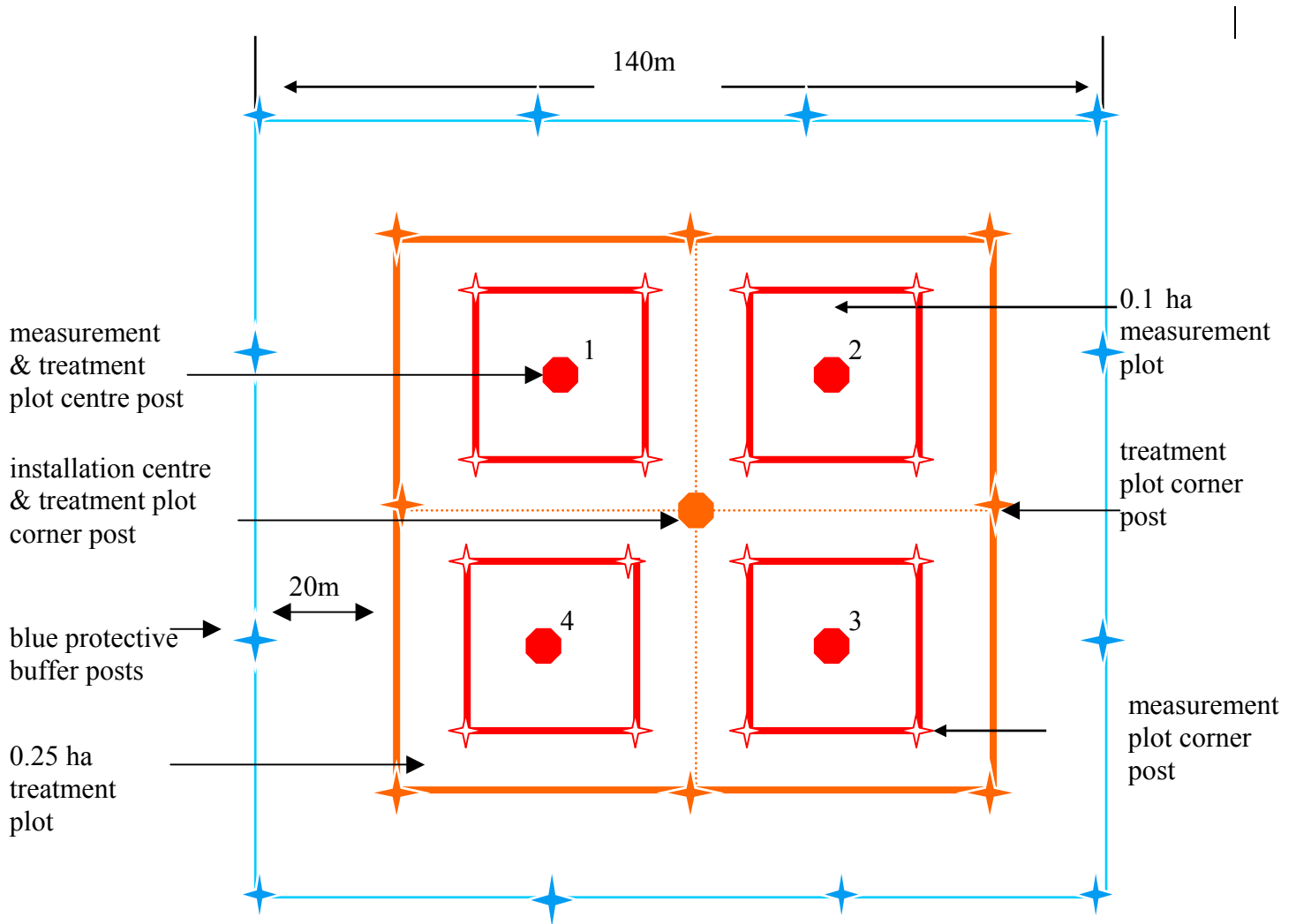


Figure 2: Installation Layout for an Installation with four Treatment and Measurement Plots.

5.2 Measurement Plots

Lay out the four 0.1 ha measurement plots shown in Figure 2 as follows.

Plots 1 and 3:

1. Establish a staff compass at the NW corner of the measurement plot. Lay out a line 31.60 m at 180 degrees. Establish a conduit post here (SW corner).
2. Measure the distance to the SE corner established earlier. It should be 31.60 m. The allowable closure error cannot be greater than 35 cm.
3. Move the compass to the SE corner. Lay out a line 31.60 m long at 360 degrees. Establish a post here (NE corner).
4. Move the compass to the NE corner. An azimuth of 270 degrees and distance of 31.60 m should lead exactly to the NW corner. The allowable closure error cannot be greater than 35 cm. Measure the diagonal distance from the NW corner to the SE corner. If this distance is within 50 cm of the required 44.69 m, the plot layout is acceptable. If the distance is less than 44.19 m or greater than 45.19 m, the plot layout must be re-done.

Plot 2 and 4:

1. Establish the compass at the NE corner of the plot. Lay out a line 31.60 m at 180 degrees. Establish a conduit post here (SE corner).
2. Measure the distance to the SW corner established earlier. It should be 31.60 m. The allowable closure error cannot be greater than 35 cm.
3. Move the compass to the SW corner. Lay out a line 31.60 m long at 360 degrees. Establish a post here (NW corner).
4. Move the compass to the NW corner. An azimuth of 90 degrees and distance of 31.60 m should lead exactly to the NE corner. The allowable closure error cannot be greater than 35 cm. Measure the diagonal distance from the NE corner to the SW corner. If this distance is within 50 cm of the required 44.69 m, the plot layout is acceptable. If the distance is less than 44.19 m or greater than 45.19 m, the plot layout must be re-done.

The plot layout sequence and methods described here need not be followed specifically; however, distances and allowable error must not differ from those previously described. The procedure will need to be adjusted for plots not orientated in the cardinal directions.

Once the installation has been laid out, ensure all posts are firmly in place. Be sure the appropriate tag/plaque is securely established on each plot and installation center post.

5.3 Regeneration Plots

Install center posts (green) for 16 regeneration sub-plots in every measurement plot. This will require the layout of a 7.90 m square grid, commencing 3.95 m from the edge of the measurement plot (see Figure 3). This is best accomplished using a Total Station. However, accurate layout can also be done by having a crew member at each end of the plot holding the tape tight and a third person going along the tape and placing the regeneration posts at their appropriate locations.

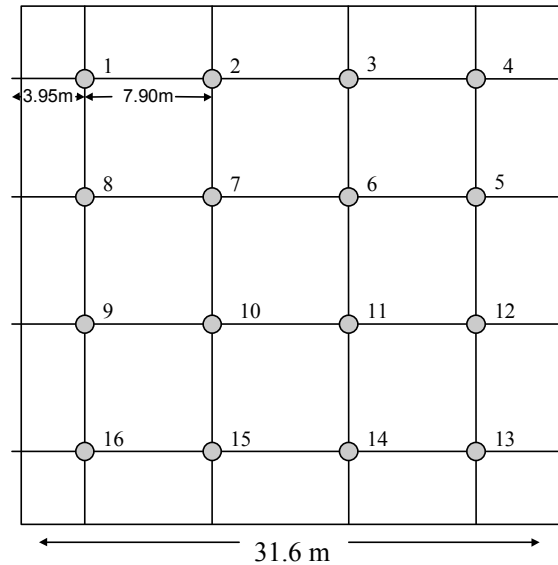


Figure 3. Layout of Regeneration Plots within the Measurement Plot.

5.4 Establishing a Tie point

Once all work at the plot is completed, establish a tie point. Starting at the installation center, accurately chain out to a natural or manmade tie point using a steel or nylon chain. All azimuths and distances must be recorded *from* the tie point *to* installation center (or treatment plot centers if installations are split). Acceptable tie points are:

- a). Where roads cross creeks.
- b). The center of road junctions.
- c). Where power lines, pipelines, or seismic lines cross roads.
- d). Creek junctions.
- e). The point where roads enter into cutblocks.
- f). Established and marked block corners.
- g). Alberta Land Survey legal monuments.

5.5 Industrial Sample Plot Protection (ISP).

Once a location has been confirmed and set up it is essential that Industrial Sample Plot notation is applied for in order to protect the installations from other potential land users. The application process involves doing a LSAS land status check on the area to be applied for, making a sketch and submitting an application to the Government as per the standards located in the reservation/notation guide located on the Government web page:

www.agric.gov.ab.ca/publiclands/res_index.html

On applications be sure to provide hectares per LSD as well as total hectares, this will speed up the process. GPS coordinates, contact names, etc, can be entered in the Agency comments field on the application. The Agency Comments section should also state something similar to the following: “Industrial Sample Plot located in harvested cutblock #XXXX, plot is marked with blue painted posts”. Term required is 20 years. Land use restriction should state No Entry” The Governments Integration Committee has approved a code for Growth and Yield Research Plots: 0284.

The assigned ISP number will be recorded in the database. (See section 8.1.10 Administration/Site History - #8 ISP Number)

6. Treatment Procedures

6.1 Planting and Initial Spacing

The whole installation (the four treatment plots, NOT the blue buffer) must be planted following the prescribed spacing and density (see Table 2). The blue buffer area should be planted to the operational density that is prescribed for the rest of the block.

All installations within a group should be planted in the same season, with the same type of planting stock. If possible the same planting crew should plant all six installations within a group. If the block has already been planted in the same season, trees may be filled in or culled to achieve the required density.

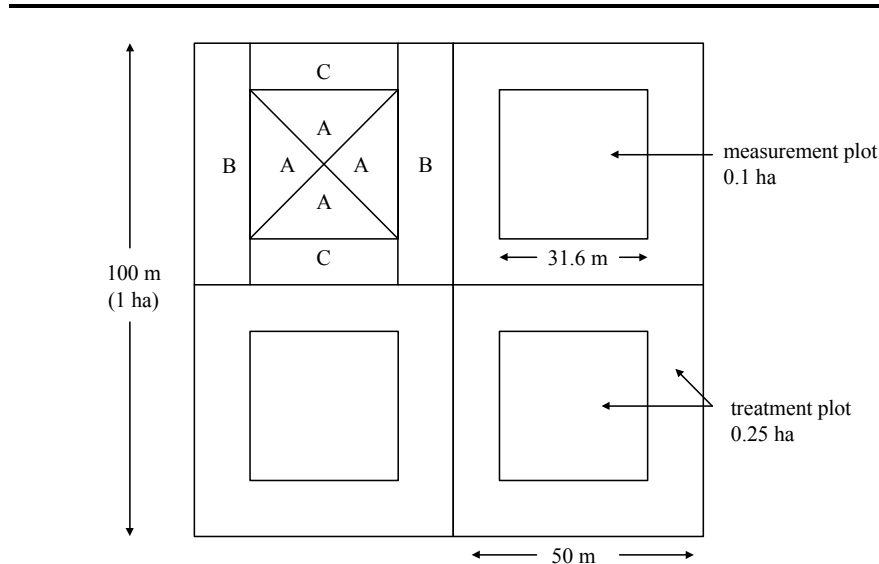
Planters may deviate by up to one meter from the theoretical planting location implied by the required spacing, in order to select suitable micro sites. The specific method for meeting the required densities will be left to the discretion of the contractor. The recommended approach for controlling planting density is no formal grid; but instead divide and string the treatment plot into segments, and control the number of trees by segment. In Figure 4, the segments are illustrated in the NW treatment plot of the installation. The areas of each segment are as follows:

- a). 0.0250 ha
- b). 0.0460 ha
- c). 0.0290 ha

Therefore, to obtain the required number of seedlings in each, multiply the required density (stems/ha) by the appropriate segment area.

Close supervision of the planting crew(s) is essential to ensure the planting objectives are met.

Figure 4. Recommended Approach for Controlling Planting Density.



6.1.1 Fill-in Planting

In order to maintain as closely as possible the targeted initial spacing, fill-in planting may be required to replace planted trees that have died. Fill-in planting should take place during normal and appropriate planting seasons and conditions. Nursery stock (the same type as original planting) is to be used. If possible, planting 2+0 stock or other “older” stock to “catch up” is recommended. Transplants using planted stock or natural regeneration are not permitted. The replacement tree will be planted near the original seedling in an appropriate micro site. The original tree (dead) should be left in place and not pulled out.

The decision as to whether fill-in planting is required will be based on annual mortality checks. If the number of surviving planted trees is less than 90% of the target planting density on any measurement plot, all dead planted trees within the treatment plot will be replaced tree by tree. This will maintain the original planting density. To facilitate the ordering/securing of planting stock, plots assessed during the regular measurement window may be planted the next regular planting season (Spring or Summer). Fill-in planting will not be continued after the third growing season.

Seedlings planted to replace dead trees will be given a unique number, DO NOT use the number from the dead tree as this number remains in the database as a “dead tree” and its record cannot be replaced.

6.2 Vegetation Management – Weeding

Weeding will be conducted on treatment plots 2 and 3 of every installation (including “0” planting density installations), as required, to maintain brush competition below specified index values.

6.2.1 Treatment Method

The selected primary treatment method is backpack (ground) fall foliar spraying with glyphosate. Basal bark application of triclopyr ester may also or alternatively be used where aspen competition exceeds specified thresholds (see below). Manual weeding of treatment plots where competition index has reached thresholds, but does not warrant herbicide treatment, may be considered on a plot by plot basis.

Glyphosate (trade name *Vision*) is a non-selective, post emergent, systemic herbicide that is extensively used on forestry to control a wide range of annual and perennial grasses, broadleaf weeds and woody plants.

Triclopyr (trade name *Release*) is a selective, post emergent, systemic herbicide that can be used for highly selective control of woody plants and broadleaf weeds in woodlands.

Fall foliar spraying of glyphosate may be undertaken August to mid-September. This is after lodgepole pine buds have formed and hardened off. Grasses and weeds are still susceptible to herbicide at this time, and there is thus little chance of any herbicide injury to conifers. Woody plants may be less susceptible to glyphosate than to triclopyr, especially with fall application.

The decision to apply herbicide will be made on a plot-by-plot basis. (Each treatment plot is 0.25 ha.) Once the decision is made to spray a plot with glyphosate, normally the entire 0.25 ha will be sprayed. Triclopyr will be applied selectively to targeted woody plant species.

Application rates and concentrations will be determined by expert evaluations of site, crop and vegetation data gathered during the two years prior to application.

6.2.2 Competition Index and Treatment Thresholds

Competition index (CI) will be measured and computed annually on all plots for at least the first three growing seasons, and thereafter periodically as required. Separate assessments are made for the shrub/herb layer and deciduous tree competition. The measurement procedures facilitate the computation of a number of different CI systems. At least initially, the following simple static index will be used, based on the work of Comeau¹:

$$CI = ((\%C_1 \times H_1) + (\%C_2 \times H_2) + (\%C_3 \times H_3) + (\%C_4 \times H_4) + (\%C_5 \times H_5)) / CTH$$

where:

CI = competition index for a single crop tree;

¹ Comeau, P. 1993. *Competition indices in decision-making*. Proceedings: NIVMA AGM.

$\%C_n$ = percent cover for the nth competitor species within a specified radius of the crop tree);
 H_n = modal height of the nth competitor species in cm; and,
CTH = height of the crop tree in cm.

A maximum of five competitor species will be included in each calculation, and to qualify the species must have a cover of at least 5%. The average of individual crop-tree indices will be computed for each treatment plot.

To assess “0” planting density installations for competition, follow the regular protocol with the exception that the best natural coniferous (ingress) seedling (>10.0 cm in height) within each regen plot is selected as the crop tree. This natural seedling must be tagged and given a unique number. All size and growth measurements, and stocking/density measurements/assessments should be taken for this ingress seedling.

Based on provisional expert opinion, validated by experimental data provided by Weldwood of Canada, the following CI values will be used as a “guide” to determine the need for herbicide application to a treatment plot:

shrub and herbs:	60
deciduous trees:	100

If only a portion of a treatment plot exceeds these thresholds, treatment may be considered to avoid creating variability within the plot. If the density of aspen exceeds 400 stems per ha, even if the CI is less than 100, consideration may be given to treatment. The final decision to spray a plot should be based on assessments made earlier in the same season. Installations which, based on the previous year’s assessments or local knowledge of the sites, are candidates for vegetation control, should be queued first for measurement. This will provide a window for assessment, making the spray decision, and spraying, if required, by mid September.

Application of the above threshold values are expected to result in a maximum of about 40% of the brushing treatment plots requiring treatment. This equates to a total of 20 ha for the entire field trial.

6.2.3 Regulatory Approval Process for Herbicide Use

For the purposes of regulatory planning and approval by the Government of Alberta, all herbicide treatments for the Regenerated Lodgepole Pine Trial will be reviewed, approved, monitored and reported as a single Industrial Evaluation Project. The Association’s Coordinating Agency will prepare the industry proposal, with input from the Technical Committee and approval of the Steering Committee. The proposal will be developed according to requirements outlined in the *Forest Management Herbicide Reference Manual* (Alberta Environment, Land and Forest Services, February 2001). No public involvement or notification will be required, because the Project is expected to involve not more than 20 ha of herbicide treatment. (This may be subject to further review if annual treatments consistently exceed the 20 ha limit.) The Coordinating Agency will prepare and submit a single monitoring report each year, in conformance with provincial guidelines and a monitoring reporting plan submitted as

part of the Project proposal. The monitoring plan will include monitoring and reporting obligations for individual members, consistent with their roles and responsibilities as specified in the Memorandum of Agreement among Association members.

The Project plan will cover the entire period over which herbicides are expected to be required to establish crop trees on the brushing treatment plots. However, approval will be granted on an annual basis, and subject to annual review, with revisions if justified.

6.2.4 Implementation

Individual members are responsible for implementation of trials on their tenured lands. All application of herbicide must be conducted by a registered pesticide applicator certified for forestry applications under the Alberta Environmental Protection and Enhancement Act. It is expected that members may wish to collaborate in the retention and contracting of applicators, because of the small areas requiring treatment on any one tenure.

6.3 Vegetation Management – Thinning

Thinning will be conducted on treatment plots 3 and 4 of each installation (except the unplanted control installations) if, owing to natural ingress, the lodgepole pine densities exceed the target spacing values for the plot. Only sufficient trees will be thinned to return the coniferous density (stems per ha of lodgepole pine) on the treatment plot to the target spacing value.

Thinning schedules and prescriptions will be developed, depending on the rate and extent of ingress occurring during the next five-10 years. No thinning is expected to be undertaken during the first five years.

7. Referencing and Numbering Conventions

7.1 Plots

Each installation will be uniquely referenced by a 3-digit numeric code:

1. Ecosite category (valid codes 1 – 5).
2. Group number (valid codes 1 –5, expandable if additional replications added).
3. Spacing (valid codes 1 – 6: 1 = no planting, 2 = 3.5m/816spha, 3 = 3.0m/1111spha, 4 = 2.5m/1600spha, 5 = 2.0m/2500spha, 6 = 1.5m/4444spha)

In the database each installation header will also contain the Alberta standard cut block location code (opening number). This opening number is made up of the following:

- Meridian (4-6);
- Range (01-30);
- Township (001-126);
- Section Number (01-36);
- Grid Coordinate Number (00-99); and

- Dummy Number (A-C, or blank).

Measurement and treatment plots will be numbered 1 – 4, starting with the most Northwesterly and going clockwise. Corresponding treatments are as follows:

1. No weeding, no thinning. (Control)
2. Weeding, no thinning. (Weed)
3. Weeding and thinning. (Weed/Thin)
4. Thinning, no weeding. (Thin)

This numbering convention with applicable treatments is to be applied in all situations, as per the manual, with no exceptions. Regeneration sub-plots in each measurement plot will be numbered 1-16 (see Figure 3 under 5.3 Regeneration Plots).

7.2 Seedlings

All seedlings planted within measurement plots will be pinned and numbered, using 9-gauge 45 cm painted wire pins, aluminum tags and wires. This will involve approximately 4200 trees per group of 6 installations, and a maximum of about 1776 per installation. Numbering within an installation will be consecutive and continuous, i.e.; If measurement plot #1 had seedlings numbered 1-444, measurement plot #2 seedling numbering would start at 445 NOT 1. Pins should be consistently placed 20 cm North of seedlings to reduce confusion with ingress. Seedlings must never be painted.

If a naturally regenerated seedling is replacing a planted crop tree, the ingress tree will be tagged and given a new unique number (a new series of numbers can be used here as well to signify replacement trees. i.e.: the first replacement tree may be numbered 5001 or 4001, etc). The replacement will be considered to have occurred if the previous crop tree has died, or it has been otherwise overtaken by another tree with superior height, diameter, and health. Tags with tree numbers will be retained on both the original and the candidate replacement crop tree.

8. Measurements

Table 4 identifies when measurements are required during the first five years of the trial. Ten categories of measurement are recognized. Note that timing of measurements is expressed in growing seasons completed after planting. Measurements should be made at the end of the growing season, following terminal bud set.

The required information for Growing Season 0 should be collected for all installations at the time of establishment (or earlier in the case of site index). If an installation is established with cold-stored stock and planted in the Spring of 2001 so that the trees flush in the 2001 growing season, the measurements indicated for Growing Season 1 should also be made in 2001, following bud set. If an installation is planted late in the season with set trees, the measurements for Growing Season 1 should be made after bud set in 2002.

Table 4. Timing of Required Measurements

Measurement Category	Growing Season					
	0	1	2	3	4	5
Planting density	x					
Coniferous density		x		x		x
Coniferous stocking		x		x		
Competition – shrubs and herbs	x	x	x	x		x
Competition – deciduous trees	x	x	x	x		x
Size and growth	x	x		x		x
Vigor	x	x	x	x	x	x
Health	x	x		x		x
Age						x
Photographs	x	x	x	x	x	x

8.1 Data Collection/Submission Methodology

The data required for this trial can be collected using a digital data collection device or manual tally sheets.

8.1.1 Introduction

The Foothills Model Forest (FMF), and specifically the Geographic Information Systems (GIS) team will act as the central loading, storage, and distribution agency for the Foothills Growth and Yield Association (FGYA). To date GIS personnel have worked closely with the Association to develop a standard data model that defines what information is to be collected, the standard field codes and ranges and the structure of how it is to be delivered to the FMF. The objective is to ensure that all relevant data are being collected and it is being done so in a standardized fashion so as to facilitate easy amalgamation into a single database.

It is expected that there will be continual changes to the database design to keep up with the changing needs of the association and address questions that arise during the installation and measurements of the plots. Therefore this document will be updated on an as needed basis to accommodate those changes.

8.1.2 Database Design

A formal database design process was initiated to develop a standard data model to house all data collected for the installations. The benefits of a formal design process are as follows:

- Set a standard for what data are to be collected
- Set standards for codes and ranges used in data collection
- Ensure database integrity
- Minimize data redundancy

An entity relationship (ER) diagram was created from the design process. This document illustrates how the data will be stored in the master FGYA database. See Appendix II for the ER diagram.

As changes to the model are anticipated, change requests to the model will be directed through the field co-coordinator and then to the FMF. The changes will be implemented and new documentation for those changes will be distributed, again through the field co-coordinator.

8.1.3 Data Flow

The diagram below describes the flow of installation data from the contractors through to the member companies.

Installation data collected by the contractors will be provided to the FMF in a standard file format. These data will be loaded and quality control measures taken at the time of loading. If non-standard data are detected the files will be returned to the contractor to be resolved. Once the data have been loaded the database will be backed up and then distributed to the contributing members.

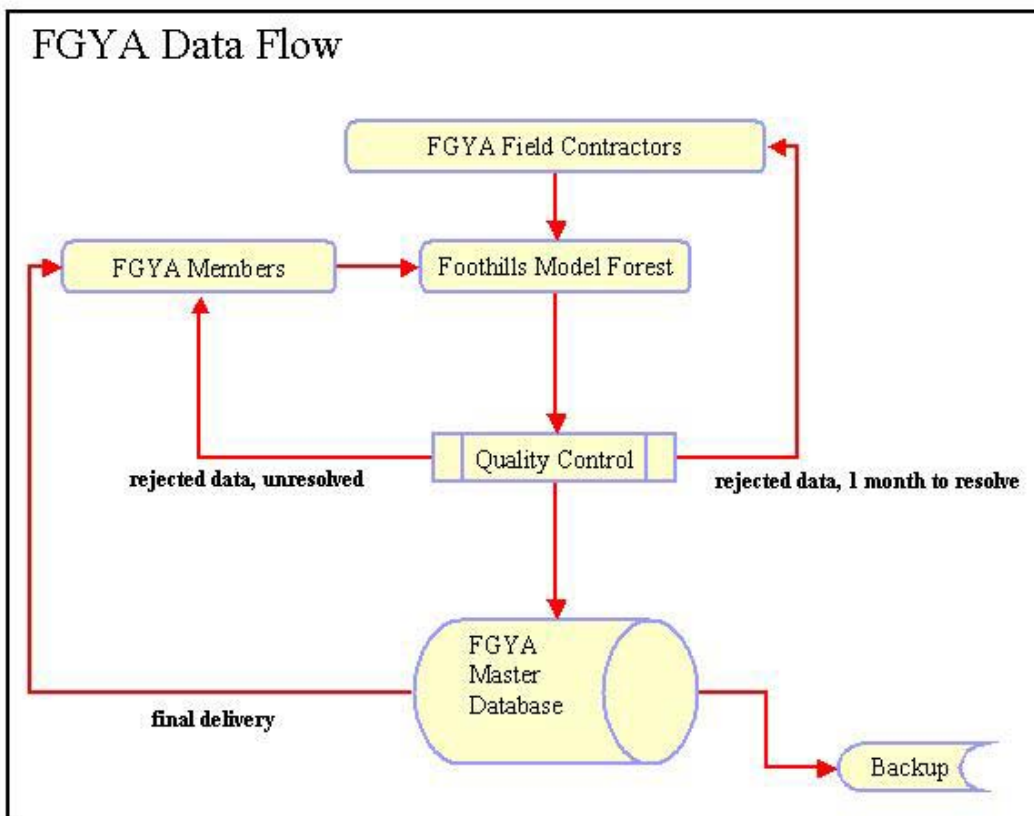


Figure 5. Flow chart showing the Foothills Growth and Yield Association Data Flow.

8.1.4 Data Formats

Data delivered to the FMF will be in Microsoft Access tables. Data submitted in any other format will not be accepted. It is also recommended that FGYA contractors avoid the use of Microsoft Excel in processing their data due to problems encountered during the first two years of data loading. For the installation year the contractor will provide a minimum of nine, and a maximum of 12 (three optional) individual tables. After the installation is complete and re-measurement takes place in subsequent years the number of files will be reduced to a minimum of two files and a maximum of five (three optional).

The table below describes the table naming convention that must be followed by the contractors for delivery of the data to the FMF.

Table 5. List of Loading Table Names, Descriptions and Naming Conventions.

Load Table	Description
L01_Installation	Installation level (required first year only)
L02_TreatmentPlot	Treatment plot level (required first year only)
L03_Ecological	Treatment plot ecological (required first year only)
L04_Planting	Treatment plot planting treatment (required first year only)
L05_BlockInfo	Block (opening) reference (required first year only)
L06_SiteIndex	Treatment plot site index (required first year only)
L07_RegenPlot	Regeneration plot measurements
L08_Trees	Tree measurements
L09_StemMapping	Tree stem mapping (optional, and only required once)
L10_Tending	Treatment plot tending treatments (required only at re-measurement if tending has occurred)
L11_Photos	Treatment plot photographs
L12_Trees_fillplant	Tree replacement/fill planting (required only at re-measurement if fill planting occurred)

See Appendix V for detailed listings of the file structure and descriptions for all fields.

8.1.5 Data Loading

Data contained in the Access tables delivered to the FMF will be loaded into the master database using a combination of manual and automated processes. Incoming Access tables will be manually imported into the database and loading queries will be run to disseminate the data into the data model.

8.1.6 Quality Assurance

There are three levels of data verification or data checking that take place during the loading process. They are constraints, referential and logical (also known as business rules).

The first level of checks are constraint checks. These are inherently performed when the data are loaded by way of rules that are placed on individual fields to ensure the values are reasonable. (e.g. tree height < 100cm)

The second level of checks are referential checks. These checks are inherently performed during the process of disseminating the data into the individual tables in the database. The database is relational in design minimizing duplication and maximizing integrity (correctness). The referential checks ensure the following:

- All child records have a matching parent record. (e.g. all regeneration plots must have a valid measurement, treatment plot and installation).
- All codes (categorical data) match the standard list defined in the manual (domain lists). (e.g. tree species codes must be within the range PL,SW,AW etc.)

The third set of checks are logical or business rule checks. These are performed to identify problems with the logical relationships between tables and/ or records in the database (e.g. there must be exactly four treatment plots in each installation). These checks are run by executing queries against the database to find instances of incorrect logic. Below is the most current list of logical queries run against the database.

- Count of the number of treatment plots per installation. There should be four.
- Count of the number of site index plots per installation. There should be three.
- Count of the number of regeneration plots per treatment plot. There should be 16.
- Count of the number of trees measured per treatment plot. There should be at least 50.
- Count of the number of trees per treatment plot in total. This should be 1/10 of the planting density. (eg 1600 = 160 trees.). This check is a guideline check, counts within five trees.
- Count of the number of crop trees in a given treatment plot. There should be 16.
- Duplicate tree numbers. There should be none.
- Duplicate regeneration plot numbers. There should be none.
- Duplicate stem mapped trees. There should be none. This test is only run once, the year the trees were mapped.
- Negative change in tree measurements with no health code or comments indicating cause.
- Compare tree counts between measurements and stem mapping. The counts should be the same.

In the event errors are found the records will be flagged as rejected and the entire file will be returned to the member company or contractor to be resolved.

8.1.7 Data Management

Management of the master FGYA database will be the responsibility of the FMF GIS team. They will perform the data loading, quality control, security, backup and distribution of the database.

8.1.8 Software

Database design, loading and distribution is performed using Microsoft Access 2000. Database modeling and documentation (ER diagrams) is performed using Microsoft Visio Enterprise 2000. Microsoft Access was chosen as the database system for the following reasons:

- most FGYA members are familiar with the software.
- data can be easily read by and/or ported to mainstream analysis tools such as Microsoft Excel, Statistical Analysis System (SAS) etc.

Initially the installation data will be stored in Access. If the needs of the database exceed the capabilities of Access (e.g. speed, size etc.) the database will be ported to Oracle.

8.1.9 Distribution

The data will be distributed to the member companies upon request. Note that a reasonable amount of time must be allowed to perform the data loading and quality control processes after the data has been delivered to the FMF. It is not unreasonable to expect the data to be ready for distribution by mid November if all measurements are complete and delivered by mid September. The loading period should decrease after the first year as the number of files lessens and the process becomes more automated.

8.1.10 Administration/Site History

This information will be collected in the field where applicable. However, information from the member will be necessary to fill out many of the fields in this section. Many fields require collection at the treatment plot level (four separate measurements per installation), while this may seem redundant it is necessary to capture all information on installations in which the treatment plots are separated.

1. Agency:

- Enter the member company the installation is for.
- Where collected/applicability: Installation.

Example: WEYGP (Weyerhaeuser Grande Prairie)

Agency Code	Agency
ANC	Alberta News Print Company
BRL	Blue Ridge Lumber
CFPGP	Canadian Forest Products Grande Prairie
MWFP	Millar Western Forest Products
SDA	Sundance Forest Products
SLS	Spray Lakes Sawmills
SPI	Sunpine Forest Products
WEYDV	Weyerhaeuser Drayton Valley
WEYED	Weyerhaeuser Edson
WEYGP	Weyerhaeuser Grande Prairie
WWC	Weldwood of Canada

2. Installation Date:

- Enter the date that the installation was established in the field.
- Where collected/applicability: Installation.

Example: ddmmyy: 150801

3. Target Eco-Class:

- Enter the targeted eco-class code for the installation (1-5) See Pg.2, Section 2.1, Table 1
- Where collected/applicability: Installation.

Example: 4

4. Target Group:

- Enter the target geographic grouping code (1-5) as assigned by the FGYA.
- Where collected/applicability: Installation.

Example: 2

5. Target Tree Density:

- Enter the prescribed “target” density code (1-6) for the installation.
- Where collected/applicability: Installation.

Example: 3 (Codes listed on page 3, Table 2)

6. Contractor:

- Enter the name of the contract company installing the plot.
- Where collected/applicability: Installation.

Example: Integrity Consulting Ltd.

7. Crew Initials (1 and 2):

- Enter the initials of the crewmembers installing the plot.
- Where collected/applicability: Installation.

Example: RTY HYU

8. ISP Number:

- Enter the Industrial Sample Plot protection number.
- Where collected/applicability: Installation.

Example: ISP010031

9. Tie Point Description, Azimuth, Distance, UTM Coordinates:

- Enter a description of tie point location, the azimuth and distance in meters from the Tie Point TO the treatment plot center. Collect the UTM coordinates of the tie point using a gps. (UTM Nad 83 Zone 11, Alberta/BC).
- Where collected/applicability: Treatment plot.

Example: T.P.#1 located at the “y” intersection of the big and little Berland roads. 256 meters @ 125° from T.P.#1 to treatment plot #2 center. T.P. # 1 GPS Coordinates UTM N:5897643 E:675653.

10. Treatment Plot Center UTM Coordinates & Plot Orientation:

- Collect the UTM coordinates of each treatment plot center using a gps. (UTM Nad 83 Zone 11, Alberta/B.C.), Record the azimuth of an imaginary line running from regeneration plots 13 through regeneration plots 12, 5, & 4 (This would be the azimuth of the East Boundary on a typical installation [0 or 360°]).
- Where collected/applicability: Treatment plot.

Example: Treatment Plot #1 UTM N: 5897643 E:675632, Orientation: 25°

11. Tree Count Total:

- Record the total number of trees planted within each Treatment plot (orange boundary).
- Where collected/applicability: Treatment plot.

Example: 1600

12. Elevation:

- Record the elevation in meters (A.S.L.) at each Treatment plot center.
- Where collected/applicability: Treatment plot.

Example: 1600

Precision: +/- 50 m

13. Slope Percent:

- Record the average % slope of each Treatment plot.
- Where collected/applicability: Treatment plot.

Example: 7%

Precision: +/- 5%

14. Aspect:

- Record the general aspect in degrees for each Treatment plot.
- Where collected/applicability: Treatment plot.

Example: 350°

Precision: +/- 10°

15. Slope Position:

- Record the meso-slope position code for each Treatment plot.
- Where collected/applicability: Treatment plot.

Example: F

Slope Position Codes	Code Descriptions
C	Crest
D	Depression
F	Level/flat
L	Lower slope
M	Middle slope
T	Toe
U	Upper slope

16. Natural Subregion:

- Record the natural sub-region code for each Treatment plot.
- Where collected/applicability: Treatment plot.

Example: SWLF

Natural Subregion Codes	Code Description
SWLF	South West, Lower Foothills
SWSA	South West, Subalpine
SWUF	South West, Upper Foothills
WCLF	West Central, Lower Foothills
WCSA	West Central, Subalpine
WCUF	West Central, Upper Foothills

17. Planting Start and End Dates:

- Record the dates when planting was started and completed in the treatment plot.
- Where collected/applicability: Treatment plot.

Example: ddmmyy: 150801

18. Seedlot:

Alberta seedlot numbers are composed of:

- Owner/township/range/meridian/year of collection
- Record the Alberta Seedlot Number for the stock planted on the treatment plot.
- Where collected/applicability: Treatment plot.

Example: WW 50-21-5-87

19. Stock Code:

- Record the Stock Code for the stock planted on the treatment plot.
- Where collected/applicability: Treatment plot.

Example: BRP + 1

Stock Code	Description	Stock Code	Description
BB	Bare Root (3+0)	S211	Styroblock 211
BRP + 1	Bare Root Plug + 1	S211A	Styroblock 211A
BRP1.5	Bare Root Plug + 1.5	S211B	Styroblock 211B
BRT	Bare Root Transplant	S211P	Styroblock 211P
C40CC	Spencer Lemaire	S310	Styroblock 310
C45CC	Spencer Lemaire	S310B	Styroblock 310B
C50CJ	50 cc Jiffy	S310P	Styroblock 310P
C65CC	Spencer Lemaire	S312	Styroblock 312
C78CJ	78 cc Jiffy	S313	Styroblock 313
C90CC	Spencer Lemaire	S313A	Styroblock 313A
C90CJ	90 cc Jiffy	S313B	Styroblock 313B
CARC	ARC Sausage	S313C	Styroblock313C
CBCC	CBCC	S313E	Styroblock 313E
CDR100	Drader 100	S313P	Styroblock 313P
CDR200	Drader 200	S315	Styroblock 315
CDR75	Drader 75	S315B	Styroblock 315B
CDRAE	Drader	S323	Styroblock 323
CJIFFY	Jiffy Pots	S400CU	Styroblock 410 Copper Treated
CJP36	Jiffy Pots P36	S410	Styroblock410
CKH	King Horns	S410A	Styroblock 410A
CLTRANS	Container Transplant	S410B	Styroblock 410B
CMINI	Mini Container	S410C	Styroblock 410C
CONT	Container	S410M	Styroblock 410M
CONTT	Ontario Tubes	S410P	Styroblock 410P
CP + 1	Container Plug + 1	S411	Styroblock 411

Stock Code	Description	Stock Code	Description
CP + 1.5	Container Plug + 1.5	S412	Styroblock 412
CP + 2	Container Plug + 2	S412A	Styroblock 412A
CPNTH	Panth	S412CU	Styroblock 412A Copper Treated
CPP	Paper Plots	S412D	Styroblock 412D
CPSB	CPSB	S415	Styroblock 415
CXL410	CXL410	S415B	Styroblock 415B
S 10075	Styroblock CS10075	S415D	Styroblock 415D
S100	Styroblock S100	S512	Styroblock 512
S112	Styroblock CS112	S515	Styroblock 515
S11280	Styroblock CS11280	S615	Styroblock 615
S121	Styroblock CS121	S615B	Styroblock 615B
S16060	Styroblock CS16060	SQ	Styroblock
S16065	Styroblock CS16065	SQ100	Styroblock Q100
S18070	Styroblock CS18070	SQ75	Styroblock Q75

20. Planting Season:

- Record the season for the stock planted in each Treatment plot.
- Where collected/applicability: Treatment plot.

Example: Spring (Will flush and grow again in same season)

21. Harvesting Start and End Dates:

- Record the dates when harvesting was started and completed in each Treatment plot.
- Where collected/applicability: Treatment plot.

Example: ddmmyy: 150801

22. Harvesting Type/Method:

- Record the type/method of harvesting that was used in each Treatment plot.
- Where collected/applicability: Treatment plot.

Example: MLS

Harvest Type	Description
HFW	Harvester, forwarder
HGR	Hand fall, grapple skidder
HLS	Hand fall, line skidder
MGR	Feller buncher, grapple skidder
MLS	Feller buncher, line skidder

23. Site Preparation Start and End Dates:

- Record the dates on which site preparation was started and completed in the treatment plot.
- Where collected/applicability: Treatment plot.

Example: ddmmyy: 150801

24. Site Preparation Contractor:

- Enter the name of the contract company site preparing the treatment plot.
- Where collected/applicability: Treatment plot.

Example: Bottomless Pit Mounding Co.

25. Site Preparation Type/Method:

- Record the type/method of site preparation that was used on the treatment plot.
- Where collected/applicability: Treatment plot.

Example: MODO (Donaren Mounding).

Site Prep Description			
BLAD	Blade	MODP	Moulder – Dual
BLBR	Blade – Brush rake	MOEC	Moulder – EC
BLMO	Blade – Modified	MOEH	Moulder – Excavator Hoe
BLRT	Blade – Hensley	MOLA	Moulder – Lannen
BLSH	Blade – Shear	MOOJ	Moulder – Oje Hogen
BLST	Blade – Straight	MOTT	Moulder – Terra Tech
CHEM	Chemical	MOUN	Moulder – Unknown
DIHD	Disk – Harrow -	PLCH	Plow – C&H
DIHS	Disk – Harrow -	PLCM	Plow – C&H Modified/Vinge
DIKT	Ditching – Koppo	PLCP	Plow – C & S Ripper – Plant
DIMA	Ditching – Martini	PLCR	Plow – Crossley
DIPA	Disk – Passive	PLCS	Plow – C & S Ripper – Seed
DIPO	Disk – Powered	PLDV	Plow – DV
DRAG	Drag	PLMA	Plow – Martini
DRHV	Drag – Heavy	PLOW	Plow Unknown
DRLT	Drag – Light	PLSB	Plow – Savanna Bedding Plow
DRSF	Drag – Shark Fin	PLSH	Plow – Shear
HAMM	Hand – Motor	PLSR	Plow- Single Row Bedding
HAND	Hand Scalped	PLSS	Plow – Winged Sub Soiling
MICH	Mixer – Marsden	SPBR	Spot – Bracke
MIER	Mixer – Excavator	SPLE	Spot – Leno
MIGR	Mixer – Grizzly	SPSI	Spot – Sinkilla
MIMC	Mixer – Merri	UNK	Unknown
MIMU	Mixer – AZ Forester		
MIVM	Mixer – VM Mulcher		
MOBC	Moulder –		
MOBU	Moulder – Butler		
MOCA	Moulder – CA		
MODE	Moulder – Ditching		
MODO	Moulder – Donaren		

26. Site Preparation Density:

- Enter the site preparation target density where applicable.
- Where collected/applicability: Treatment plot.

Example: 1600 mounds/ha.

27. Vegetation Management Target Treatment:

- Enter one of the four treatment regimes for each treatment plot.
 1. Control
 2. Weed
 3. Weed and Thin
 4. Thin
- Where collected/applicability: Treatment plot.

Example: 1. Control

28. Vegetation Management Treatment Method:

- Record the treatment method for each treatment plot.
- Where collected/applicability: Treatment plot.

Tending Method	Description
BPGF	Backpack Glyphosate foliar spray (Vision®)
BBTE	Basal bark application Triclopyr ester (Release®)
BSTH	Brush saw thinning

29. Vegetation Management Treatment Comments

- Enter comments about treatment (e.g.: Ezject used for Triclopyr application)
- Any methods or treatment types not matching the codes should be recorded here.
- Where collected/applicability: Treatment plot.

30. Treatment Intensity.(l/ha, kg/ha, girdling density, etc.):

- Record treatment intensity, application rates, concentrations, e.t.c..
- Where collected/applicability: Treatment plot.

31. Treatment Start and End Dates:

- Record the dates on which the treatment was started and completed in the treatment plot.
- Where collected/applicability: Treatment plot.

Example ddmmyy: 150801

32. Treatment Contractor:

- Enter the name of the contract company treating the plot.
- Where collected/applicability: Treatment plot.

Example: Double Vision Herbicide Applicators Inc.

33. Crew Initial:

- Enter the initials of the contractor performing the treatment on the plot (if applicable).
- Where collected/applicability: Treatment plot.

Example: RTY (Initials of pilot doing aerial spraying of herbicide).

8.1.11 Soils

Soil data is to be collected at each Treatment plot center. The “check” pits are to be done in locations where changes in soil characteristics are suspected. There is a comments area in the data model if anomalies are encountered such as small deviances in soil types, which don’t warrant plot adjustment or re-location. If there is more than one A or B horizon, please record in the comments section as well.

34. Parent Material:

- Record the Parent Material (Mode of deposition) for each Treatment plot.
- Where collected/applicability: Treatment plots.

Example: LT

Parent Material Codes	Code Descriptions
C	Colluvium
E	Eolian
F	Fluvial
FE	Fluvioeolian
FL	Fluviolacustrine
GF	Glaciofluvial
GL	Glaciolacustrine
L	Lacustrine
LT	Lacustro Till
M	Morainal Till
O	Organic
R	Rock
S	Saprolite

35. “L” Layer Thickness:

- Record the average thickness of the litter layer.
- Where collected/applicability: Treatment plot center soil pit.

Example: 2 cm

Precision: +/- 1 cm

36. “F” Layer Thickness:

- Record the average thickness of the fermented layer.
- Where collected/applicability: Treatment plot center soil pit.

Example: 5 cm

Precision: +/- 1 cm

37. “H” Layer Thickness:

- Record the average thickness of the humus layer.
- Where collected/applicability: Treatment plot center soil pit.

Example: 3 cm

Precision: +/- 1 cm

38. Humus Form:

- Record the predominant humus form. (*Can use basic Mor, Modor, Mull if can’t determine humus form accurately)
- Where collected/applicability: Treatment plot center soil pit.

Example: Lignomoder

Humus Forms	
FIBRIMOR	LIGNOMOR
HEMIMOR	MESIMOR
HUMIMOR	MORMODER
HYDROMODER	MULLMODER
HYDROMOR	RESIMOR
HYDROMULL	RHIZOMULL
LEPTOMODER	SAPRIMODER
LIGNOMODER	VERMIMULL
*MOR	*MODER
*MULL	

39. “A” Horizon Modifier(s):

- Record up to three applicable horizon modifier(s) for the “A” layer.
- Where collected/applicability: Treatment plot center soil pit.
- Acceptable horizon modifiers: b, c, ca, cc, e, f, g, h, I, k, m, n, p, s, sa, t, u, x, y, z

Example: “A” horizon modifier code #1 = h

40. “A” Horizon Thickness:

- Record the average thickness of the “A” Horizon.
- Where collected/applicability: Treatment plot center soil pit.

Example: 6 cm

Precision: +/- 1 cm

41. “A” Horizon Texture:

- Record the texture of the fine fraction (particles less than 2 mm diameter) of the soil in the “A” horizon.
- Where collected/applicability: Treatment plot center soil pit.

Example: Sandy clay loam

Texture Codes	Textures
C	Clay
CL	Clay loam
fSL	Fine Sandy Loam
HC	Heavy clay
L	Loam
LS	Loamy sand
S	Sand
SC	Sandy clay
SCL	Sandy clay loam
Si	Silt
SiC	Silty clay
SiCL	Silty clay loam
SiL	Silty loam
SiS	Silty sand
SL	Sandy loam

42. “B” Horizon Modifier(s):

- Record up to three applicable horizon modifier(s) for the “B” layer.
- Where collected/applicability: Treatment plot center soil pit.

Example: “B” horizon modifier code#1 = t , code #2 =j

- Acceptable horizon modifiers: b, c, ca, cc, e, f, g, h, I, k, m, n, p, s, sa, t, u, x, y, z

43. “B” Horizon Thickness:

- Record the average thickness of the “B” Horizon.
- Where collected/applicability: Treatment plot center soil pit.

Example: 46 cm

Precision: +/- 1 cm

44. “B” Horizon Texture:

- Record the texture of the fine fraction (particles less than 2 mm diameter) of the soil in the “B” horizon.
- Where collected/applicability: Treatment plot center soil pit.

Example: SCL

Texture Codes	Textures
C	Clay
CL	Clay loam
FSL	Fine Sandy Loam
HC	Heavy clay
L	Loam
LS	Loamy sand
S	Sand
SC	Sandy clay
SCL	Sandy clay loam
Si	Silt
SiC	Silty clay
SiCL	Silty clay loam
SiL	Silty loam
SiS	Silty sand
SL	Sandy loam

45. Moisture Regime:

- Record the numeric value for the relative moisture regime appropriate for the soil pit. This value “should” match the edatopic grid position (moisture regime) of the targeted eco-class for the establishment.
- Where collected/applicability: Treatment plot center soil pit.

Example: 4

Moisture Code	Moisture Regime RegimeDescription
2	Xeric
3	Subxeric
4	Submesic
5	Mesic
6	Subhygric
7	Hygric
8	Subhydric
9	Hydric

46. Nutrient Regime:

- Record the letter code for the relative nutrient regime appropriate for the soil pit. This value “should” match the edatopic grid position (nutrient regime) of the targeted eco-class for the establishment.
- Where collected/applicability: Treatment plot center soil pit.

Example: B

Nutrient Code	Nutrient Regime
A	Very Poor
B	Poor
C	Medium
D	Rich
E	Very Rich

47. Ecology Check:

- Check the ecology from the data collected to determine if the ecological classification is correct.
- Where collected/applicability: Treatment plot center soil pit.

Example: Yes (Can make notes in the comments section).

48. Coarse Fragments:

- Record the total percentage of coarse fragment content (particles greater than 2.0 mm) of the entire soil profile. Gravel + cobbles + stones = total coarse fragment.
- Where collected/applicability: Treatment plot center soil pit.

Example: 22%

Precision: +/- 5%

49. Depth to Gley:

- Record the depth from the top of the “A” horizon to evidence of gleying.
- Where collected/applicability: Treatment plot center soil pit.

Example: 15 cm

Precision: +/- 5 cm

50. Depth to Mottling:

- Record the depth from the top of the “A” horizon to evidence of mottles.
- Where collected/applicability: Treatment plot center soil pit.

Example: 15 cm

Precision: +/- 5 cm

8.1.12 Site Index

Ideally, site index is completed pre-harvest, on each treatment plot center (or installation center if typical installation). Since this is not applicable in most instances, site index will be collected in adjacent parent stands having the same soil moisture, nutrient regime, and physiographic site characteristics as the associated treatment plot. Three 300 m² Site Index plots in the adjacent parent stand will be done for each installation (or for each treatment plot should the treatment plots have different parent stands in instances of split installations).

Plot radius is 9.77 m. Measure total height, and breast height age & diameter of each of the three largest DBH *Lodgepole Pine* trees in the plot. If three suitable trees (see below) are not available, two site trees will be considered sufficient for a plot of 300 m². If there is only one suitable site tree in a plot, the plot is dropped and a new plot location is selected (i.e., at least two site trees are needed to be considered a valid plot).

Site trees cannot be replaced by the 4th, 5th, 6th, etc.. largest DBH trees.- If one of the 3 candidate trees is invalid, the estimate for the plot will be based on the 2 valid trees.

If two or more of the candidate trees are invalid, a new plot location is selected

The three largest, suitable DBH trees will:

- have no damage affecting height growth;
- not have been suppressed (check cores for evidence of past suppression);
- be standing and live with good vigor
- be dominant or codominant
- be accurately measurable for breast height age
- not be a veteran or “wolf” tree (bull pine)

Counted Tree Age:

- taken at breast height (1.3 m). The core should deviate no more than 1 cm from the pith.
- precision +/- 1 year

Total Height:

- precision +/- 5%

Diameter:

- taken at breast height (1.3 m) on the high side of the tree
- Precision +/- 0.1 cm

51. Site Index Method:

- Record whether the site index measurements were done pre or post harvest.
- Where collected/applicability: Treatment plot.(Can be same 3 SI plots for all four treatment plots if applicable).

Example: POST

Site Index Method	Description
POST	Post harvest SI assessment in adjacent, parent stand
PRE	Pre harvest SI assessment in treatment plot

52. Plot Size (m²):

- Record the site index plot size. This field is to accommodate site index plots which were done pre-methodology. The default plot size is 300 m².
- Where collected/applicability: Treatment plot.(Can be same SI plots for all four treatment plots if applicable).

Example: Record the size of the circular site index plot in square metres.

53. Site Index Tie Point Description, Azimuth, Distance & UTM coordinates:

- Enter a description of tie point location (collect a GPS point here as well). Record the azimuth and distance in Meters from the S.I. Tie Point TO the Site Index Plot center. Collect the UTM coordinates of the tie point using a gps. (UTM Nad 83 Zone 11, Alberta/BC).
- Where collected/applicability: Pre-Harvest, Treatment plot center or Adjacent Parent Stand.

Example: S.I.#1 located 250 m @ 56° from SE block corner sign (GPS'd @ UTM N:5897643 E:675653).

8.1.13 Tree & Competition Measurements

“**Crop tree**”, for competition assessment purposes, is defined as the coniferous tree with the best overall height, root-collar diameter and health within each regeneration plot. Each treatment plot will have a maximum of 16 crop trees. Initially, on planted installations, the crop tree should be a planted pine; However, as per section 7.2 (pg 18), if a naturally regenerated conifer in a regeneration plot exceeds the height **and** diameter of an existing crop tree, and is at least as healthy and vigorous as the crop tree, then that natural is to be tagged, numbered and considered to be the new crop tree. Moreover, any *planted* Pine in a regeneration plot, which exceeds the height, diameter, and health of an existing crop tree will also replace the existing crop tree (It will be tagged and numbered already so just record that number as the new crop tree). Crop trees will continue to be replaced by better candidates throughout the life of the plots, often more than once. If no coniferous tree is located within the regen plot; that plot will not have a crop tree.

Competition is assessed using the crop tree as theoretical plot centre. If no crop tree exists within a particular regeneration plot then competition is to be assessed using regeneration plot centre. This holds true for control (non-planted) plots, i.e.: competition must still be assessed regardless

of the presence (or absence) of a crop tree. In control plots, the best natural coniferous (ingress) seedling within each regen plot is selected as the crop tree (minimum 10cm height). This natural seedling must be tagged and given a unique number.

Size and growth measurements are to be taken on 50 tagged trees per measurement plot, these trees will be referred to as “**sample trees**”. To select the sample trees, start by selecting all tagged trees *within* each regen plot until 50 sample trees have been selected. On lower density installations, you may not have 50 trees within the 16 regeneration plots, in this case, go back to the first plot and select the closest pine *outside* the regen plot, go to the next plot and do the same, continue through this until you've achieved the required 50. If only a few extra trees are needed, this may result in "groups" of trees; However, it is still a simple unbiased selection method. If, during a fill in plant, dead sample trees are replaced, the newly planted tree is given a unique number and is now assessed as a sample tree. A sample tree may or may not be a “crop tree” (See #57 Tree Sample Type).

At this stage of the trial (2003) the selection and measurement of sample trees on 0 density (non-planted) installations is not required. A protocol will be developed for future assessment of sample trees on those installations where natural ingress occurs

Any trees displaying measurements which have “shrunk” significantly since last measure should have a valid health code or comment explaining shrinkage. Contractors should have previous measurements available in data collectors or on tally forms to assist in identifying these trees.

54. Regeneration Plot Number:

- Record the regeneration plot number if applicable (1-16), or enter NULL (No Entry) if a tree is not within a regeneration plot.
- Where collected/applicability: Regeneration plot.

Example: 14

55. Coniferous Density:

- Record the number of live coniferous trees >10.0 cm in height by species & origin in a 1.78 meter radius plot around each regeneration plot center.

56. Tree Number:

- Assign/record a tree number for each tree tagged in each measurement plot (tags are never to be moved from one tree to another for replacement or otherwise. i.e.: If a tagged tree has died and you have an ingress that you need to tag, don't take the dead trees tag. Use a new tag and assign a new tree number.
- Where collected/applicability: Measurement plot (**All** trees initially planted in the measurement plot will be numbered).

Example: 45

57. Tree Sample Type:

- For each tree in the database (i.e.: all tagged trees within measurement plots), a sample type must be assigned.
- Where collected/applicability: All tagged trees within each measurement plot.

Example: “C” (Crop Tree)

Code	Sample Type
C	Crop Tree
S	Sample Tree
B	Crop Tree & Sample Tree
N	Neither*

* Trees tagged and assessed for health and vigor, which are neither crop or sample trees, are assigned the code “N”.

58. Tree Species Code:

- Record the tree species code of the tree you are measuring.
- Where collected/applicability: Regeneration plot (50 “sample” trees – may be outside regen plot).

Example: Pl

Code	Species
Fa	Sub-alpine Fir
Fb	Balsam Fir
Lt	Tamarack (Larch)
Pj	Jack pine
Pl	Lodgepole Pine
Sb	Black Spruce
Se	Englemann Spruce
Sw	White Spruce

59. Tree Source:

- Record whether the tree you are measuring is planted *or* from natural regeneration.
- Where collected/applicability: Regeneration plot (50 “sample” trees – may be outside regen plot).

Example: Planted

60. Seedling Position Code:

- Record the position where the tree is situated. The codes apply to mechanical site preparation (mounding in particular). By assessing seedling position, we can draw some broad conclusions with regards to tree mortality/vigor vs. seedling position. Albeit difficult, use the closest match from the codes on non-mound type site prep areas.
- Where collected/applicability: Regeneration plot (50 “sample” trees – may be outside regen plot). Only done once per tree during life of plot.

Example: H

Code	Seedling Position
AH	Above hinge, below crest
B	Base of trench or patch
BH	Below hinge, above base of trench or patch
C	Crest of berm or mound
H	Hinge
U	Undisturbed ground

61. Rooting Media Code:

- Record the trees rooting media code.
- Where collected/applicability: Regeneration plot (50 “sample” trees – may be outside regen plot). Only done once per tree during life of plot.

Example: H

Code	Rooting Media Description
B	Blended (anything <75% humus,mineral,organic, including mech site prep mixed soils)
F	Fire influenced soil
H	Mainly humus (>75%)
M	Mainly mineral soil (>75%)
O	Mainly organic (>75%)
R	Rotting wood

62. Tree Height:

- Record the tree height from tree stem ground level to the base of the bud. Leaning trees are to be measured from the base of the bud plumb to the ground level. E.g.; If a tree had an extreme lean of about 45° you would measure from the base of the terminal bud straight down to the ground, in other words, you do not measure the *length* of the tree, only the *height* above ground level.
- Where collected/applicability: Regeneration plot (50 “sample” trees – may be outside regen plot).

Example: 32.6 cm

Precision: Record to mm accuracy on trees < 2 m tall, trees over 2 m are recorded to cm accuracy. Checked to +/- 1 cm for trees < 3 m, +/- 10 cm for trees > 3 m.

63. Ground Line Diameter:

- Record stem diameter in **cm** at ground level. Be careful not to damage trees with the calipers when taking measurements. Trees will be measured at ground line until the tree is 2.0 m tall, after which diameter will be taken at breast height.
- Where collected/applicability: Regeneration plot (50 “sample” trees – may be outside regen plot).

Example: 0.4 cm

Precision: +/- 1 mm

64. Crown Diameter:

- Record the crown diameter in **cm** at the widest point.
- Where collected/applicability: Regeneration plot (50 “sample” trees – may be outside regen plot).

Example: 8 cm

Precision: +/- 1 cm for trees < 3 m, +/- 10 cm for trees > 3 m.

65. Crown Length:

- Record the crown length in **cm**. Start at the bottom where the live crown starts and measure up to the tip of the terminal bud.
- Where collected/applicability: Regeneration plot (50 “sample” trees – may be outside regen plot).

Example: 18 cm

Precision: +/- 1 cm for trees < 3 m, +/- 10 cm for trees > 3 m.

66. Vigor:

Assign each tree one of the four following vigor codes:

- AL - Alive and likely to survive
- AU - Alive but unlikely to survive
- D - Dead
- M – Missing (after being recorded as missing for three years, can assign as Dead)
- Each tree assigned an “AU” or “D” should have at least one applicable health code backing up the vigor call.
- Where collected/applicability: **ALL tagged trees within the measurement plot will be assessed.**

Example: AL

67. Health Code:

- Record up to two health codes from the acceptable list of codes, if applicable.
- Where collected/applicability: **ALL tagged trees within the measurement plot will be assessed.**

Example: AE

Code	Description	Code	Description	Code	Description
A	Abiotic injuries	DSB	White Pine Blister Rust	IMD	Coneworms
AB	Fire	DSC	Comandra Blister Rust	IME	Eastern Pine Seedworm
AC	Chemical Pollutants (not pesticides)	DSD	Sphaeropsis (Diplodia) Blight	IMK	Cone Midges
AD	Drought	DSF	Sweet Fern Blister Rust	IMM	Spruce Seed Chalid/Midge
AE	Winter Damage	DSG	Scleroderris Canker	IMP	European Fruit Lecanium
AES	Snow or Ice	DSH	Hypoxylon Canker	IMS	Cone Maggots
AEW	Winter Desiccation	DSN	Aspen/Poplar Cankers General	IP	Pitch Blister Moths
AF	Frost	DSR	Diplodia Gall and Rough Bark	IR	Wood Borers
AFC	Frost Crack	DSS	Stalactiform Blister Rust	IRA	Carpenter Ant
AFH	Frost Heaved	DSW	Western Gall Rust	IRB	Poplar Borer
AFK	Shoot/Bud Frost Damage	DT	Burls	IRC	Poplar and Willow Borer
AH	Hail	I	Insects	IRF	Flathead Borers
AL	Lightening	IA	Aphids, Adelgids and Scale Insects	IRM	Clearwing Moth
AO	Flooding	IAG	Gall Forming Aphids	IRT	Spruce Borers
AR	Redbelt	IAO	Open feeding Aphids and Adelgids	IRW	White Spotted Sawyer Beetle
AS	Slide	IAP	Pine Needle Scale	IRY	Northeastern Sawyer Beetle
AW	Windthrow	IB	Bark Beetles	IS	Seedling Insects
AWS	Soil Failure	IBA	Ambrosia Beetles	ISO	Strawberry Root Weevil

Code	Description	Code	Description	Code	Description
AWT	Treatment or Harvesting Related	IBD	Douglas Fir Beetle	IST	Crane Flies
AX	Scarring/Rubbing	IBE	Eastern Larch Beetle	IT	Terminal Weevils
CL	Condition - Leaning	IBH	Ash Bark Beetles	ITS	White Pine Weevil
CDT	Dead Top	IBL	Lodgepole Pine Beetle	ITT	Lodgepole Terminal Weevil
CFT	Fork Top	IBM	Mountain Pine Beetle	IW	Root Weevils
CNL	New Leader	IBR	Spruce Beetle	IWA	Northern Pine Weevil
CSM	Settling Mound (microsite)	IC	Defoliators – Coniferous	IWP	Couper Collar Weevil
D	Disease	ICA	Needle Miners General	IWS	Yosemite Bark Weevil
DB	Broom Rusts	ICB	Budworms General	IWW	Warren Root Collar Weevil
DBC	Yellow Witches Broom of Spruce	ICC	Spruce Budworm	T	Treatment Injuries
DBM	Witches Broom Rust of Fir	ICG	Black Army Cutworm	TC	Chemical
DC	Spruce Cone Rust	ICN	Sawflies General	TL	Logging
DD	Stem Decays	ICP	Yellowheaded Spruce Sawfly	TM	Mechanical
DDA	Aspen/Poplar Decays and Stains	ICZ	Budmoths General	TP	Planting
DDP	Red Ring Rot	ID	Defoliators – Deciduous	TPJ	J Root
DE	Seedling Diseases	IDA	Aspen Leaf Beetle	TPM	Poor Planting Microsite
DED	Damping off Disease	IDB	Birch Skelotonizer	UNS	Seedling Shrinkage – Unexplained
DEG	Grey Mold	IDC	Cankerworms General	V	Vegetation Problems
DEM	Powdery Mildew	IDF	Leafminers General	VP	Vegetation Press
DES	Storage Mold	IDG	Grey Willow Leaf Beetle	W	Wildlife
DF	Needle Diseases	IDL	Large Aspen Tortrix	WA	Bear
DFB	Needle Cast General	IDM	Forest Tent Caterpillar	WB	Browsing Damage
DFD	Elytroderma Needle Cast	IDO	Bruce Spanworm	WBC	Cows or Horses
DFE	Needle Rusts General	IDP	Aspen Leafroller	WBH	Hare or Rabbit
DL	Leaf Diseases	IDS	Satin Moth	WBU	Ungulates (Deer, Elk, Moose)
DLR	Leaf Rusts General	IE	Engravers/IPS	WM	Mice or Voles
DLS	Leaf Spot Diseases	IF	Spruce Bud Midge	WP	Porcupine
DLV	Aspen and Poplar Leaf and Twig Blight	IM	Seed and Cone Insects	WS	Squirrel
DM	Lodgepole Pine Dwarf Mistletoe	IMC	Spruce Seed Moth	WV	Beaver
DR	Root Diseases			WY	Sapsuckers
DRA	Armillaria Root Disease				
DRI	Tomentosus Root Rot				
DS	Stem Diseases				
DSA	Atropellis Canker				

68. Last Three Internode Lengths:

- Internodal measurements capture one or more previous years measurements when plots are not visited annually. Internodal measurements are also recorded for the previous three years growth on new crop trees that are replacing existing crop trees.
- Where collected/applicability: Regeneration plot (50 sample “crop” trees – may be outside regen plot).

Example: 2001 = 3.4 cm, 2002 = 2.2 cm, 2003 = 3.2 cm.

Precision: Record to mm accuracy on trees < 2 m tall, trees over 2 m are recorded to cm accuracy. Checked to +/- 1 cm for trees < 3 m, +/- 10 cm for trees > 3 m.

69. Stem Mapping (Elective):

- Some members have elected to do stem mapping. This is commonly done by selecting a tree number and recording the azimuth and distance (m) from treatment plot center to the selected tree. Other methods may be used to stem map as long as the data is compatible with the existing database.
- Where collected/applicability: Treatment plot.

Example: Tree # 212 = 3.2 m @ 256° from treatment plot center.

Precision: +/- 5 cm and within 2°.

70. Deciduous Competition:

- For each deciduous species record the # of stems over 30 cm in height in a 2 m radius plot centered on the crop tree (Suckered deciduous stems are to be counted as individuals if the suckering has occurred under ground and is not visible. A “group” of stems visibly suckered and originating above ground may be counted as a single stem).
- In the same 2 m radius plot, record the modal height and modal diameter for each deciduous species. Modal height or diameter is the most frequently occurring height or diameter in a plot, not the average. On plots with no crop tree, regeneration plot center is to be used for plot center in assessing competition.
- In the same 2.0 m plot as above, record the height, species and proximity to crop tree (or regeneration plot center if applicable) of the tallest deciduous tree over 30 cm height.

Where collected/applicability: 2.0 m radius plot centered on crop tree or regeneration plot center if no crop tree is available.

Example: AW = 21 stems, Modal Height = 37.5 cm Modal Diameter = 0.9 cm

PB = 28 stems, Modal Height = 47.7 cm Modal Diameter = 1.1 cm

Tallest Deciduous: Species: Aw Height: 75.0 cm, Proximity: 25 cm

Precision: Mod. Ht: +/- 2 cm on trees < 1 m tall, Auditors’ discretion on trees > 1 m tall Mod. Diam.: +/- 0.1 cm.

Ht. of tallest decid: +/- 1 cm for trees < 3 m, +/- 10 cm for trees > 3 m. Proximity: +/- 1 cm

Deciduous stem counts: If the number of deciduous trees in the plot is less than or equal to 10, the exact number of trees should be recorded; However, if the stem count exceeds 10, an

estimate (+/- 10%) is acceptable. This may be obtained by estimation from a representative segment of the circular plot (e.g. counting trees in a ¼ segment, and multiplying by 4 to obtain the estimate for the plot).

71. Shrub & Herb Competition:

For up to five herb and shrub species competing with the crop tree, record the percent cover for each species along with the modal height of each in a 1.0 m radius plot centered on the crop tree (assessment is done on plot center when no crop tree is present). It is the assessor's decision as to whether or not a given species is competing with the crop tree and is based on the volume of vegetation and its proximity to the crop tree within the 1 m cylinder.

Don't try to fill all five species if they aren't actually competing with the crop tree. Where two or more species are encountered with overlapping foliage covering the same ground area, the species with the tallest average height for that given area is assigned the percent cover (for that area).

eg: In a 1m radius plot you have two species, Loniinv @ 50% cover with a 60cm avg ht., and Corncan @ 10% cover with a 8cm avg ht.. 5% of the Corncan is overtopped by the Loniinv; Therefore, you would record Loniinv @ 50% cover and Corncan at 5% cover (the other 5% corncan is overtopped by the Loniinv and is not counted.)

By doing this, shrub and herb competition percent cover will never exceed 100% at any given plot.

- Where collected/applicability: 1.0 m radius plot centered on crop tree or regeneration plot center if no crop tree is available.

Example: Loniinv: Percent Cover = 6% Modal Height = 22 cm

Rosaaci: Percent Cover = 8%, Modal Height = 16 cm

Calacan: Percent Cover = 30% Modal Height = 55 cm

72. Dropped Cone Survey/Slash Rating:

- In the same 1.0 m radius plot in which shrub and herb competition was assessed, count the number of pine cones present on the surface of the plot and also record the percent cover of slash (use the same percent cover assessment procedure used for herb and shrub competition).

Example: Plot #15: 21 cones, slash rating = 32%

Precision: +/- 10%.

73. Measurement Number:

A consecutive measurement number, starting at one [1], will be assigned each time a set of data is collected (ie: one "measurement year" could consist of an early competition assessment and a regular size & growth measurement. Two measurement numbers would be assigned in one season if there was a pre & post growing season data collection for that season resulting in two sets of data. For installations in which spring planting resulted in two separate measurements the first year, measurement numbers 1 & 2 would have been assigned respectively.

74. Growing Season Number:

A consecutive growing season number will be assigned for each consecutive growing season. This will display how many growing seasons have elapsed since planting. Spring planted/measured trees would be assigned a zero [0], as no seasons would have elapsed since planting.

8.1.14 Installation Photographs

Not unlike data, photographs collected year to year have little value until combined/compared with prior and subsequent years photographs. Once compared, photographs can often illustrate a trials performance in a way that data cannot. Therefore, collecting photographs will be considered an invaluable component of the trial.

Photographs are to be taken at least every two years (more frequently if a vegetation treatment has been completed or the site is highly dynamic). Photographs may be taken digitally or conventional photographs may be collected and converted to digital (Access) format. Digital photograph files will be submitted annually to the Foothills Model Forest for inclusion in the project database. (They can be submitted along with mensuration data or separately.) Photos are stored directly in the Access Database as a photo object (OLE Object). Appendix V describes the table structure for these data.

Photograph Collection Methodology:

- At each treatment plot center (4 per installation), take one landscape orientated photo toward each treatment plot corner. This will give us four photos per treatment plot and therefore 16 photos per installation. Photographs must be labelled accurately in order to avoid any confusion later on in the trial. (Optional “portrait” photographs may be taken at the members discretion)
- Contractors will confirm the photograph submission format & protocol with the database manager prior to any collection of data.

9. Quality Control/Auditing (Field Work)

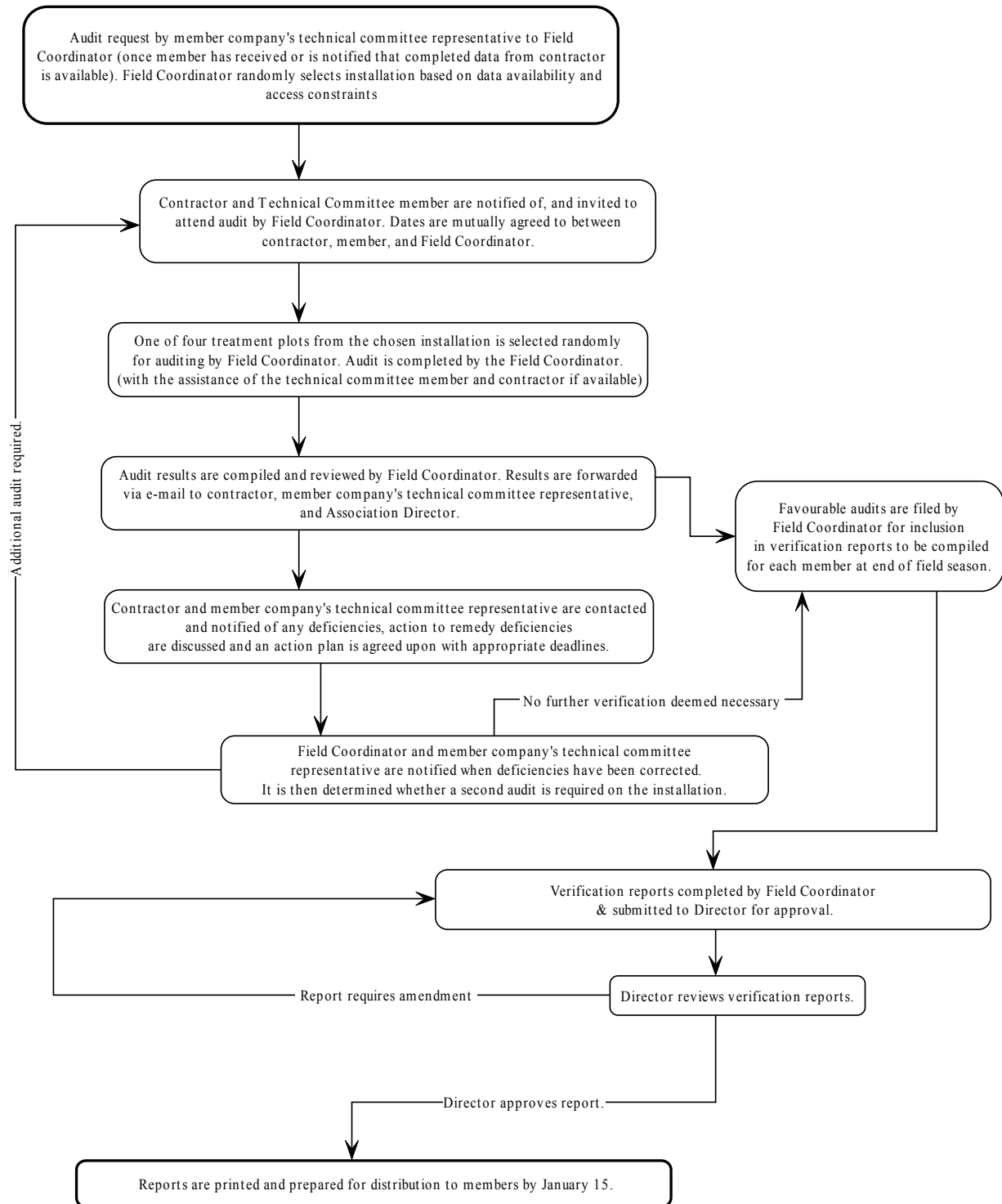
Field audits will initially be done in the form of informal “mentoring audits” with the objective of helping contractors to attain consistency and ensuring that all necessary measurements are completed and accurate. [For data quality control see section 8.1.6 (pg.18)]

Contractors and Technical Committee members are encouraged to attend and assist the audits to get the most out of the “mentoring” process. Ten percent of the 92 installations installed and measured in the 2001 field season are to be formally audited and documented by the Field Coordinator. Every effort will be made to ensure that audits are evenly distributed among the member companies. A ten percent sampling intensity will tentatively be applied for future field seasons as well.

Any deficiencies observed in formal field audits or general quality checks will be ratified as directed by the Field Coordinator and the applicable Technical Committee representative. Once ratified to a level acceptable by the Field Coordinator and the applicable Technical Committee representative a decision will be made as to whether an additional formal audit is necessary. A verification report will be completed at the end of each season for each member. The report will detail the formal audit results and any other quality issues observed by the Field Coordinator. It will also detail any ratification necessary to bring installations and/or their measurements to an acceptable quality level.

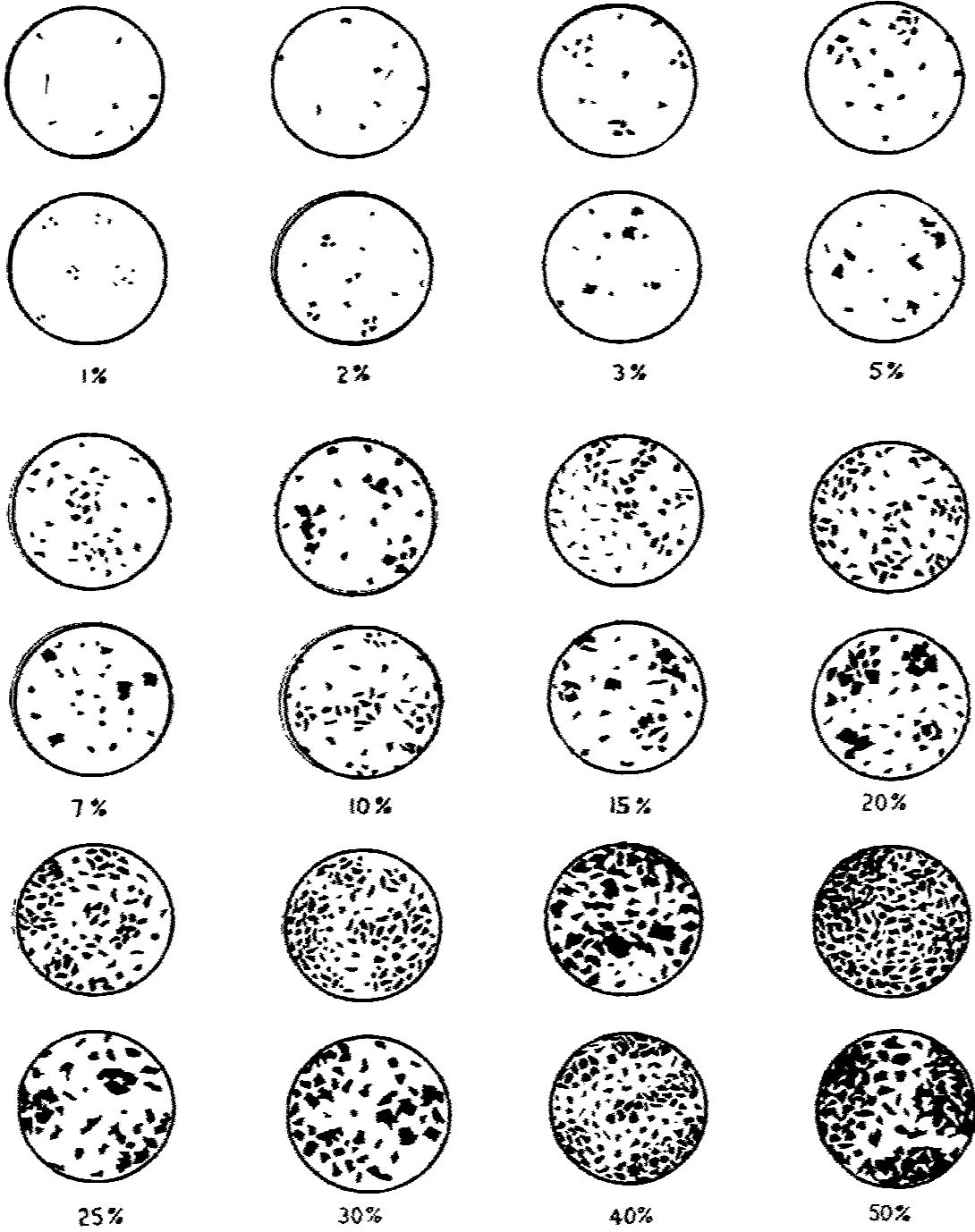
Please see Figure 6 (p.46) outlining the auditing process and Appendix IV: Sample Field Audit Form.(p.52).

Figure 6. FGYA Field Work Audit Flow Chart



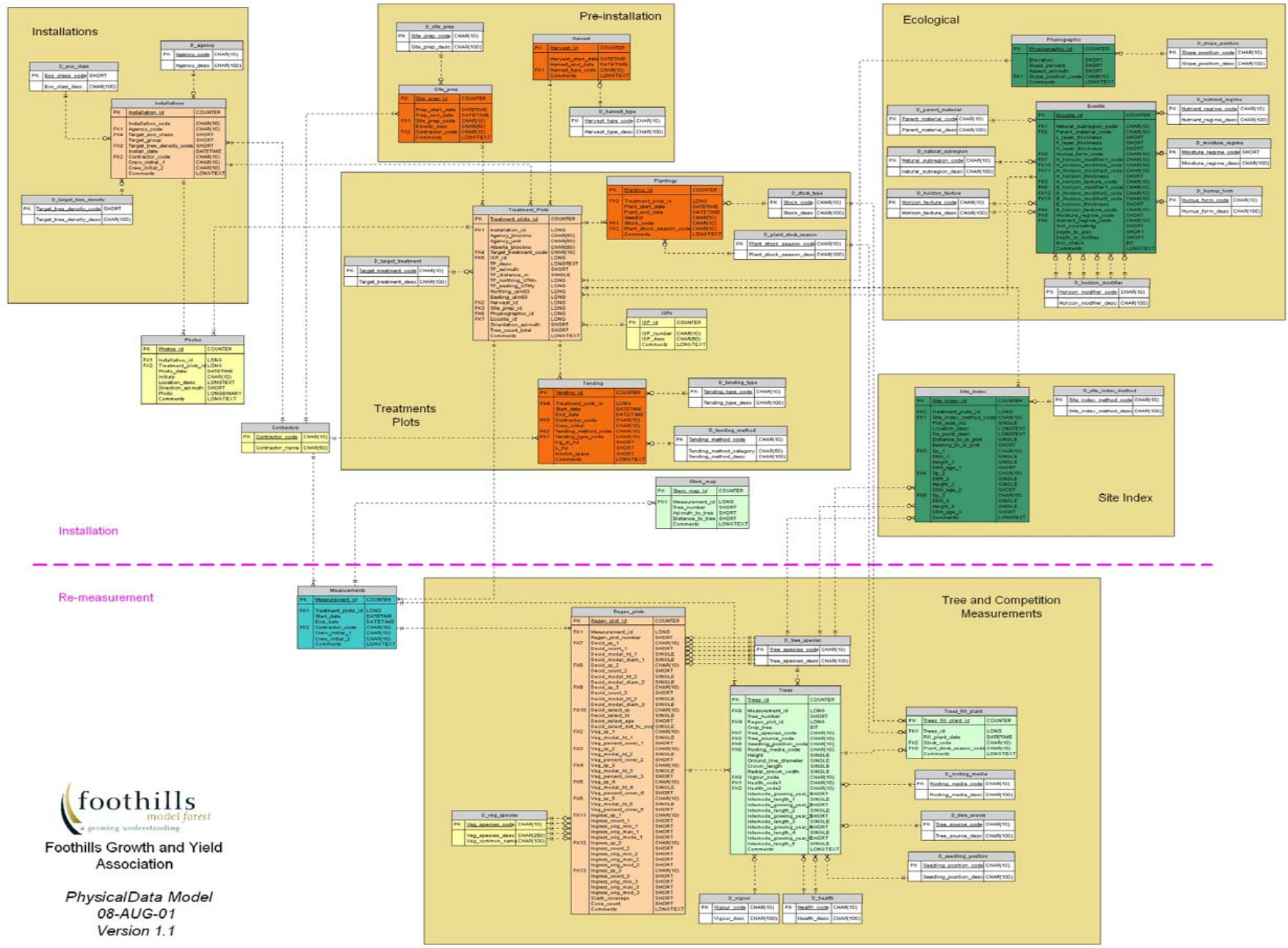
APPENDIX I

Comparison Chart for Visual Estimation of Percent Cover



APPENDIX II

Foothills Growth and Yield Association Data Model ER Diagram



APPENDIX III

Sample Field Audit Form

Foothills Growth and Yield Association

Lodgepole Pine Regeneration Project

Audit Sheet

Agency:	Auditor:
Contractor:	Date of Audit:
Crew Initials:	Target Treatment:
Target Eco-Class (1-5):	Target Tree Density:
Group #(1-5):	Treatment Plot# (1-4):
Spacing Code (1-6):	

Site Selection and Administration

1 Plot easily located using provided maps Comments:	Yes	No	N/A	See Comments
2 Tie point(s) established and documented. Comments:	Yes	No	N/A	See Comments
3 Treatment plot location selection meets conditions detailed in manual. Comments:	Yes	No	N/A	See Comments
4 Buffers installed as per manual. Comments:	Yes	No	N/A	See Comments
5 Posts established and demarcated correctly. Comments:	Yes	No	N/A	See Comments

Planting Quality

6 Planted density/spacing meets "target" planting density. Comments:	Yes	No	N/A	See Comments
7 Planting stock healthy and vigorous. Comments:	Yes	No	N/A	See Comments
8 Planting quality assessed and o.k. (>85% quality). 8.5 out of Ten trees planted to industry standards. Comments:	Yes	No	N/A	See Comments

Ecological/Soils					
9	Treatment plots fits into target eco-class. Comments:	Yes	No	N/A	See Comments
10	Elevation, aspect, & slope assessed correctly. Comments:	Yes	No	N/A	See Comments
11	Parent material correctly identified. Comments:	Yes	No	N/A	See Comments
12	LFH layer thickness accurate Comments:	Yes	No	N/A	See Comments
13	A-C layer thickness accurate & modifiers correct. Comments:	Yes	No	N/A	See Comments
14	Soil textures correctly identified within 1 class Comments:	Yes	No	N/A	See Comments
15	Moisture/Nutrient regimes assessed correctly. Comments:	Yes	No	N/A	See Comments
16	Humus form identified correctly. Comments:	Yes	No	N/A	See Comments
17	Soil coarse fragment content assessed correctly Comments:	Yes	No	N/A	See Comments
18	Depth tp Gley/mottles recorded accurately Comments:	Yes	No	N/A	See Comments
19	Evidence that soil was checked in suspect non-homogenous areas. Comments:	Yes	No	N/A	See Comments
Site Index					
20	Plot size recorded Comments:	Yes	No	N/A	See Comments
21	Location of Site index plot acceptable. Comments:	Yes	No	N/A	See Comments
22	Tie point, location description, distances and azimuth to plot acceptable. Comments:	Yes	No	N/A	See Comments
23	Site index trees meet criteria as outlined in manual. Comments:	Yes	No	N/A	See Comments
24	Heights/Diameters accurate Comments:	Yes	No	N/A	See Comments
25	Ages accurate Comments:	Yes	No	N/A	See Comments

Competition/Tree measurements

26	Deciduous tree count within acceptable limits Plot#'s Checked: Comments:	Yes	No	N/A	See Comments
27	Deciduous species identified correctly Plot#'s Checked: Comments:	Yes	No	N/A	See Comments
28	Modal height for deciduous within acceptable limits	Yes	No	N/A	See Comments
29	Modal diameter for deciduous within acceptable limits Plot#'s Checked: Comments:	Yes	No	N/A	See Comments
30	Tallest deciduous selected and measured correctly Plot#'s Checked: Comments:	Yes	No	N/A	See Comments
31	Veg species identified correctly	Yes	No	N/A	See Comments
32	Veg modal height measured correctly	Yes	No	N/A	See Comments
33	Vegetation percent cover assessed accurately Plot#'s Checked: Comments:	Yes	No	N/A	See Comments
34	Crop tree selected and marked as per manual. Comments:	Yes	No	N/A	See Comments
35	Regen plot number recorded for measured trees. Comments:	Yes	No	N/A	See Comments
36	Tree source recorded for measured trees Comments:	Yes	No	N/A	See Comments
37	Seedling position recorded for measured trees Comments:	Yes	No	N/A	See Comments
38	Rooting media recorded for measured trees Comments:	Yes	No	N/A	See Comments
39	Heights of tagged trees in regen plots accurate.	Yes	No	N/A	See Comments
40	Ground line diameter of tagged trees in regen plots accurate.	Yes	No	N/A	See Comments
41	Crown length of tagged trees in regen plots accurate	Yes	No	N/A	See Comments
42	Crown diameter of tagged trees in regen plots accurate. Tree numbers checked: Comments:	Yes	No	N/A	See Comments
43	Vigour and health assessed correctly Tree numbers checked: Comments:	Yes	No	N/A	See Comments
44	Coniferous Density assessed correctly. Plot numbers checked: Comments:	Yes	No	N/A	See Comments
45	Cone count and slash rating assessed correctly. Plot numbers checked: Comments:	Yes	No	N/A	See Comments

APPENDIX IV

Detailed Delivery File Structure Description

Query: FileStructure_L01_Installation

Name	Type	Size
Agency_code Description: Required: Source Table:	Text Code for company name (BRL, WWC etc) True Installations	10
Target_eco_class Description: Required: Source Table:	Integer Target numeric ecological class as defined by FGYA (1-5) True Installations	2
Target_group Description: Required: Source Table: ValidationRule:	Integer Target geographic group as defined by FGYA (1-5) True Installations >=1 And <=5	2
Target_tree_density_code Description: Ordinal Position: Required: Source Table:	Integer Target tree density for the given installation (0,816,1111 etc.) 3 True Installations	2
Install_date Description: Required: Source Table: ValidationRule:	Date/Time Start date of installation layout True Installations >=#1/1/2000# And <=#1/1/2003#	8
Contractor_code Description: Ordinal Position: Required: Source Table:	Text Code for contractor performing installation installation 5 True Installations	10
Crew_initial_1 Description: Required: Source Table:	Text Crew initials 1 True Installations	10
Crew_initial_2 Description: Required: Source Table:	Text Crew initials 2 False Installations	10
Comments Description: Required: Source Table:	Text Installation comments False Installations	255

Query: FileStructure_L02_TreatmentPlot

Name	Type	Size
Agency_code Description: Required: Source Table:	Text Code for company name (BRL, WWC etc) True Installations	10
Target_eco_class Description: Required: Source Table:	Integer Target numeric ecological class as defined by FGYA (1-5) True Installations	2
Target_group Description: Required: Source Table: ValidationRule:	Integer Target geographic group as defined by FGYA (1-5) True Installations >=1 And <=5	2
Target_tree_density_code Description: Ordinal Position: Required: Source Table:	Integer Target tree density for the given installation (0,816,1111 etc.) 3 True Installations	2
Target_treatment_code Description: Required: Source Table:	Text Target treatment code for the treatment plot (C,W,T,WT) True Treatment_Plots	10
ISP_number Description: Required: Source Table:	Text ISP identifier True ISPs	10
ISPs.Comments Description: Required: Source Table:	Text ISP Comments False ISPs	255
TP_desc Description: Required: Source Table:	Text Tie point description for treatment plot location False Treatment_Plots	255
TP_azimuth Description: Required: Source Table: ValidationRule:	Integer Bearing FROM tie point to Treatment Plot Centre False Treatment_Plots >=0 And <=360	2
TP_distance_m Description: Required: Source Table:	Single Distance FROM tie point to Treatment Plot Centre False Treatment_Plots	4
TP_northing_UTMx Description: Required: Source Table: ValidationRule:	Long Integer Tie point northing from GPS False Treatment_Plots >5500000 And <=620000	4

TP_easting_UTMy	Long Integer	4
Description:	Tie point easting from GPS	
Required:	False	
Source Table:	Treatment_Plots	
ValidationRule:	>300000 And <=750000	
Northing_utm83	Long Integer	4
Description:	UTM northing for treatment plot centre	
Required:	False	
Source Table:	Treatment_Plots	
ValidationRule:	>5500000 And <=6200000	
Easting_utm83	Long Integer	4
Description:	UTM easting for treatment plot centre	
Required:	False	
Source Table:	Treatment_Plots	
ValidationRule:	>300000 And <=750000	
Orientation_azimuth	Integer	2
Description:	Orientation of the square treatment plot along the eastern most boundary	
Required:	False	
Source Table:	Treatment_Plots	
ValidationRule:	>0 And <=360	
Tree_count_total	Integer	2
Description:	Total number of planted trees within the treatment plot. This will include the areas outside the measurement plot (red plot).	
Required:	False	
Source Table:	Treatment_Plots	
Treatment_Plots.Comments	Text	255
Description:	Treatment plot comments	
Required:	False	
Source Table:	Treatment_Plots	

Query: FileStructure_L03_Ecological

Name	Type	Size
Agency_code Description: Required: Source Table:	Text Code for company name (BRL, WWC etc) True Installations	10
Target_eco_class Description: Required: Source Table:	Integer Target numeric ecological class as defined by FGYA (1-5) True Installations	2
Target_group Description: Required: Source Table: ValidationRule:	Integer Target geographic group as defined by FGYA (1-5) True Installations >=1 And <=5	2
Target_tree_density_code Description: Ordinal Position: Required: Source Table:	Integer Target tree density for the given installation (0,816,1111 etc.) 3 True Installations	2
Target_treatment_code Description: Required: Source Table:	Text Target treatment code for the treatment plot (C,W,T,WT) True Treatment_Plots	10
Elevation Description: Required: Source Table: ValidationRule:	Integer Elevation at treatment plot centre True Physiographic >=500 And <=3000 Or 9999	2
Slope_percent Description: Required: Source Table: ValidationRule:	Integer Average slope percent over treatment plot True Physiographic >=0 And <=150 Or 9999	2
Aspect_azimuth Description: Required: Source Table: ValidationRule:	Integer Average aspect azimuth for the treatment plot True Physiographic >=0 And <=360 Or 9999	2
Slope_position_code Description: Required: Source Table:	Text Slope position of the treatment plot True Physiographic	10
Physiographic.Comments Description: Required: Source Table:	Text Physiography comments False Physiographic	255
Natural_subregion_code Description: Required: Source Table:	Text Natural subregion code True Ecosite	10

Parent_material_code	Text	10
Description:	Parent material code	
Required:	True	
Source Table:	Ecosite	
L_layer_thickness	Integer	2
Description:	Litter layer average thickness in centimeters	
Required:	True	
Source Table:	Ecosite	
F_layer_thickness	Integer	2
Description:	Fermented layer average thickness in centimeters	
Required:	True	
Source Table:	Ecosite	
H_layer_thickness	Integer	2
Description:	Humus layer average thickness in centimeters	
Required:	True	
Source Table:	Ecosite	
Humus_form_code	Text	10
Description:	Humus form code	
Required:	True	
Source Table:	Ecosite	
A_horizon_modifier1_code	Text	10
Description:	A horizon modifier code	
Required:	True	
Source Table:	Ecosite	
A_Horizon_modifier2_code	Text	10
Description:	A_Horizon_modifier2_code is of Ecosite	
Required:	False	
Source Table:	Ecosite	
A_Horizon_modifier3_code	Text	10
Description:	A_Horizon_modifier3_code is of Ecosite	
Required:	False	
Source Table:	Ecosite	
A_horizon_thickness	Integer	2
Description:	A horizon thicknes in centimeters as average depth from LFH to B horizon	
Required:	True	
Source Table:	Ecosite	
ValidationRule:	>=0 And <=100	
A_horizon_texture_code	Text	10
Description:	A horizon soil texture code	
Required:	True	
Source Table:	Ecosite	
B_horizon_modifier1_code	Text	10
Description:	B horizon modifier code	
Required:	True	
Source Table:	Ecosite	
B_Horizon_modifier2_code	Text	10
Description:	B_Horizon_modifier2_code is of Ecosite	
Required:	False	
Source Table:	Ecosite	

B_Horizon_modifier3_code	Text	10
Description:	B_Horizon_modifier3_code is of Ecosite	
Required:	False	
Source Table:	Ecosite	
B_horizon_thickness	Integer	2
Description:	B horizon depth in centimeters as average depth from bottom of A to bottom of B horizons	
Required:	False	
Source Table:	Ecosite	
B_horizon_texture_code	Text	10
Description:	B horizon soil texture	
Required:	False	
Source Table:	Ecosite	
Moisture_regime_code	Integer	2
Description:	Moisture regime code	
Required:	True	
Source Table:	Ecosite	
Nutrient_regime_code	Text	10
Description:	Nutrient regime code	
Required:	True	
Source Table:	Ecosite	
Soil_coursefrag	Integer	2
Description:	Average course fragment percentage for entire profile	
Required:	True	
Source Table:	Ecosite	
ValidationRule:	>=0 And <=100	
Depth_to_gley	Integer	2
Description:	Depth in centimeters to evidence of gleying from top of A	
Required:	False	
Source Table:	Ecosite	
ValidationRule:	>=0 And <=100	
Depth_to_mottles	Integer	2
Description:	Depth in centimeters to evidence of mottling from top of A	
Required:	False	
Source Table:	Ecosite	
ValidationRule:	>=0 And <=100	
Eco_check	Yes/No	1
Description:	Has the treatment plot been confirmed for correct	
Required:	True	
Source Table:	Ecosite	
Ecosite.Comments	Text	255
Description:	Ecology comments	
Required:	False	
Source Table:	Ecosite	

Query: FileStructure_L04_Planting

Name	Type	Size
Agency_code Description: Required: Source Table:	Text Code for company name (BRL, WWC etc) True Installations	10
Target_eco_class Description: Required: Source Table:	Integer Target numeric ecological class as defined by FGYA (1-5) True Installations	2
Target_group Description: Required: Source Table: ValidationRule:	Integer Target geographic group as defined by FGYA (1-5) True Installations >=1 And <=5	2
Target_tree_density_code Description: Ordinal Position: Required: Source Table:	Integer Target tree density for the given installation (0,816,1111 etc.) 3 True Installations	2
Target_treatment_code Description: Required: Source Table:	Text Target treatment code for the treatment plot (C,W,T,WT) True Treatment_Plots	10
Plant_start_date Description: Required: Source Table: ValidationRule:	Date/Time Start date for planting of treatment plot True Plantings >=#1/1/2000# And <=#1/1/2003#	8
Plant_end_date Description: Required: Source Table: ValidationRule:	Date/Time End date for planting of treatment plot False Plantings >=#1/1/200# And <=#1/1/2003#	8
Seedlot Description: Required: Source Table:	Text Seedlot of trees planted in the TP True Plantings	50
Stock_code Description: Required: Source Table:	Text Stock_code identifies D_stock_type True D_stock_type	10
Plant_stock_season_code Description: Required: Source Table:	Text Target season for planting stock - spring or summer True Plantings	10
Comments Description: Required: Source Table:	Text Planting comments False Plantings	255

Query: FileStructure_L05_BlockInfo

Name	Type	Size
Agency_code Description: Required: Source Table:	Text Code for company name (BRL, WWC etc) True Installations	10
Target_eco_class Description: Required: Source Table:	Integer Target numeric ecological class as defined by FGYA (1-5) True Installations	2
Target_group Description: Required: Source Table: ValidationRule:	Integer Target geographic group as defined by FGYA (1-5) True Installations >=1 And <=5	2
Target_tree_density_code Description: Ordinal Position: Required: Source Table:	Integer Target tree density for the given installation (0,816,1111 etc.) 3 True Installations	2
Target_treatment_code Description: Required: Source Table:	Text Target treatment code for the treatment plot (C,W,T,WT) True Treatment_Plots	10
Agency_blockno Description: Required: Source Table:	Text Company/agency block number/identifier False Treatment_Plots	50
Agency_unit Description: Required: Source Table:	Text Company/agency operating unit False Treatment_Plots	50
Alberta_blockno Description: Required: Source Table:	Text Provincial unique block identifier (eg SRMS number) False Treatment_Plots	50
Target_treatment_code Description: Required: Source Table:	Text Target treatment code for the treatment plot - Control, Weed, Thin, Weed and Thin True Treatment_Plots	10
Harvest_start_date Description: Required: Source Table: ValidationRule:	Date/Time Start date for harvest of treatment plot True Harvest >=#1/1/1998# And <=#1/1/2003#	8
Harvest_end_date Description: Required: Source Table: ValidationRule:	Date/Time End date for harvest of treatment plot False Harvest >=#1/1/1998# And <=#1/1/2003#	8

Harvest_type_code	Text	10
Description:	Harvest method on the TP	
Required:	False	
Source Table:	Harvest	
Harvest.Comments	Text	255
Description:	Harvest comments	
Required:	False	
Source Table:	Harvest	
Prep_start_date	Date/Time	8
Description:	Start date for site preparation of treatment plot	
Required:	False	
Source Table:	Site_prep	
ValidationRule:	>=#1/1/1999# And <=#1/1/2003#	
Prep_end_date	Date/Time	8
Description:	End date for site preparation of treatment plot	
Required:	False	
Source Table:	Site_prep	
ValidationRule:	>=#1/1/1999# And <=#1/1/2003#	
Site_prep_code	Text	10
Description:	Code for type of site preparation	
Required:	False	
Source Table:	Site_prep	
Density_desc	Text	50
Description:	Generic field to capture prep density where applicable. (eg mounds/ha)	
Required:	False	
Source Table:	Site_prep	
Contractor_code	Text	10
Description:	Contractor_code partly identifies Site_prep	
Required:	False	
Source Table:	Site_prep	
Site_prep.Comments	Text	255
Description:	Site prep comments	
Required:	False	
Source Table:	Site_prep	

Query: FileStructure_L06_SiteIndex

Name	Type	Size
Agency_code Description: Required: Source Table:	Text Code for company name (BRL, WWC etc) True Installations	10
Target_eco_class Description: Required: Source Table:	Integer Target numeric ecological class as defined by FGYA (1-5) True Installations	2
Target_group Description: Required: Source Table: ValidationRule:	Integer Target geographic group as defined by FGYA (1-5) True Installations >=1 And <=5	2
Target_tree_density_code Description: Required: Source Table:	Integer Target tree density for the given installation (0,816,1111 etc.) True Installations	2
Target_treatment_code Description: Required: Source Table:	Text Target treatment code for the treatment plot (C,W,T,WT) True Treatment_Plots	10
Site_index_method_code Description: Ordinal Position: Required: Source Table:	Text Site index determination method code. How the site index was determined. (eg PHA on TP, PHA in adjacent etc.) 5 True Site_Index	10
Plot_size_m2 Description: Required: Source Table:	Single Size of plot in square meters True Site_Index	4
Location_desc Description: Required: Source Table:	Text Description of site index plot location False Site_Index	255
Tie_point_desc Description: Required: Source Table:	Text Description of reference point for locating site index plot False Site_Index	255
Distance_to_si_plot Description: Required: Source Table:	Single Distance from SI tie point desc to SI plot centre False Site_Index	4
Bearing_to_si_plot Description: Required: Source Table:	Integer Bearing from SI tie point desc to SI plot centre False Site_Index	2
Sp_1 Description: Required: Source Table:	Text Tree species for tree 1 True Site_Index	10

DBH_1	Single	4
Description:	Tree diameter at breast height in centimeters for tree 1	
Required:	True	
Source Table:	Site_Index	
ValidationRule:	>=0 And <=300	
Height_1	Single	4
Description:	Tree height in meters for tree 1	
Required:	True	
Source Table:	Site_Index	
ValidationRule:	>=0 And <=50	
DBH_age_1	Integer	2
Description:	Tree age for tree 1	
Required:	True	
Source Table:	Site_Index	
ValidationRule:	>=0 And <=500 Or 9999	
Sp_2	Text	10
Description:	Tree species for tree 2	
Required:	True	
Source Table:	Site_Index	
DBH_2	Single	4
Description:	Tree diameter at breast height in centimeters for tree 2	
Required:	True	
Source Table:	Site_Index	
ValidationRule:	>=0 And <=300	
Height_2	Single	4
Description:	Tree height in meters for tree 2	
Required:	True	
Source Table:	Site_Index	
ValidationRule:	>=0 And <=50	
DBH_age_2	Integer	2
Description:	Tree age for tree 2	
Required:	True	
Source Table:	Site_Index	
ValidationRule:	>=0 And <=500 Or 9999	
Sp_3	Text	10
Description:	Tree species for tree 3	
Required:	True	
Source Table:	Site_Index	
DBH_3	Single	4
Description:	Tree diameter at breast height in centimeters for tree 3	
Required:	True	
Source Table:	Site_Index	
ValidationRule:	>=0 And <=300	
Height_3	Single	4
Description:	Tree height in meters for tree 3	
Required:	True	
Source Table:	Site_Index	
ValidationRule:	>=0 And <=50	
DBH_age_3	Integer	2
Description:	Tree age for tree 3	
Required:	True	
Source Table:	Site_Index	
ValidationRule:	>=0 And <=500 Or 9999	
Comments	Text	255
Description:	Site index comments	
Required:	False	
Source Table:	Site_Index	

Query: FileStructure_L07_RegenPlot

Name	Type	Size
Agency_code Description: Required: Source Table:	Text Code for company name (BRL, WWC etc) True Installations	10
Target_eco_class Description: Required: Source Table:	Integer Target numeric ecological class as defined by FGYA (1-5) True Installations	2
Target_group Description: Required: Source Table: ValidationRule:	Integer Target geographic group as defined by FGYA (1-5) True Installations >=1 And <=5	2
Target_tree_density_code Description: Required: Source Table:	Integer Target tree density for the given installation (0,816,1111 etc.) True Installations	2
Target_treatment_code Description: Required: Source Table:	Text Target treatment code for the treatment plot (C,W,T,WT) True Treatment_Plots	10
Measurement_number Description: Required: Source Table: ValidationRule:	Integer Incremental measurement number, starting at 1 True Measurements >=1 And <=10	10
Growing_season_number Description: Required: Source Table: ValidationRule:	Long Integer Number of growing seasons that have elapsed. 0 if no seasons have elapsed. Number of growing seasons that have elapsed. 0 if no seasons have elapsed. False Measurements >=0 And <=10	4
Measurement_season_code Description: Required: Source Table:	Text Intended season of measurement, that is Spring or Summer False Measurements	50
Start_date Description: Required: Source Table: ValidationRule:	Date/Time Measurement start date. This can be measurement of any kind; mortality, tree count, regeneration survey etc. True Measurements >=#1/1/2000# And <=#1/1/2005#	8
End_date Description: Required: Source Table: ValidationRule:	Date/Time Measurement end date. False Measurements >=#1/1/2000# And <=#1/1/2005#	8
Contractor_code Description: Required: Source Table:	Text Contractor code for measurement True Measurements	10

Crew_initial_1	Text	10
Description:	Crew initial 1	
Required:	False	
Source Table:	Measurements	
Crew_initial_2	Text	10
Description:	Crew initial 2	
Required:	False	
Source Table:	Measurements	
Regen_plot_number	Integer	2
Description:	Regen plot number	
Required:	True	
Source Table:	Regen_plots	
ValidationRule:	>=1 And <=16	
Decid_sp_1	Text	10
Description:	Deciduous species 1	
Required:	False	
Source Table:	Regen_plots	
Decid_count_1	Integer	2
Description:	Tree count for deciduous species 1	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=0 And <=500	
Decid_modal_ht_1	Single	4
Description:	Deciduous species 1 modal height in centimeters	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=5 And <=300	
Decid_modal_diam_1	Single	4
Description:	Deciduous species 1 modal diameter in centimeters	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=0 And <=30	
Decid_sp_2	Text	10
Description:	Deciduous species 2	
Required:	False	
Source Table:	Regen_plots	
Decid_count_2	Integer	2
Description:	Tree count for deciduous species 2	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=0 And <=500	
Decid_modal_ht_2	Single	4
Description:	Deciduous species 2 modal height in centimeters	
Ordinal Position:	20	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=5 And <=300	
Decid_modal_diam_2	Single	4
Description:	Deciduous species 2 modal diameter in centimeters	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=0 And <=30	

Decid_sp_3	Text	10
ColumnWidth:	Default	
Description:	Deciduous species 3	
Required:	False	
Source Table:	Regen_plots	
Decid_count_3	Integer	2
Description:	Tree count for deciduous species 3	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=0 And <=500	
Decid_modal_ht_3	Single	4
Description:	Deciduous species 3 modal height in centimeters	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=5 And <=300	
Decid_modal_diam_3	Single	4
Description:	Deciduous species 3 modal diameter in centimeters	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=0 And <=30	
Decid_select_sp	Text	10
Description:	Tallest deciduous competition tree species	
Required:	False	
Source Table:	Regen_plots	
Decid_select_ht	Single	4
Description:	Tallest deciduous competition tree height	
Required:	False	
Source Table:	Regen_plots	
Decid_select_age	Integer	2
Description:	Decid_select_age is of Regen_plots	
Required:	False	
Source Table:	Regen_plots	
Decid_select_dist_to_crop	Single	4
Description:	Tallest deciduous competition tree distance to crop tree	
Required:	False	
Source Table:	Regen_plots	
Veg_sp_1	Text	10
Description:	Vegetation species 1	
Required:	False	
Source Table:	Regen_plots	
Veg_modal_ht_1	Single	4
Description:	Vegetation species 1 average height in centimeters	
Required:	False	
Source Table:	Regen_plots	
Veg_percent_cover_1	Integer	2
Description:	Vegetation species 1 percent cover	
Required:	False	
Source Table:	Regen_plots	
Veg_sp_2	Text	10
Description:	Vegetation species 2	
Required:	False	
Source Table:	Regen_plots	

Veg_modal_ht_2	Single	4
Description:	Vegetation species 2 average height in centimeters	
Ordinal Position:	34	
Required:	False	
Source Table:	Regen_plots	
Veg_percent_cover_2	Integer	2
Description:	Vegetation species 2 percent cover	
Ordinal Position:	35	
Required:	False	
Source Table:	Regen_plots	
Veg_sp_3	Text	10
Description:	Vegetation species 3	
Required:	False	
Source Table:	Regen_plots	
Veg_modal_ht_3	Single	4
Description:	Vegetation species 3 average height in centimeters	
Required:	False	
Source Table:	Regen_plots	
Veg_percent_cover_3	Integer	2
Description:	Vegetation species 3 percent cover	
Required:	False	
Source Table:	Regen_plots	
Veg_sp_4	Text	10
Description:	Vegetation species 4	
Required:	False	
Source Table:	Regen_plots	
Veg_modal_ht_4	Single	4
Description:	Vegetation species 4 average height in centimeters	
Required:	False	
Source Table:	Regen_plots	
Veg_percent_cover_4	Integer	2
Description:	Vegetation species 4 percent cover	
Required:	False	
Source Table:	Regen_plots	
Veg_sp_5	Text	10
Description:	Vegetation species 5	
Required:	False	
Source Table:	Regen_plots	
Veg_modal_ht_5	Single	4
Description:	Vegetation species 1 average height in centimeters	
Required:	False	
Source Table:	Regen_plots	
Veg_percent_cover_5	Integer	2
Description:	Vegetation species 5 percent cover	
Required:	False	
Source Table:	Regen_plots	
Ingress_sp_1	Text	10
Description:	Ingress species 1	
Required:	False	
Source Table:	Regen_plots	
Ingress_count_1	Integer	2
Description:	Ingress species 1 tree count	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=0 And <=150	

Ingress_sp_2	Text	10
Description:	Ingress species 2	
Required:	False	
Source Table:	Regen_plots	
Ingress_count_2	Integer	2
Description:	Ingress species 2 tree count	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>0 And <=150	
Ingress_count_3	Integer	2
Description:	Ingress species 3 tree count	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>0 And <=150	
Conifer_count_1	Integer	2
Description:	Conifer species 1 count	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=0 And <=150	
Conifer_sp_2	Text	10
Description:	Conifer present species 2, for the purpose of counting all conifer, by species in the regen plot	
Required:	False	
Source Table:	Regen_plots	
Conifer_count_2	Integer	2
Description:	Conifer species 2 count	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=0 And <=150	
Conifer_sp_3	Text	10
Description:	Conifer present species 3, for the purpose of counting all conifer, by species in the regen plot	
Required:	False	
Source Table:	Regen_plots	
Conifer_count_3	Integer	2
Description:	Conifer species 3 count	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=0 And <=150	
Slash_coverage	Integer	2
Description:	Slash coverage for 1m radius around crop, or around regen plot if no crop tree present.	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=0 And <=100	
Cone_count	Integer	2
Description:	Cone count (all species) for 1m radius around crop, or around regen plot if no crop tree present.	
Required:	False	
Source Table:	Regen_plots	
ValidationRule:	>=0 And <=500	
Comments	Text	255
Description:	Regen plot comments	
Required:	False	
Source Table:	Regen_plots	

Query: FileStructure_L08_Trees

Name	Type	Size
Agency_code Description: Required: Source Table:	Text Code for company name (BRL, WWC etc) True Installations	10
Target_eco_class Description: Required: Source Table:	Integer Target numeric ecological class as defined by FGYA (1-5) True Installations	2
Target_group Description: Required: Source Table: ValidationRule:	Integer Target geographic group as defined by FGYA (1-5) True Installations >=1 And <=5	2
Target_tree_density_code Description: Required: Source Table:	Integer Target tree density for the given installation (0,816,1111 etc.) True Installations	2
Target_treatment_code Description: Required: Source Table:	Text Target treatment code for the treatment plot (C,W,T,WT) True Treatment_Plots	10
Growing_season_number Description: Required: Source Table: ValidationRule:	Long Integer Number of growing seasons that have elapsed. 0 if no seasons have elapsed. Number of growing seasons that have elapsed. 0 if no seasons have elapsed. False Measurements >=0 And <=10	4
Measurement_season_code Description: Required: Source Table:	Text Intended season of measurement, that is Spring or Summer False Measurements	50
Regen_plot_number Description: Required: Source Table: ValidationRule:	Integer Regen plot number False Regen_plots >=1 And <=16 or 9999	2
Start_date Description: Required: Source Table: ValidationRule:	Date/Time Measurement start date. This can be measurement of any kind; mortality, tree count, regeneration survey etc. True Measurements >=#1/1/2000# And <=#1/1/2005#	8
End_date Description: Required: Source Table: ValidationRule:	Date/Time Measurement end date. False Measurements >=#1/1/2000# And <=#1/1/2005#	8
Contractor_code Description: Required: Source Table:	Text Contractor code for measurement True Measurements	10

Crew_initial_1	Text	10
Description:	Crew initial 1	
Required:	False	
Source Table:	Measurements	
Crew_initial_2	Text	10
Description:	Crew initial 2	
Required:	False	
Source Table:	Measurements	
Tree_number	Integer	2
Description:	Tree tag number	
Required:	True	
Source Table:	Trees	
Tree_sample_type_code	Text	50
Description:	Tree sample type. Formerly crop tree but specifies if tree is selected as crop, sample, neither or both. Unknown identifies trees measured before this new field was created.	
Required:	True	
Source Table:	Trees	
Tree_species_code	Text	10
Description:	Tree species code	
Required:	True	
Source Table:	Trees	
Tree_source_code	Text	10
Description:	Source code for given tree - ingress vs planted	
Required:	True	
Source Table:	Trees	
Seedling_position_code	Text	10
Description:	Seedling position code on scarification	
Required:	False	
Source Table:	Trees	
Rooting_media_code	Text	10
Description:	Rooting media code	
Required:	False	
Source Table:	Trees	
Height	Single	4
Description:	Height of tree in centimeters	
Required:	False	
Source Table:	Trees	
ValidationRule:	>0 And <=80	
Ground_line_diameter	Single	4
Description:	Root collar diameter at ground level, in centimeters	
Required:	False	
Source Table:	Trees	
ValidationRule:	>0 And <=20	
Crown_length	Single	4
Description:	Length of crown in centimeters	
Required:	False	
Source Table:	Trees	
ValidationRule:	>0 And <=100	
Crown_diameter	Single	4
Description:	Crown diameter in centimeters	
Required:	False	
Source Table:	Trees	
ValidationRule:	>0 And <=160	

Vigour_code	Text	10
Description:	Tree vigour code - capture mortality if applicable	
Required:	True	
Source Table:	Trees	
Health_code1	Text	10
Description:	Tree health code 1.	
Required:	False	
Source Table:	Trees	
Health_code2	Text	10
Description:	Tree health code 2.	
Required:	False	
Source Table:	Trees	
Internode_growing_year_1	Integer	2
Description:	First year for internode (previous_year) length measurement.	
Required:	False	
Source Table:	Trees	
ValidationRule:	>=1999 And <=2007	
Internode_length_1	Single	4
Description:	First year internode length.	
Required:	False	
Source Table:	Trees	
ValidationRule:	>=0 And <=100	
Internode_growing_year_2	Integer	2
Description:	Second year for internode (previous_year) length	
Required:	False	
Source Table:	Trees	
ValidationRule:	>=1999 And <=2007	
Internode_length_2	Single	4
Description:	Second year internode length.	
Required:	False	
Source Table:	Trees	
ValidationRule:	>=0 And <=100	
Internode_growing_year_3	Integer	2
Description:	Third year for internode (previous_year) length measurement.	
Required:	False	
Source Table:	Trees	
ValidationRule:	>=1999 And <=2007	
Internode_length_3	Single	4
Description:	Third year internode length.	
Required:	False	
Source Table:	Trees	
ValidationRule:	>=0 And <=100	
Internode_growing_year_4	Integer	2
Description:	Fourth year for internode (previous_year) length measurement.	
Required:	False	
Source Table:	Trees	
ValidationRule:	>=1999 And <=2007	
Internode_length_4	Single	4
Description:	Fourth year internode length.	
Required:	False	
Source Table:	Trees	
ValidationRule:	>=0 And <=100	

Internode_growing_year_5	Integer	2
Description:	Fifth year for internode (previous_year) length measurement..	
Required:	False	
Source Table:	Trees	
ValidationRule:	>=1999 And <=2007	
Internode_length_5	Single	4
Description:	Fifth year internode length.	
Required:	False	
Source Table:	Trees	
ValidationRule:	>=0 And <=100	
Comments	Text	255
Description:	Tree comments	
Required:	False	
Source Table:	Trees	

Query: FileStructure_L09_StemMapping

Name	Type	Size
Agency_code Description: Required: Source Table:	Code for company name (BRL, WWC etc) True Installations	
Target_eco_class Description: Required: Source Table:	Integer Target numeric ecological class as defined by FGYA (1-5) True Installations	2
Target_group Description: Required: Source Table: ValidationRule:	Integer Target geographic group as defined by FGYA (1-5) True Installations >=1 And <=5	2
Target_tree_density_code Description: Required: Source Table:	Integer Target tree density for the given installation (0,816,1111 etc.) True Installations	2
Target_treatment_code Description: Required: Source Table:	Text Target treatment code for the treatment plot (C,W,T,WT) True Treatment_Plots	10
Start_date Description: Required: Source Table: ValidationRule:	Date/Time Measurement start date. This can be measurement of any kind; mortality, tree count, regeneration survey etc. True Measurements >=#1/1/2000# And <=#1/1/2005#	8
End_date Description: Required: Source Table: ValidationRule:	Date/Time Measurement end date. False Measurements >=#1/1/2000# And <=#1/1/2005#	8
Contractor_code Description: Required: Source Table:	Text Contractor code for measurement True Measurements	10
Crew_initial_1 Description: Required: Source Table:	Text Crew initial 1 False Measurements	10
Crew_initial_2 Description: Required: Source Table:	Text Crew initial 2 False Measurements	10
Tree_number Description: Required: Source Table:	Integer Tree number. Number used on the tree tag. True Stem_map	2

Azimuth_to_tree	Integer	2
Description:	Bearing to tree from plot centre.	
Required:	True	
Source Table:	Stem_map	
ValidationRule:	>=0 And <=360 Or 9999	
Distance_to_tree	Single	4
Description:	Distance to tree	
Required:	False	
Source Table:	Stem_map	
ValidationRule:	>=0 And <=35 Or 9999	
Comments	Text	255
Description:	Stem map tree comments	
Required:	False	
Source Table:	Stem_map	

Query: FileStructure_L10_Tending

Name	Type	Size
Agency_code Description: Required: Source Table:	Text Code for company name (BRL, WWC etc) True Installations	10
Target_eco_class Description: Required: Source Table:	Integer Target numeric ecological class as defined by FGYA (1-5) True Installations	2
Target_group Description: Required: Source Table: ValidationRule:	Integer Target geographic group as defined by FGYA (1-5) True Installations >=1 And <=5	2
Target_tree_density_code Description: Required: Source Table:	Integer Target tree density for the given installation (0,816,1111 etc.) True Installations	2
Target_treatment_code Description: Required: Source Table:	Text Target treatment code for the treatment plot (C,W,T,WT) True Treatment_Plots	10
Start_date Description: Required: Source Table: ValidationRule:	Date/Time Treatment start date True Tending >=#1/1/1999# And <=#1/1/2007#	8
End_date Description: Required: Source Table: ValidationRule:	Date/Time Treatment end date False Tending >=#1/1/1999# And <=#1/1/2007#	8
Contractor_code Description: Required: Source Table:	Text Contractor code for tending True Tending	10
Crew_initial Description: Required: Source Table:	Text Crew initial is of person performing tending False Tending	10
Tending_method_code Description: Required: Source Table:	Text Tending method code True Tending	10
Tending_type_code Description: Required: Source Table:	Text Tending type code True Tending	10

Kg_ai_ha	Single	4
Description:	Kilograms of active ingredient per hectare	
Required:	False	
Source Table:	Tending	
ValidationRule:	>0 And <=100	
Knotch_space	Integer	2
Description:	Space between notches	
Required:	False	
Source Table:	Tending	
ValidationRule:	>0 And <300	
Herbicide_code	Text	50
Description:	Type of herbicide applied	
Required:	False	
Source Table:	Tending	
Litres_ha	Single	4
Description:	Litres per hectare	
Required:	False	
Source Table:	Tending	
ValidationRule:	>=0 And <=500	
Total_herbicide_applied	Long Integer	4
Description:	Total herbicide applied in litres	
Required:	False	
Source Table:	Tending	
PCP_number	Text	50
Description:	Unknown?	
Required:	False	
Source Table:	Tending	
Comments	Text	255
Description:	Tending comments	
Required:	False	
Source Table:	Tending	

Query: FileStructure_L11_Photos

Name	Type	Size
Agency_code Description: Required: Source Table:	Code for company name (BRL, WWC etc) True Installations	
Target_eco_class Description: Required: Source Table:	Integer Target numeric ecological class as defined by FGYA (1-5) True Installations	2
Target_group Description: Required: Source Table: ValidationRule:	Integer Target geographic group as defined by FGYA (1-5) True Installations >=1 And <=5	2
Target_tree_density_code Description: Required: Source Table:	Integer Target tree density for the given installation (0,816,1111 etc.) True Installations	2
Target_treatment_code Description: Required: Source Table:	Text Target treatment code for the treatment plot (C,W,T,WT) True Treatment_Plots	10
Photo_date Description: Required: Source Table: ValidationRule:	Date/Time Date photo was taken True Photos >=#1/1/1999# And <=#1/1/2005#	8
Initials Description: Required: Source Table:	Text Initials of person taking photo False Photos	10
Location_desc Description: Required: Source Table:	Memo Description of where photo was taken from False Photos	N/A
Direction_azimuth Description: Required: Source Table: ValidationRule:	Integer Direction faced when photo was taken. False Photos >=0 And <=360 Or Is Null	2
Photo_landscape Description: Required: Source Table:	OLE Object Landscape photo of installation or treatment plot as a an OLE True Photos	N/A
Comments Description: Required: Source Table:	Text Photo comments False Photos	255

Query: FileStructure_L12_Trees_FillPlant

Name	Type	Size
Agency_code Description: Required: Source Table:	Text Code for company name (BRL, WWC etc) True Installations	10
Target_eco_class Description: Required: Source Table:	Integer Target numeric ecological class as defined by FGYA (1-5) True Installations	2
Target_group Description: Required: Source Table: ValidationRule:	Integer Target geographic group as defined by FGYA (1-5) True Installations >=1 And <=5	2
Target_tree_density_code Description: Required: Source Table:	Integer Target tree density for the given installation (0,816,1111 etc.) True Installations	2
Target_treatment_code Description: Required: Source Table:	Text Target treatment code for the treatment plot (C,W,T,WT) True Treatment_Plots	10
Growing_season_number Description: Required: Source Table: ValidationRule:	Long Integer Number of growing seasons that have elapsed. 0 if no seasons have elapsed. Number of growing seasons that have elapsed. 0 if no seasons have elapsed. False Measurements >=0 And <=10	4
Measurement_season_code Description: Required: Source Table:	Text Intended season of measurement, that is Spring or Summer False Measurements	50
Start_date Description: Required: Source Table: ValidationRule:	Date/Time Measurement start date. This can be measurement of any kind; mortality, tree count, regeneration survey etc. True Measurements >=#1/1/2000# And <=#1/1/2005#	8
End_date Description: Required: Source Table: ValidationRule:	Date/Time Measurement end date. False Measurements >=#1/1/2000# And <=#1/1/2005#	8
Contractor_code Description: Required: Source Table:	Text Contractor code for measurement True Measurements	10
Crew_initial_1 Description: Required: Source Table:	Text Crew initial 1 False Measurements	10
Crew_initial_2	Text	10

	Description:	Crew initial 2	
	Required:	False	
	Source Table:	Measurements	
New_Tree_number			Integer 2
	Description:	Tree tag number	
	Required:	True	
	Source Table:	Trees	
	ValidationRule:	>=1 And <=5000 Or 9999	
Old_Tree_number			Integer 2
	Description:	Tree tag number	
	Required:	True	
	Source Table:	Trees	
	ValidationRule:	>=1 And <=5000 Or 9999	
Fill_plant_start_date			Date/Time 8
	Description:	Start date of fill plant.	
	Required:	True	
	Source Table:	Trees_fill_plant	
	ValidationRule:	>=#1/1/2002# And <=#1/1/2007#	
Fill_plant_end_date			Date/Time 8
	Description:	End date of fill plant.	
	Required:	False	
	Source Table:	Trees_fill_plant	
	ValidationRule:	>=#1/1/2002# And <=#1/1/2007#	
Seedlot			Text 50
	Description:	Seedlot of trees planted.	
	Required:	True	
	Source Table:	Trees_fill_plant	
Stock_code			Text 10
	Description:	Seddling stock code.	
	Required:	True	
	Source Table:	Trees_fill_plant	
Plant_stock_season_code			Text 10
	Description:	Target season for planting stock - spring or summer.	
	Required:	False	
	Source Table:	Trees_fill_plant	
Comments			Text 255
	Description:	Comments	
	Required:	False	
	Source Table:	Trees_fill_plant	