EFFECTS OF PRUNING ON IMPROVED RADIATA PINE BREEDS — TRIAL ESTABLISHMENT REPORT

I.P. McINNES & W.M. BLUNDELL

REPORT NO. 6 NOVEMBER 1994

FOREST & FARM PLANTATION MANAGEMENT COOPERATIVE

EXECUTIVE SUMMARY

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Two trials were planted during August and September, 1994, to evaluate the response to pruning of the latest genetically improved cuttings of the Growth and Form and Long Internode breeds of radiata pine. These breeds represent the extremes of radiata pine branch habit.

One trial was planted in forest cutover in Kaingaroa forest while the other is on an ex-farm site north of Taupo. Both trials have identical treatments and replications. The design used is a split plot factorial design with plots of each breed being adjacent and receiving the same silvicultural treatment. Treatments were allocated randomly. A variety of silvicultural treatments will be applied, involving three final crop stockings (and thus pruned stocking) of 200, 300, and 400 stems/ha, and three pruning severities of 2.5, 4.0, and 5.5m of green crown remaining after each pruning lift. The trees were planted at an initial stocking ratio of twice the final crop stocking.

It is intended that this trial series will be expanded in future years to include further sites and other genetic material as it becomes available.

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INTRODUCTION

With the development of genetically improved breeds of radiata pine with improved growth and form, it is important to quantify the differences between the breeds and with the older material. Work is currently being done with the improved breeds but this is concentrating on aspects such as thinning and final crop stocking (West 1994). An area where trials are lacking is in pruning. The only existing trial of this sort is at Tumunui, just south of Rotorua which has three pruning severity levels, but only one stocking treatment (Knowles 1984).

To overcome this, two trials have been planted in 1994 to specifically investigate the effect of pruning on the Growth & Form and Long Internode breeds of radiata pine. These breeds comprise multi-nodal and long-internode tree types which represent the extremes of branch morphology.

One trial is located on second rotation cutover in Kaingaroa (FR 226), and the other is located on an ex-farm site just south of the Ohaaki geothermal scheme, Taupo (FR 228).

The above trials will be the initial trials in a long term series and will complement other trials. Later trials will be able to include other breeds and further silvicultural treatments.

EXPERIMENTAL DESIGN

A split plot design was used with the Growth & Form plots being adjacent to Long Internode plots, but receiving the same silvicultural treatment. The paired plots were allocated randomly within blocks with two replications installed at each site.

The genetic material used is listed in Appendix I. These are a number of selected crosses with seedlings intermixed at time of planting within the two broad groups of Growth & Form and Long-Internode. It should be noted that the Long Internode

cuttings had a physiological age ranging from one to three years so there will be some differences in subsequent tree form. The Growth and Form cuttings were all of the same age (one year).

Silviculture will involve three final crop stockings (and hence number of pruned trees) and three levels of pruning severity (based on green crown length remaining). To reduce seedling requirements and other costs, the final crop stockings cover a typical range commonly found in production forestry. The number of trees pruned (and final crop stocking) will be 200, 300 or 400 stems/ha. All treatments were planted with an initial stocking ratio of twice the final crop stocking.

The pruning severity is of primary interest so will consist of a severe treatment (2.5 m green crown length remaining), a standard treatment (4.0 m green crown length remaining) and a mild treatment (5.5 m green crown length remaining). All treatments will have a minimum pruned height of 6.0 m and will be 'variable lift' pruned in 3-4 lifts.

Treatments are summarised in the following table.

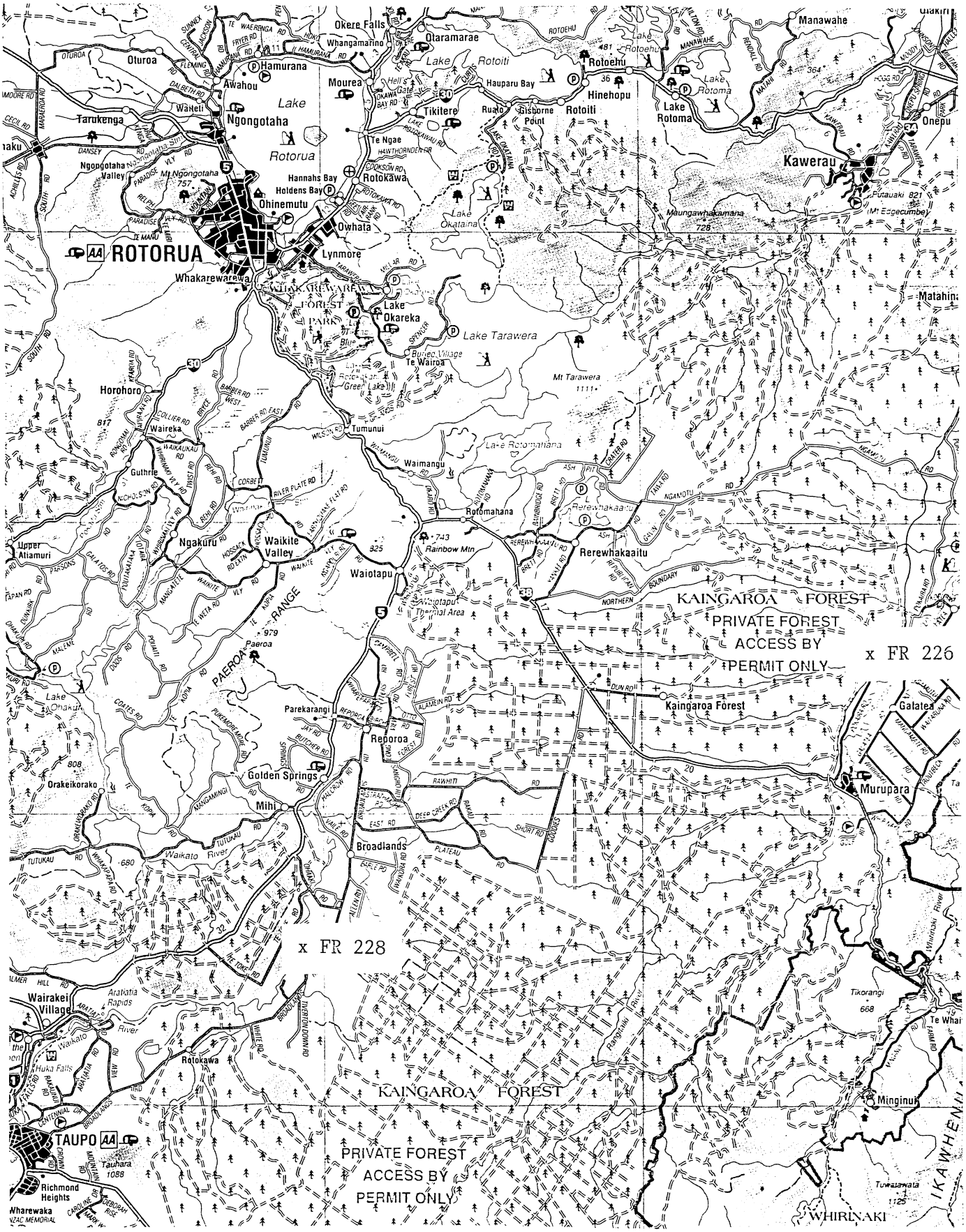
TABLE 1 — Treatments contained in Improved Breeds Pruning Trials

	Green Crown Remaining		
Final Crop Stocking	2.5m	4.0m	5.5m
200 stems/ha	✓	✓	✓
300 stems/ha	✓	✓	✓
400 stems/ha	✓	✓	✓

This trial will be analysed using ANOVA (see Appendix III).

The location of the two trials is shown in Figure 1.

FIGURE 1 — Location of Improved Breeds Pruning Trials.



1. KAINGAROA FOREST, FR 226

This trial is located in compartment 1235, Kaingaroa Forest (Forestry Corporation of NZ Ltd). It is located on second rotation radiata pine cutover.

The trial is located on a south-east facing slope of 0-5°. The lower part of the trial is on flat land adjacent to Totara Rd, while the back of the trial is on a gentle slope. Site preparation consisted of oversowing in spring of 1993 with maku lotus and yorkshire fog. In April 1994, the area was sprayed with Escort. The site had a covering of logging slash and dead blackberry with some grasses present at the time of planting. The compartment was spot sprayed in September after planting with a mixture of Gardoprim and Gallant.
The trial was planted by contract with NZ FRI supervision on 22/23 August 1994.

Measurement plots are 0.1 ha (31.6 x 31.6m) with an 11.7m buffer (total size 55 x 55m = 0.3025 ha). The 400 stems/ha final stocking has a plot size of 0.05 ha (13.5 x 37m), with two plots per 55 x 55m square. The dimensions of the smaller plots are shown in the Appendix IV.

The trial location and layout are shown in Figures 2 and 3. The trial was divided into blocks based on slope with block 1 (plots 1-18) on the lower, flatter part and block 2 (plots 19-36) on the sloping part.

Initial tree spacings for each stocking were chosen so that trees would be on a square spacing following final thinning. Nominal planting spacings were:

400 stems/ha	7.0 x 3.5m
600 stems/ha	5.8 x 2.9m
800 stems/ha	5.0 x 2.5m

Actual planting dimensions are included in Appendix II.
Planting rows are orientated approximately northwest/southeast.

FIGURE 2 — Map showing location of FR 226 within compartment 1235.

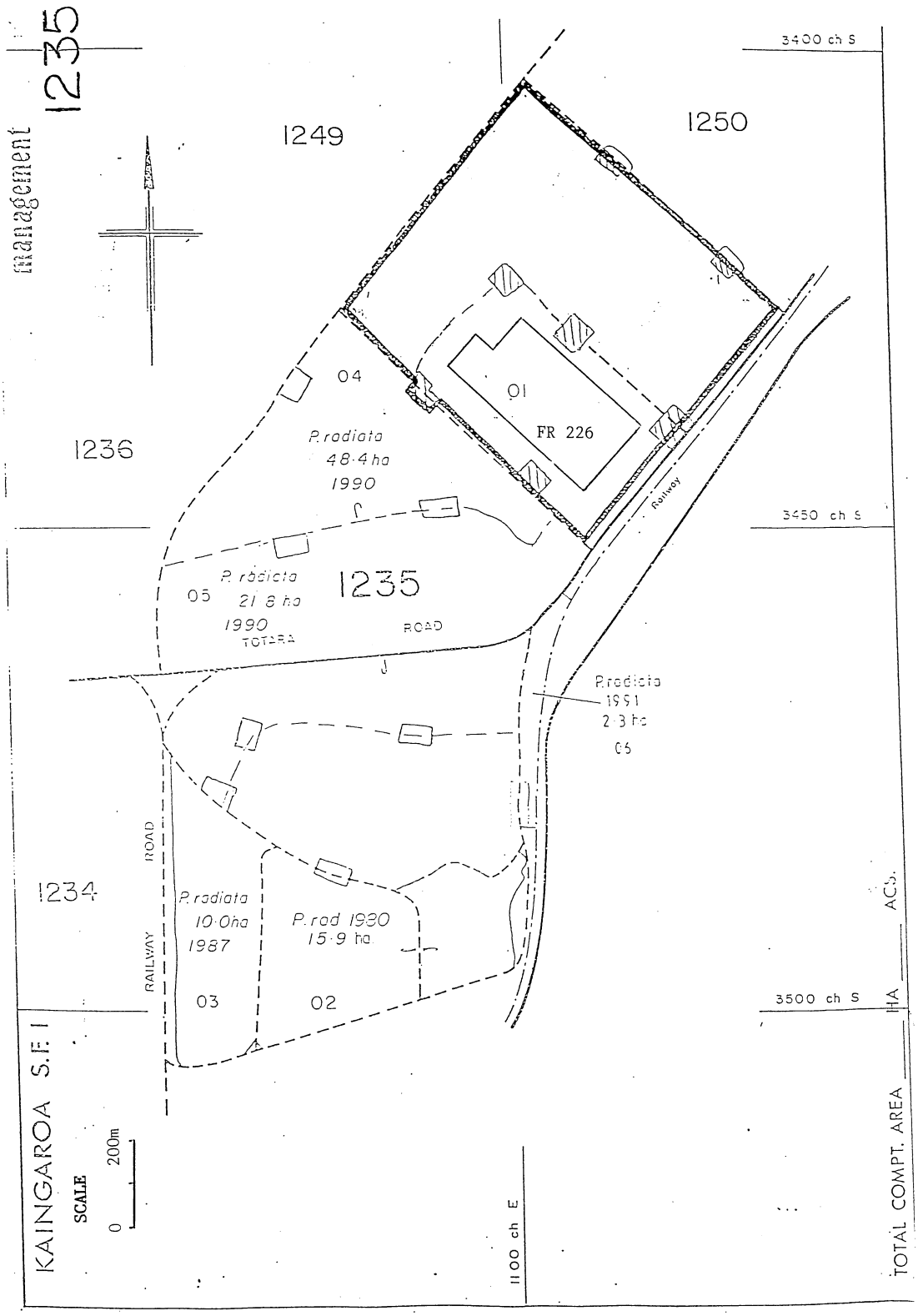
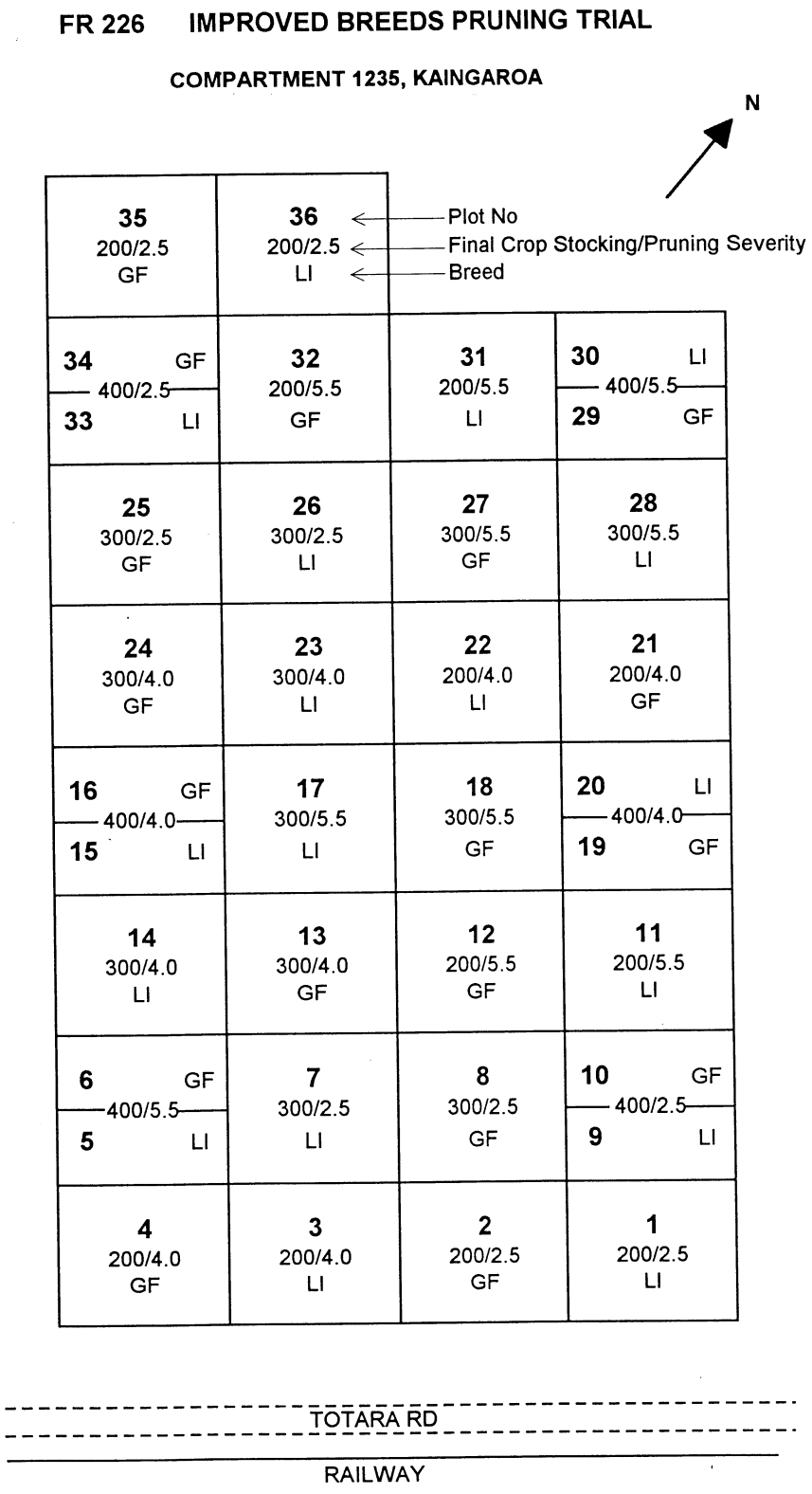


FIGURE 3 — Layout of FR 226.



2. TE TOKE MAORI TRUST, FR 228

This trial is located on Te Toke Maori Trust land which is being planted in trees over the next three years. Tasman Forestry Ltd is establishing and managing the forests on behalf of the Trust. The site is an ex-farm site adjacent to the Waikato River, just south of the Ohaaki geothermal power station.

The trial is located on flat land, although the surrounding area gradually drops down to the Waikato River. A small stream and marshy area is to the west of the trial. The Waikato River is located approximately 200 m to the east. (See Fig. 4 for details). The trial area may be susceptible to frost.

Site preparation consisted of rotary-hoed strips at 4m intervals which were then ripper-mounded. Deer fences have been retained, hence there are gaps in the rip lines either side of the fence where the machine could not go through. The area had been grazed until the day of planting.

The trial was established by labourers (provided by the Trust) who had limited planting experience. Planting was supervised by NZ FRI staff and was carried out on 20/21 September, 1994.

Measurement plots are 0.1 ha (31.6 x 31.6m) with a 12.2m buffer (total size 56 x 56m, ie 0.3136 ha). The highest stocking (400 stems/ha) has two plots per 56 x 56m plot with each measurement plot being 0.05 ha (13.5 x 37m). Appendix IV contains the dimensions of the smaller plots.

The trial location and layout are shown in Figures 4 and 5. The trial was divided into blocks with block 1 (plots 1-18) near the stream and block 2 (plots 19-36) further from the marshy area. The site is uniform other than this.

As the area had already been ripped into rows 4m apart, these had to be used as the between row spacing. The plots are 56m wide which allows 14 rows per plot, with 8 rows in each measurement plot. This was constant for all stockings. Nominal planting spacings were:

400 stems/ha	4.0 x 6.0m
600 stems/ha	4.0 x 4.5m
800 stems/ha	4.0 x 3.0m

Actual planting dimensions are included in Appendix II.

Planting rows run approximately east to west, ie across the trial.

FIGURE 4 — Map showing location of FR 228 within Trust land.

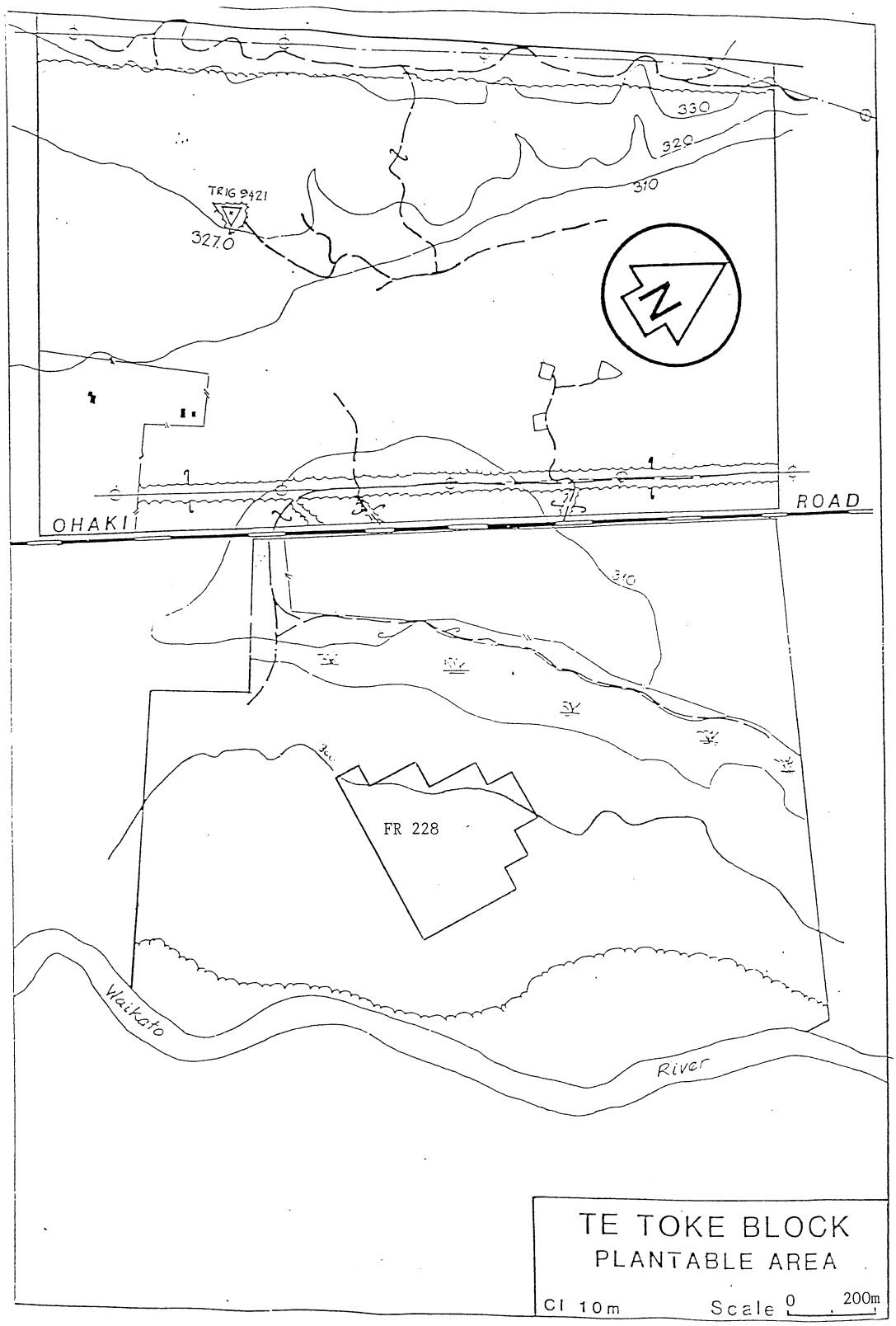
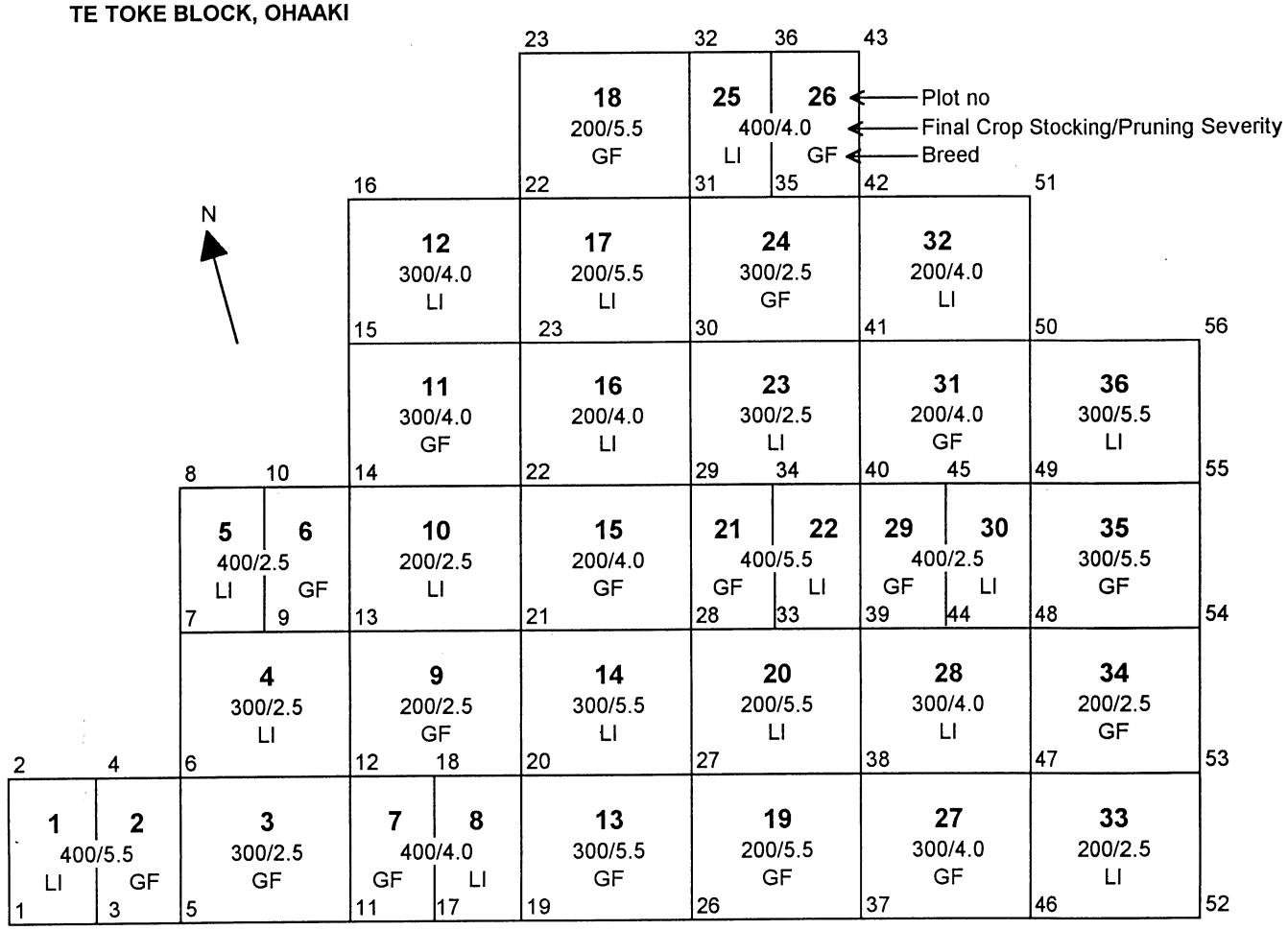


FIGURE 5 —Layout of FR 228.



FUTURE MANAGEMENT

The trial will be thinned in two stages and pruned in 3-4 lifts to at least 6.0m. Trees will be tagged at time of first pruning lift. They will be measuired at time of pruning and measured for DBH and height each winter. Data will be stored on the NZ FRI Permanent Sample Plot database.

The trial will receive weed control treatments the same as the rest of the compartment.

REFERENCES

Knowles, R.L., 1984. Establishment of Field Tests for Evaluating Response to Pruning of *Pinus radiata* '870' and '268' Progeny. FRI Workplan 429.

West, G.G., 1994. Review of Silvicultural Trials. Forest and Farm Plantation Management Coop. Report No 3.

APPENDIX I — Nursery Stock Used (1994)

Breed	Cross	Approx. No.
Long Internode	870-613 x 870-529	800
Long Internode	870-568 x 870-529	130
Long Internode	870-589 x 870-608	1720
Long Internode	870-568 x 870-592	380
Long Internode	870-533 x 870-609	380
Long Internode	870-529 x 870-565	360
Long Internode	870- 588 x 870-609	540
Long Internode	870-525 x 870-565	300
Long Internode	870-589 x 870-573	300
Growth & Form	268-196 x 875-223	360
Growth & Form	268-494 x 875-054	210
Growth & Form	268-514 x 875-242	306
Growth & Form	268-169 x 875-223	440
Growth & Form	268-169 x 875-244	600
Growth & Form	268-169 x 875-531	215
Growth & Form	268-169 x 875-109	90
Growth & Form	268-169 x 875-528	95
Growth & Form	268-494 x 875-223	50
Growth & Form	268-154 x 875-054	100
Growth & Form	268-494 x 875-244	225
Growth & Form	268-345 x 875-244	360
Growth & Form	268-532 x 875-101	505
Growth & Form	268-345 x 875-223	329
Growth & Form	268-169 x 268-622	205
Growth & Form	268-345 x 875-242	375
Growth & Form	268-169 x 875-242	415
Growth & Form	268-514 x 875-223	180
Growth & Form	268-189 x 875-223	90

Note: 870-613 x 870-529 means 870 clonal series (Long Internode Breed) clone 613 female parent crossed with clone 529 pollen parent.

APPENDIX II — Planting Spacings

FR 226 Kaingaroa			
Nominal Planting Density (stems/ha)	400	600	800
Rows	8	10	11
Distance between rows	7.0m	5.8m	5.0m
Dist. between outside rows and plot edge	3.0m	1.4m	2.5m
Seedlings per row	16	19	11
Dist. between seedlings	3.5m	2.9m	2.5m
Dist. between end seedlings and plot edge	1.25m	1.4m	1.25m
Seedlings per plot	128	190	121

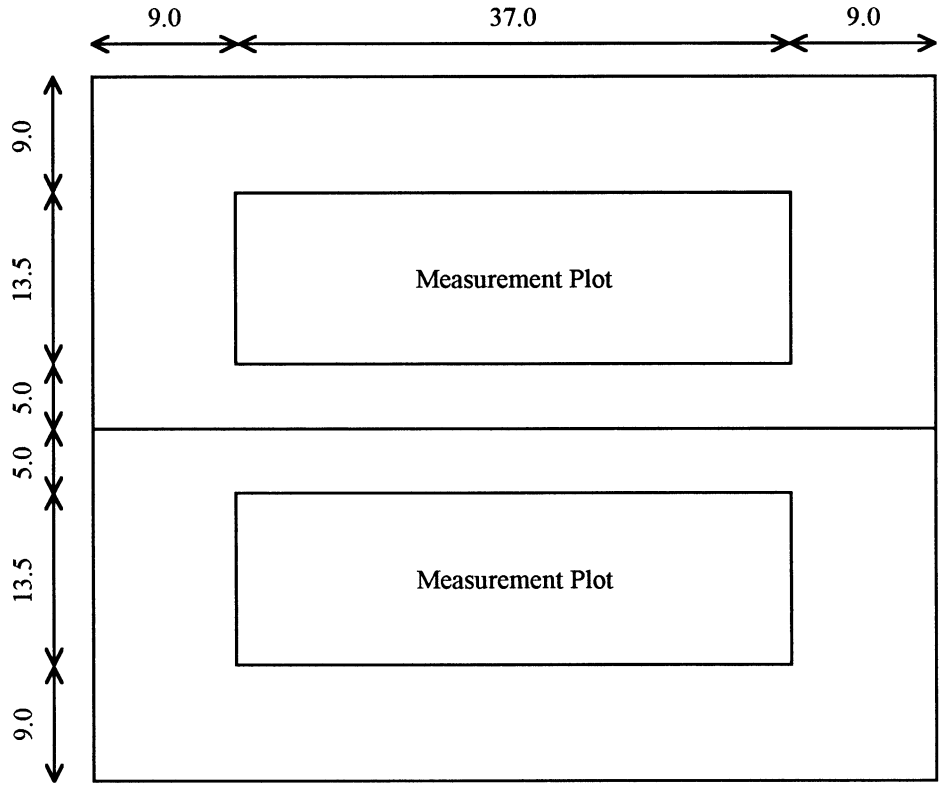
FR 228 Ohaaki			
Nominal Planting Density (stems/ha)	400	600	800
Rows	14	14	14
Distance between rows	4.0m	4.0m	4.0m
Dist. between outside rows and plot edge	2.0m	2.0m	2.0m
Seedlings per row	9	13	9
Dist. between seedlings	6.0m	4.5m	3.0m
Dist. between end seedlings and plot edge	1.25m	1.0m	0.5m
Seedlings per plot	126	182	126

APPENDIX III — Analysis of Variance

Source	D.F.
Block	1
Stocking	2
Pruning Severity	2
Stocking x Pruning	4
Main Plot Error	8
Breed	1
Breed x Stocking	2
Breed x Pruning	2
Breed x Stocking x Pruning	4
Sub-plot Error	9
Total	35

APPENDIX IV

PLOT DIMENSIONS FOR 400 STEMS/HA PLOTS



Note: FR 226 has 9.0m outer buffers (as shown)
FR 228 has 9.5m outer buffers