

MANAGEMENT OF IMPROVED RADIATA BREEDS COOPERATIVE

**FOREST RESEARCH INSTITUTE
PRIVATE BAG
ROTORUA**

**DEMONSTRATION / RESEARCH TRIALS
OF IMPROVED RADIATA PINE BREEDS
– ESTABLISHMENT REPORT**

J.D. TOMBLESON

Report No. 6

November 1988

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Note : Confidential to Participants of the Management of Improved Radiata Breeds Cooperative

FRI/INDUSTRY RESEARCH COOPERATIVES

EXECUTIVE SUMMARY

DEMONSTRATION RESEARCH/TRIALS OF IMPROVED RADIATA

PINE BREEDS - ESTABLISHMENT REPORT

J.D. TOMBLESON

REPORT NO. 6 NOVEMBER 1988

This report documents the establishment of demonstration/research plantings of improved breeds for the Management of Improved Breeds Cooperative. Seedlings of "850" open-pollinated, "268" control-pollinated, "870" long internode and cuttings collected from 1- and 3-year-old trees, were established on a range of forest sites throughout New Zealand. A Nelder spacing design was chosen as being the most effective for this demonstration/trial which will test initial spacings ranging from 209 to 2551 stems per hectare. Trial results will be used to indicate:

- (a) the most appropriate plant type and breed, and
- (b) the appropriate initial stocking for stands established by Coop members.

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Royden Downs, Te Puke
3. NZFP Forests Ltd
Kinleith
4. NZ Timberlands Ltd
Kaingaroa
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Lake Rotoaira Forest
7. NZ Timberlands Ltd
Tikokino, Waipawa
9. NZ Timberlands Ltd
Ashley Forest
10. Selwyn Plantation Board
Burnham
11. Dunedin City Council
Tokoitī Forest, Milton
12. NZ Timberlands Ltd
Dusky Forest

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Nelder Trials, Workplan 771

INTRODUCTION

This report describes the establishment of demonstration/research plantings of the improved radiata pine breeds on the land of Cooperative members (FRI Workplan 1669). A Nelder design has been chosen as being the most effective for combining trial and demonstration objectives.

LOCATIONS

Demonstration/research Nelders as shown in figure 1 have been established on 11 sites throughout New Zealand. One of the Nelders has been established on a farm site near Cheviot by the Forest Research Centre and is documented separately in Appendix 1. Two of the sites shown in Figure 1 (Tangoio Forest and Golden Downs Forest) are to be established in 1989. A third site may also be chosen for establishment in 1989 at Woodhill Forest.

An additional series of 5 half-nelders trials were established in 1986 by Dr R. Tennent (FRI) to compare the early growth of a seedlot of each of the Growth and Form, and the Long Internode Breeds (Appendix 2). Although these trials are limited to two seedlots, and were not designed specifically for demonstration purposes, the growth and tree quality information obtained from them will complement the present series.

DESIGN

One complete Nelder or one half Nelder containing five radiata pine plant types has been established on each of the eleven sites. Each complete Nelder contains 45 spokes separated by 8' intervals simulating ten initial spacings ranging from 1.98 to 6.92 square metres and representing 2551-209 stems per hectare (Table 1). Complete Nelders have been divided into two replications each containing five segments, i.e. one treatment per segment. The five segments in replication one each contain 40 tree positions. Plots are defined as arcs of 4 trees of the same seedlot at the same spacing. Segments in replication two contain 50 tree positions, with plots defined as arcs of five trees of the same seedlot at the same spacing. On those sites where it was only possible to establish half a Nelder, replication 2 (the larger of the two replications) has been established. Replication 2 was chosen because it has been designed for the optional

implementation of a systematic 50% thinning treatment. Details on establishment and trial location are provided in the following section for each of the eleven sites.

TABLE 1 - Nelder Details

Circle No.	Radii of planting circles (m)	Equivalent Square spacing (m)	Initial Stocking SPHA	Residual Stocking SPHA
0 Buffer	12.35	-	-	-
1	14.20	1.98	2551	Buffer
2	16.31	2.28	1924	-
3	18.75	2.26	1457	364
4	21.54	3.00	1111	-
5	24.75	3.46	835	209
6	28.44	3.97	635	-
7	32.68	4.56	481	120
8	37.56	5.24	364	-
9	43.16	6.03	275	69
10	49.59	6.92	209	-
11 Buffer	56.99	-	-	Buffer

SEEDLOTS AND PLANT TYPES

"850"	GF14 OP. (3/3/87/01/3)
"268"	GF22 "best-16" clones CP. (6/6/87/21)
"870"	"best-5" clones CP. (9/3/86/166) or "best-5" clones OP. (7/3/86/170)
Cuttings 1 yr	GF 19 C11 "268" "best-16" clones OP. (2/6/86/29)
Cuttings 3 yr	GF 17 C31 "268" "best-25" clones OP. (9/0/83/096)

MANAGEMENT

Access pruning to a height of 2 m is to be carried out at MCH 6 m (approx). The option to implement a systematic thinning would need to be carried out at MCH 10 m (approx). This operation would be carried out in replication 2 only by felling every second spoke and arc. This would result in four arcs remaining (contained by buffers) with a residual final crop stocking ranging from 69 to 364 stems per hectare (Table 1). A systematic thinning would not only have

the beneficial effect of lengthening the effective life of the Nelder, particularly at the higher stockings, but as a demonstration planting, it would more closely relate to a management situation.

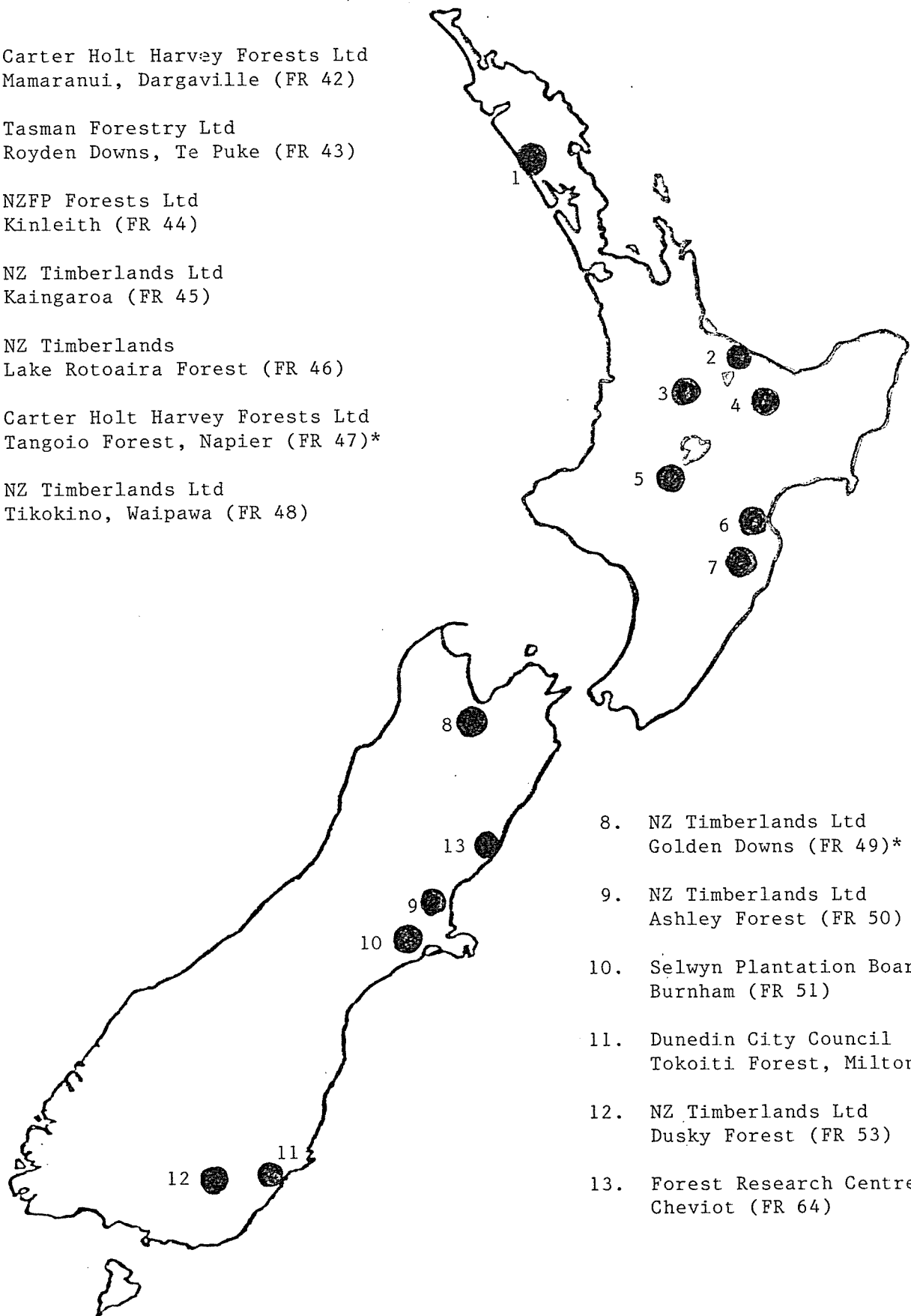
ASSESSMENT AND ANALYSIS

Nelders are to be initially measured every year, commencing at the time of access pruning. All heights will be measured by height pole until trees are over 10 m tall, after which time heights will be assessed using SUUNTOS. All diameters will be measured after trees reach height 2 m. Once canopy closure occurs for a given stocking and branch growth becomes moribund there will be an opportunity to collect branch size information, while internode lengths can be assessed as soon as the second 5.5 m log is formed.

The Forest Research Institute staff will prescribe silvicultural treatments and will request measurements as required. Results will be pooled, analysed and written up as Cooperative reports.

FIGURE 1 : LOCATION MAP - DEMONSTRATION/RESEARCH TRIALS
OF THE IMPROVED RADIATA PINE BREEDS
(Established 1988)

1. Carter Holt Harvey Forests Ltd
Mamaranui, Dargaville (FR 42)
2. Tasman Forestry Ltd
Royden Downs, Te Puke (FR 43)
3. NZFP Forests Ltd
Kinleith (FR 44)
4. NZ Timberlands Ltd
Kaingaroa (FR 45)
5. NZ Timberlands
Lake Rotoaira Forest (FR 46)
6. Carter Holt Harvey Forests Ltd
Tangoio Forest, Napier (FR 47)*
7. NZ Timberlands Ltd
Tikokino, Waipawa (FR 48)



8. NZ Timberlands Ltd
Golden Downs (FR 49)*
9. NZ Timberlands Ltd
Ashley Forest (FR 50)
10. Selwyn Plantation Board
Burnham (FR 51)
11. Dunedin City Council
Tokoititi Forest, Milton (FR 52)
12. NZ Timberlands Ltd
Dusky Forest (FR 53)
13. Forest Research Centre
Cheviot (FR 64)

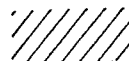
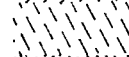



* To be established 1989

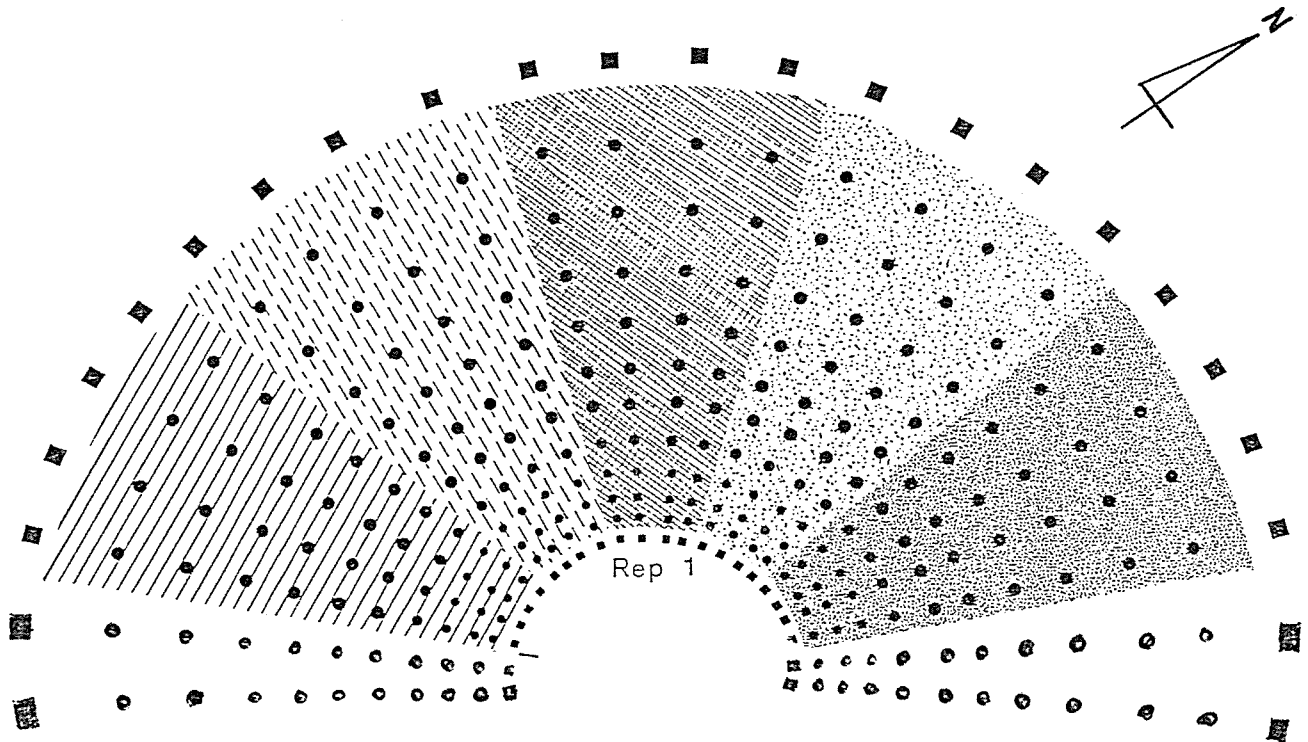
1. MAMARANUI, DARGAVILLE

Carter Holt Harvey Forests Ltd

Exp. No. FR 42

MAMARANUI FOREST
Replication 1 (northern rep.)

	870	"best-5" clones OP. (9/3/86/170)
	850	GF 14 OP. (3/3/87/01/3)
	268	GF 22 "best-16" clones CP. (6/6/87/21)
	Cuttings 1 yr	GF 19 C11 "268" "best-16" clones OP. (2/6/86/29)
	Cuttings 3 yr	GF 17 C31 "268" "best-25" clones OP. (9/0/83/096)



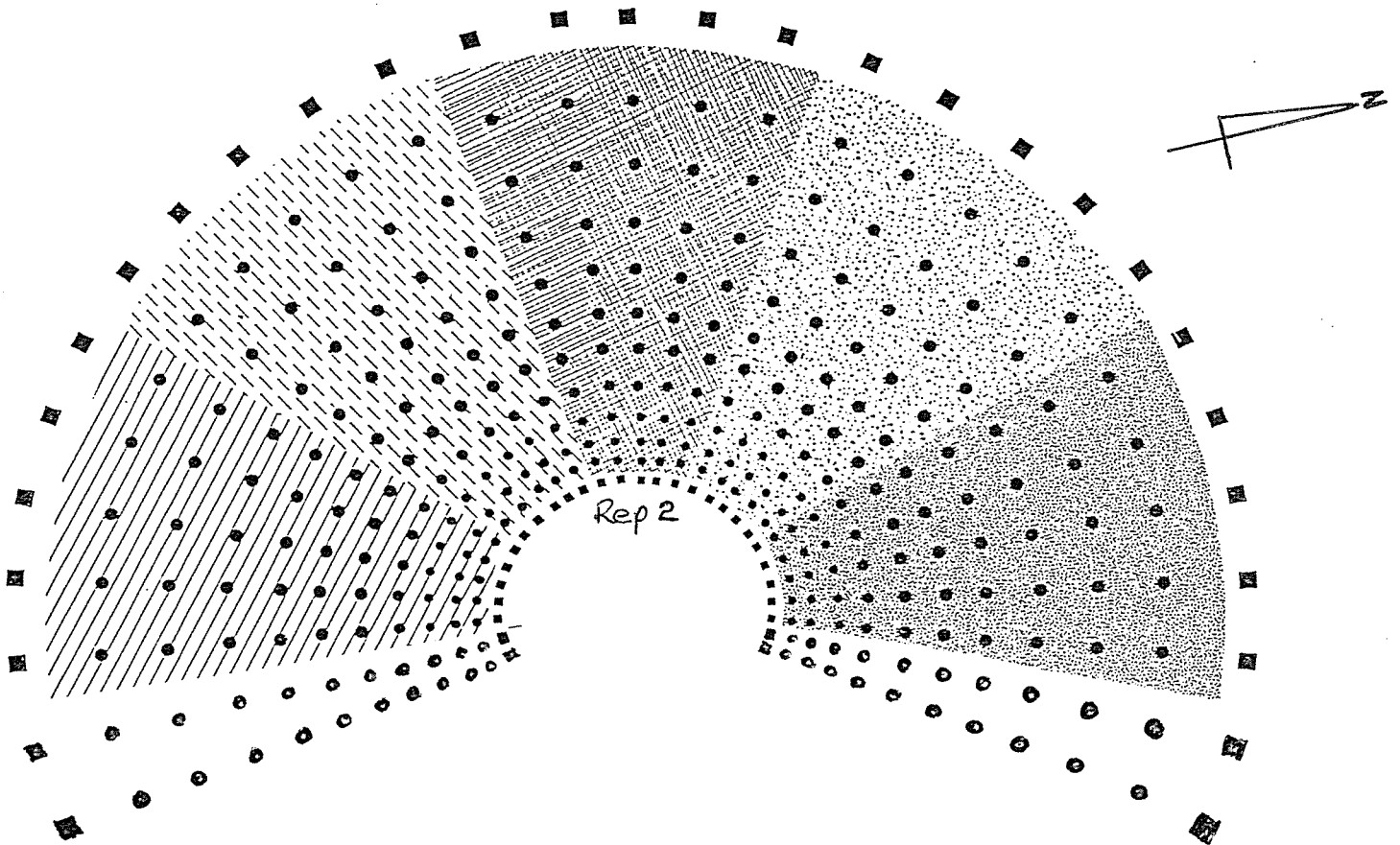
Note: Buffer spokes contain the same tree stocks as the adjacent treatment.

MAMARANUI FOREST

Replication 2 (Southern rep.)



Cuttings 3 yr	GF 17 C31 "268" "best-25" clones OP. (9/0/83/096)
Cuttings 1 yr	GF 19 C11 "268" "best-16" clones (2/6/86/29)
268	GF 22 "best-16" clones CP. (6/6/87/21)
850	GF 14 OP. (3/3/87/01/3)
870	"best-5" clones OP. (9/3/86/170)



Note: Buffer spokes contain the same tree stocks as the adjacent treatment.

MAMARANUI FOREST

Illustrating thinning option for replication 2 (southern rep.)



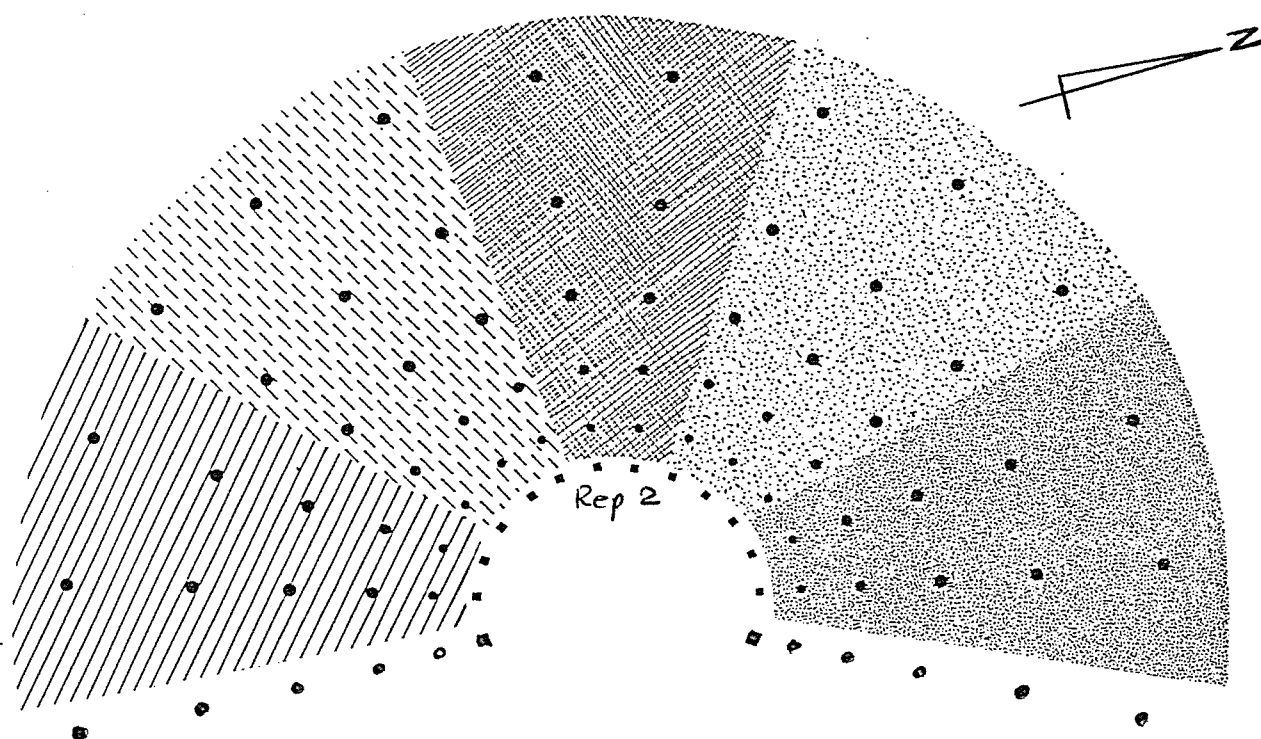
Cuttings 3 yr

Cuttings 1 yr

268

850

870



MAMARANUI FOREST

Exp. No. FR 42

The Nelder was established July 1988 on a farm site in close proximity to the forest HQ. Planted on a ridge with a limited area of flat land, it was necessary to plant the replications separately. Replication 1 is planted approximately 10 m to the north of rep. 2.

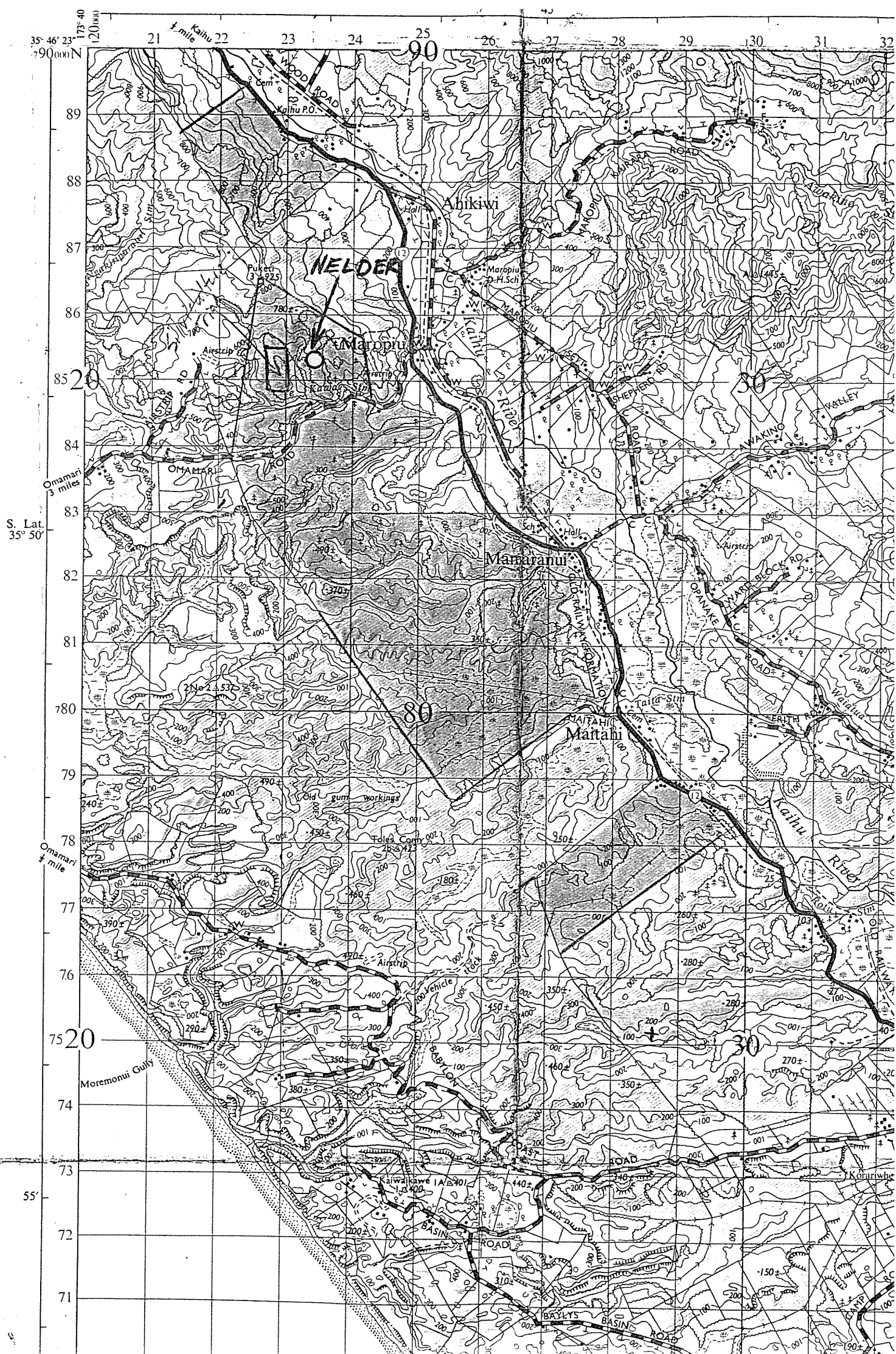
Access to the trial is gained by turning right just before (60 m) the Forest HQ driveway. The track crosses a creek and then continues up the ridge to the trial.

The trial was post plant ^{spot sprayed} with Gallant (7.5 g/ha) and Simayol (7.5 g/ha). Each tree is to be fertilised with 100 gms of diamonium phosphate.

Soil type: "Whatatoro Clay"

Forest Surround Seedlot: "268" OP. 2/6/87/34/3.

Contact person Ray Thomas
(Forest Manager)






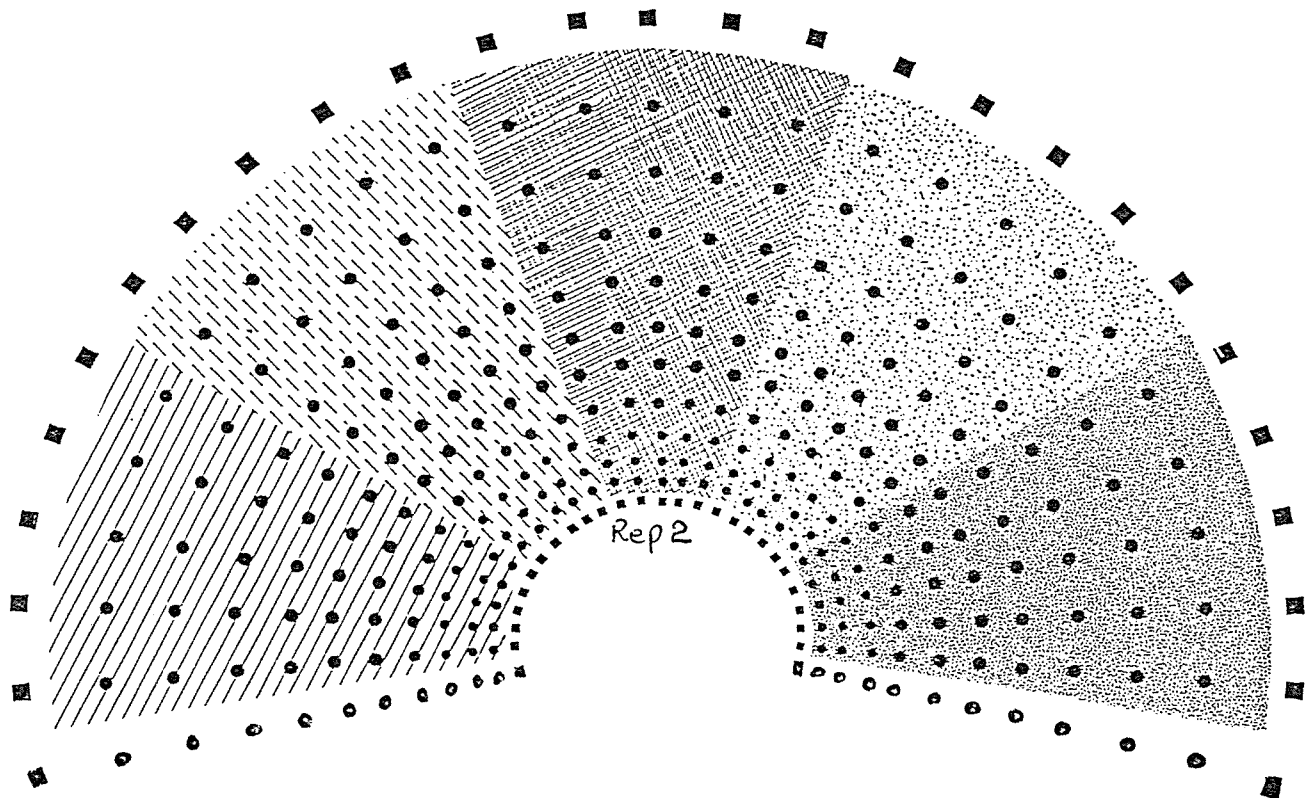
2. ROYDEN DOWNS, TE PUKE

Tasman Forestry Limited

Exp. No. FR 43

ROYDEN DOWNS

	Cuttings 3 yr	GF 17 C31 "268" "best-25" clones OP. (9/0/83/096)
	Cuttings 1 yr	GF 19 C11 "268" "best-16" clones OP. (2/6/86/29)
	268	GF 22 "best-16" clones CP. (6/6/87/21)
	850	GF 14 OP. (3/3/87/01/3)
	870	"best-5" clones CP. (9/3/86/166)

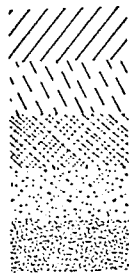


Note: Tree stocks planted in the buffer spokes are the same as those planted in the adjacent treatment.

Forest surround tree stocks on the western side: GF 19 (2/6/87/035)

Trial established August 1988. Grass release consisted of a pre-plant spot spray using Simazine/Round-up.

ROYDEN DOWNS



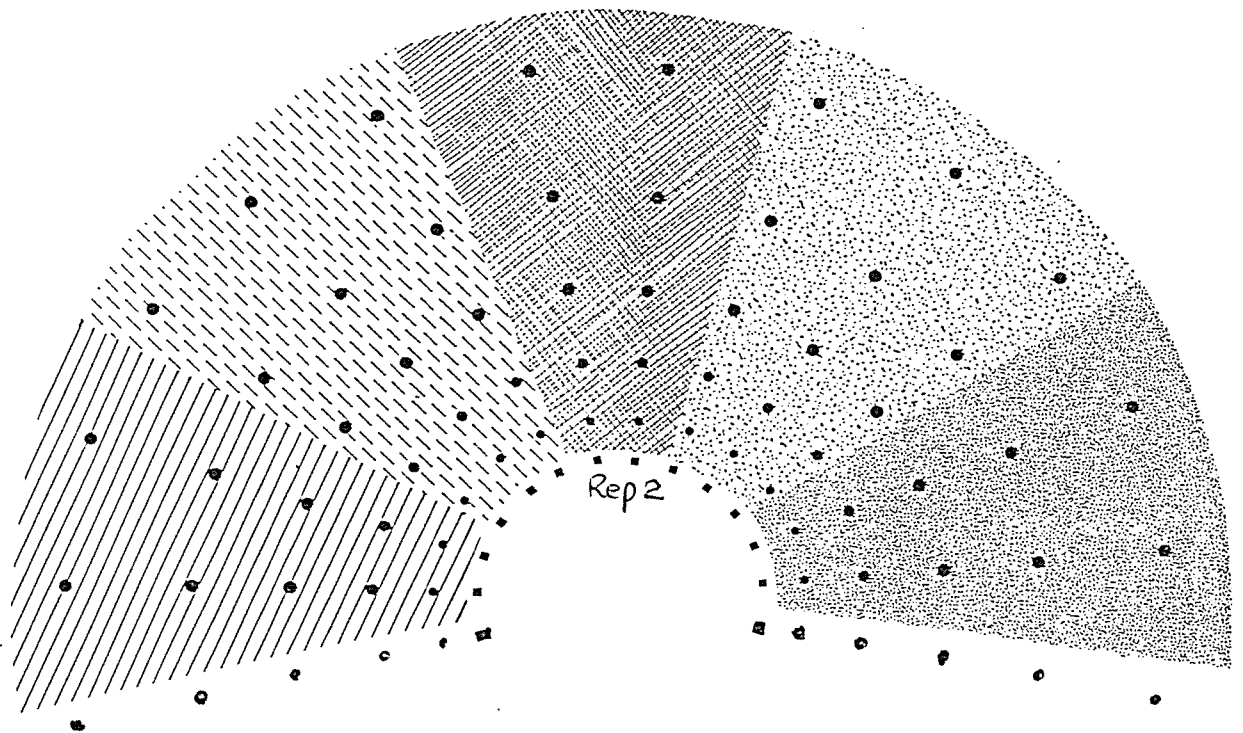
Cuttings 3 yr

Cuttings 1 yr

268

850

870



ALLPORTS Rd

Geoff + Gill Brann

781/1

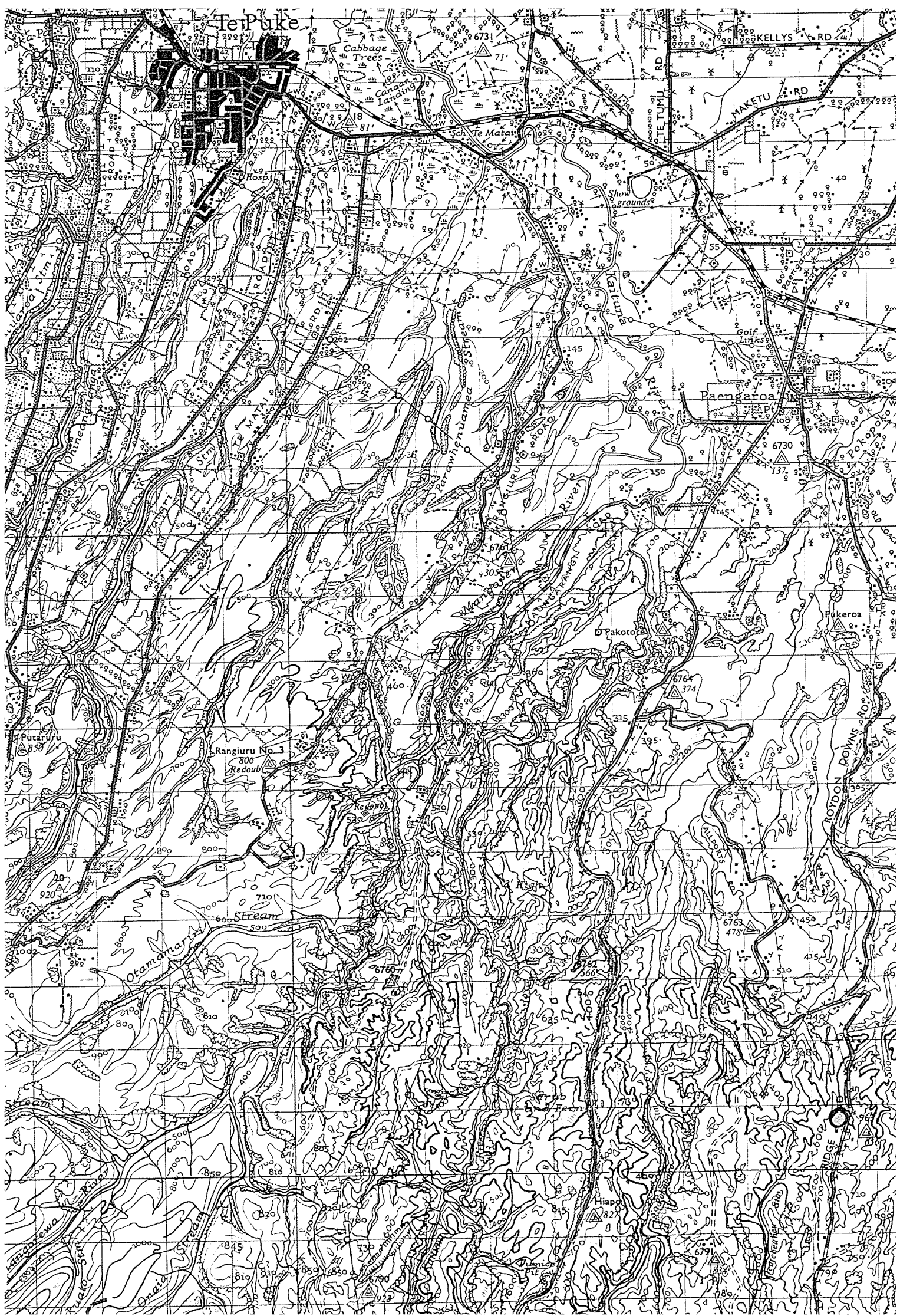
781

RIDGE ROAD

782

Cattle Yards





Te Puke

Cabbage Trees

Canoe Landing

Te Matai

TE TUMU RD

MAKETU RD

KELLYS RD

Hospital

Shooting grounds

Paengaroa

Pakotia

Pukeroa

Rangiora No. 3 Redoubt

Stream

Otamotara

Hiapo

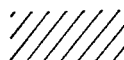




RODNEY DOWNS RD

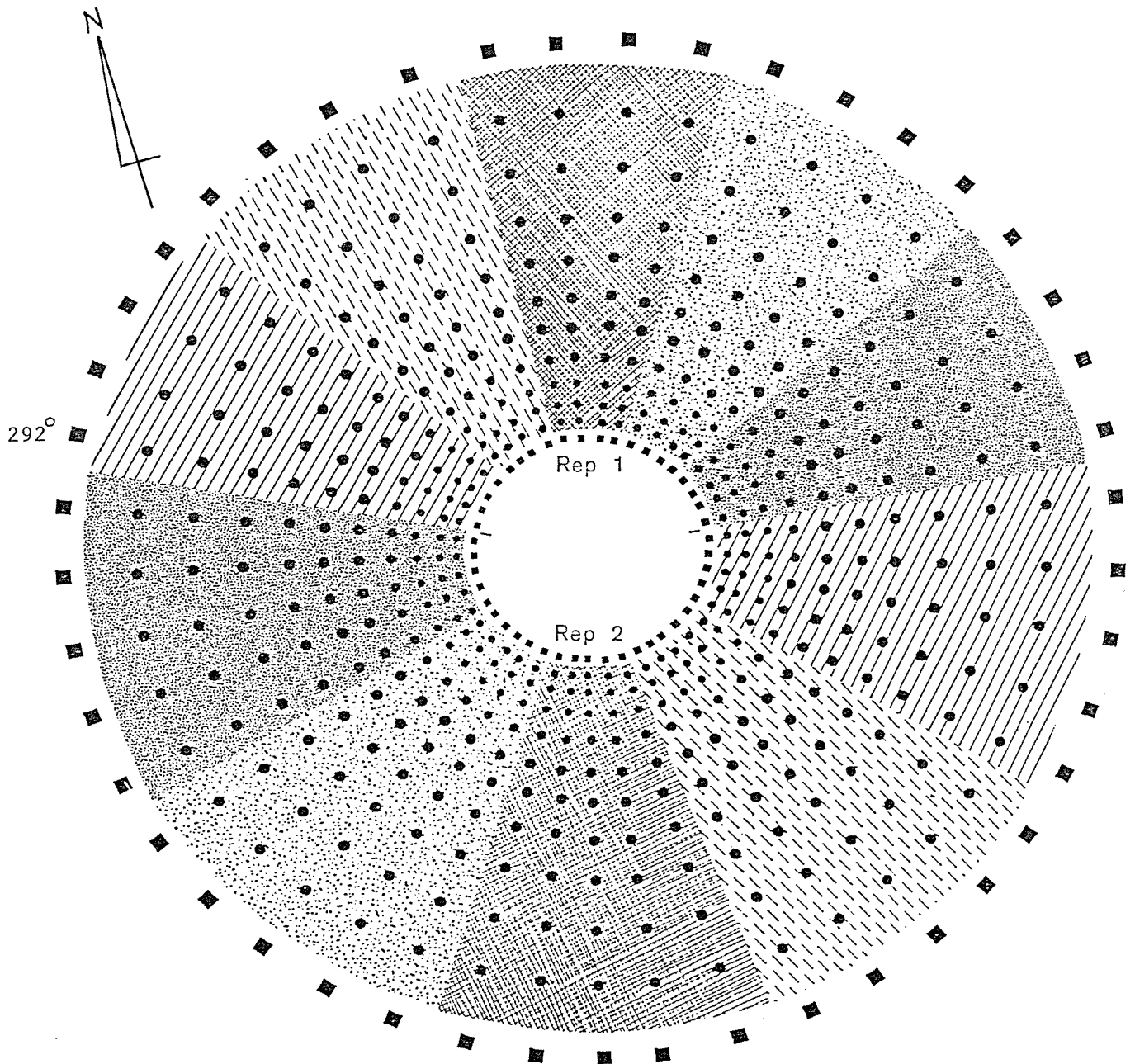
3. KINLEITH, TOKOROA

NZFP Forests Ltd

Exp. No. FR 44

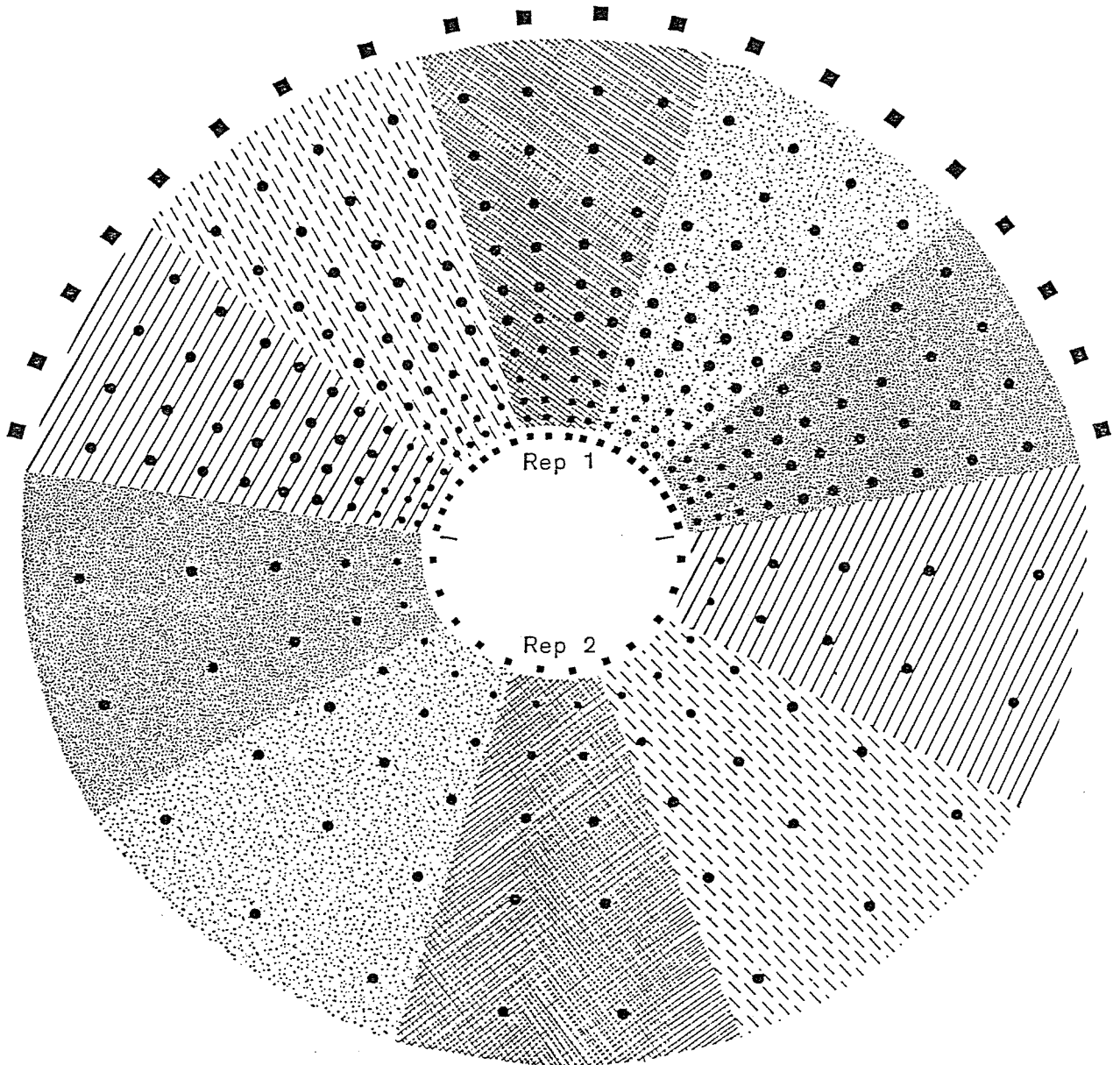
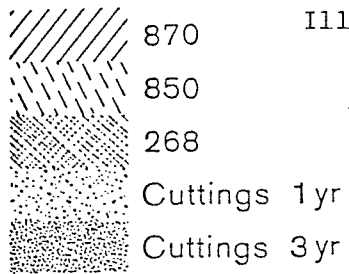
KINLEITH

	870	"best-5" clones OP. (9/3/86/166)
	850	GF 14 OP. (3/3/87/01/3)
	268	GF 22 "best-16" clones CP. (6/6/87/21)
	Cuttings 1yr	GF 19 C11 "268" "best-16" clones OP. (2/6/86/29)
	Cuttings 3yr	GF 17 C31 "268" "best-25" clones OP (9/0/83/096)



KINLEITH

Illustrating the thinning option for rep. 2.



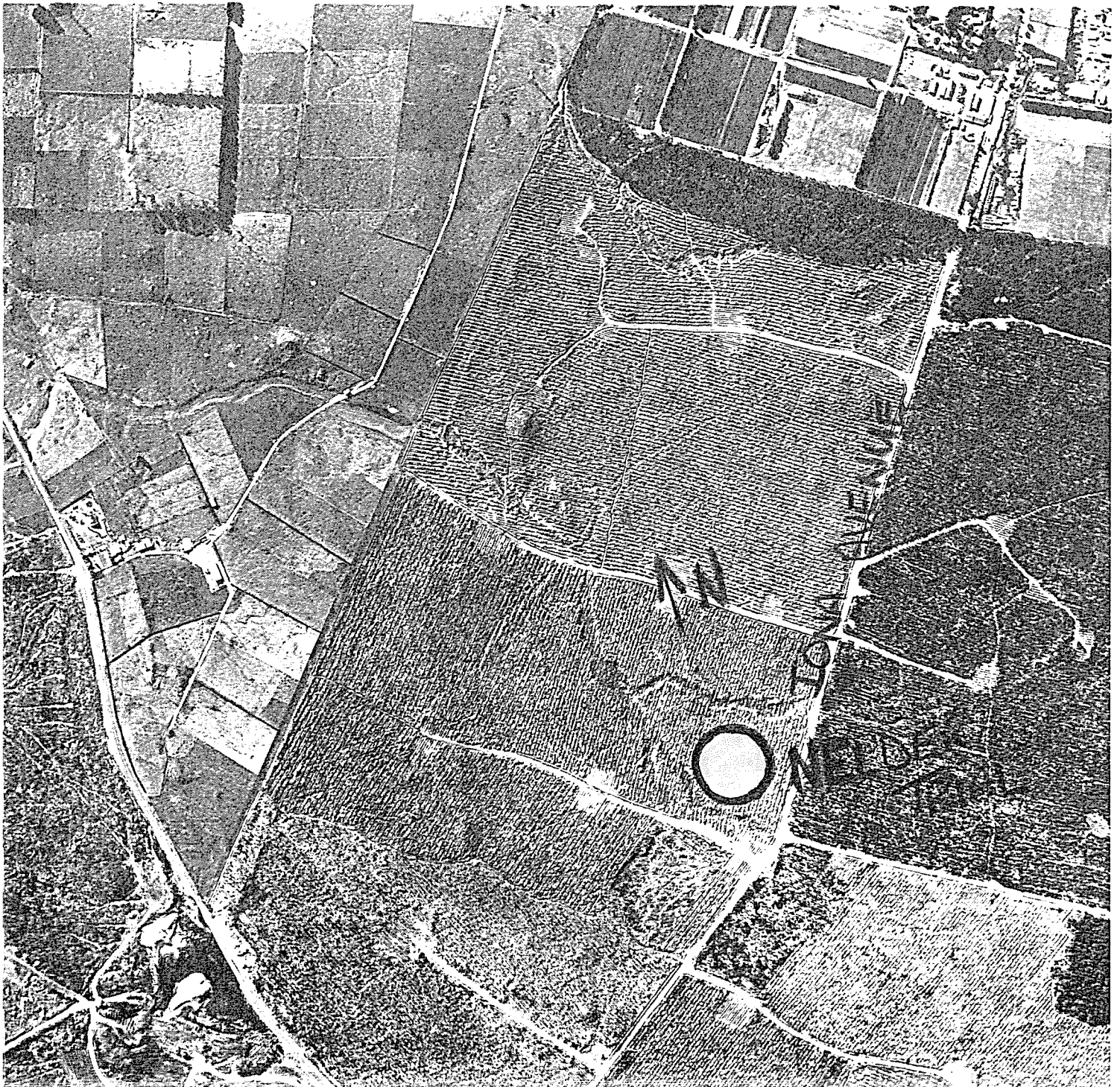
NELDER TRIAL

AREA HISTORY

A 36 year old *Pinus Radiata* cutover site which had an aerial prep of Escort at 250 gms/ha, + Paraquat at 3 l/ha + Pulse 0.32 l/ha in February 1988 for the control of Blackberry and Cape Broom and the desiccation of grass. It was then burnt in late March.

PLANTING

Area planted on 21 July 1988 followed by a grass spot-spray with Atrazine at 1.5 l/20 l mix, 2 x 10 ml doses per m² with tree in centre on the 29th September 1988.



4. KAINGAROA FOREST

NZ Timberlands Ltd

Exp. No. FR 45

CABLE

OLD CAMBRIDGE - Tr

WARNING
P & T CABLE

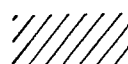




ROAD

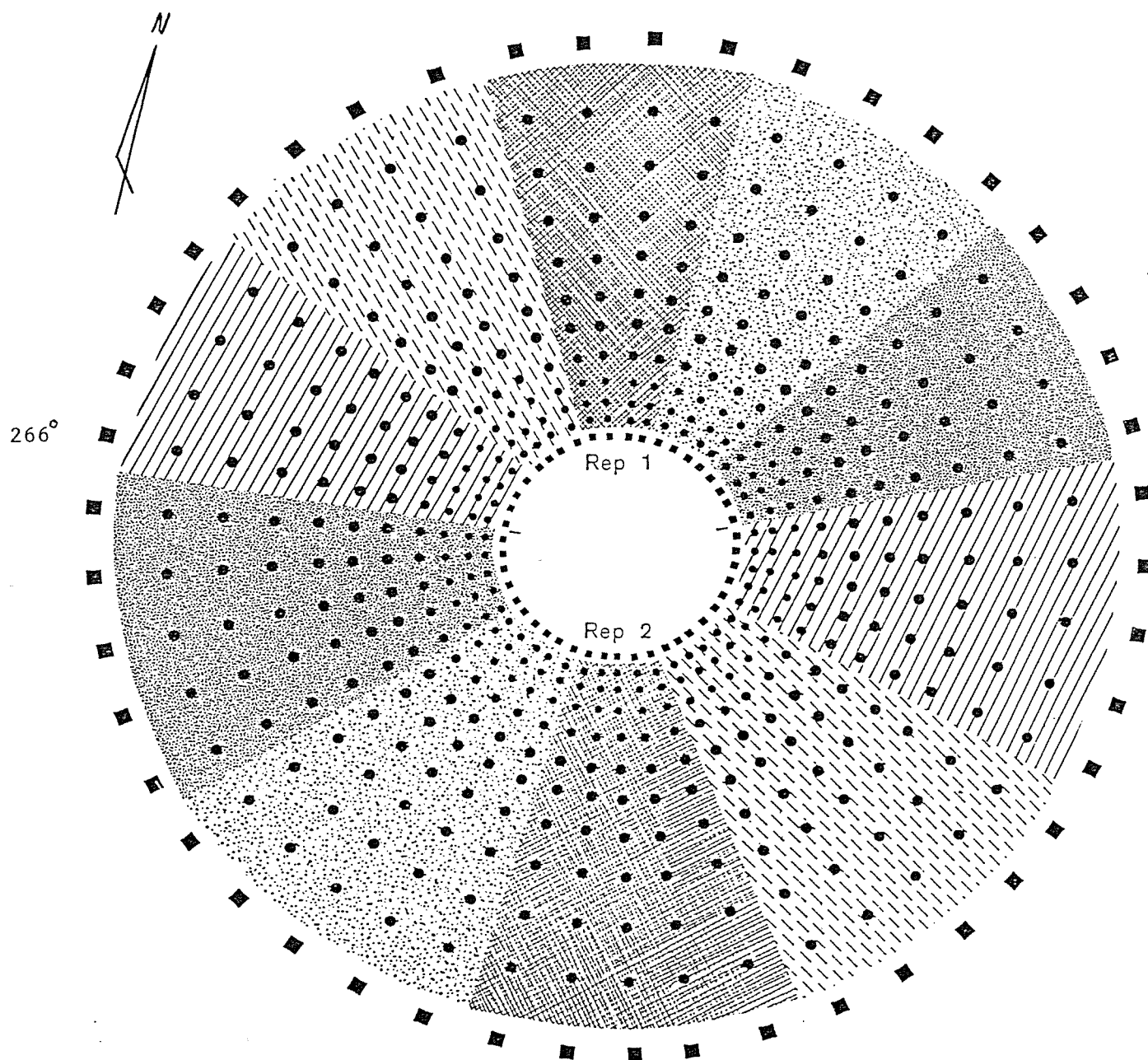
THAV

Track

IONA

KAINGAROA

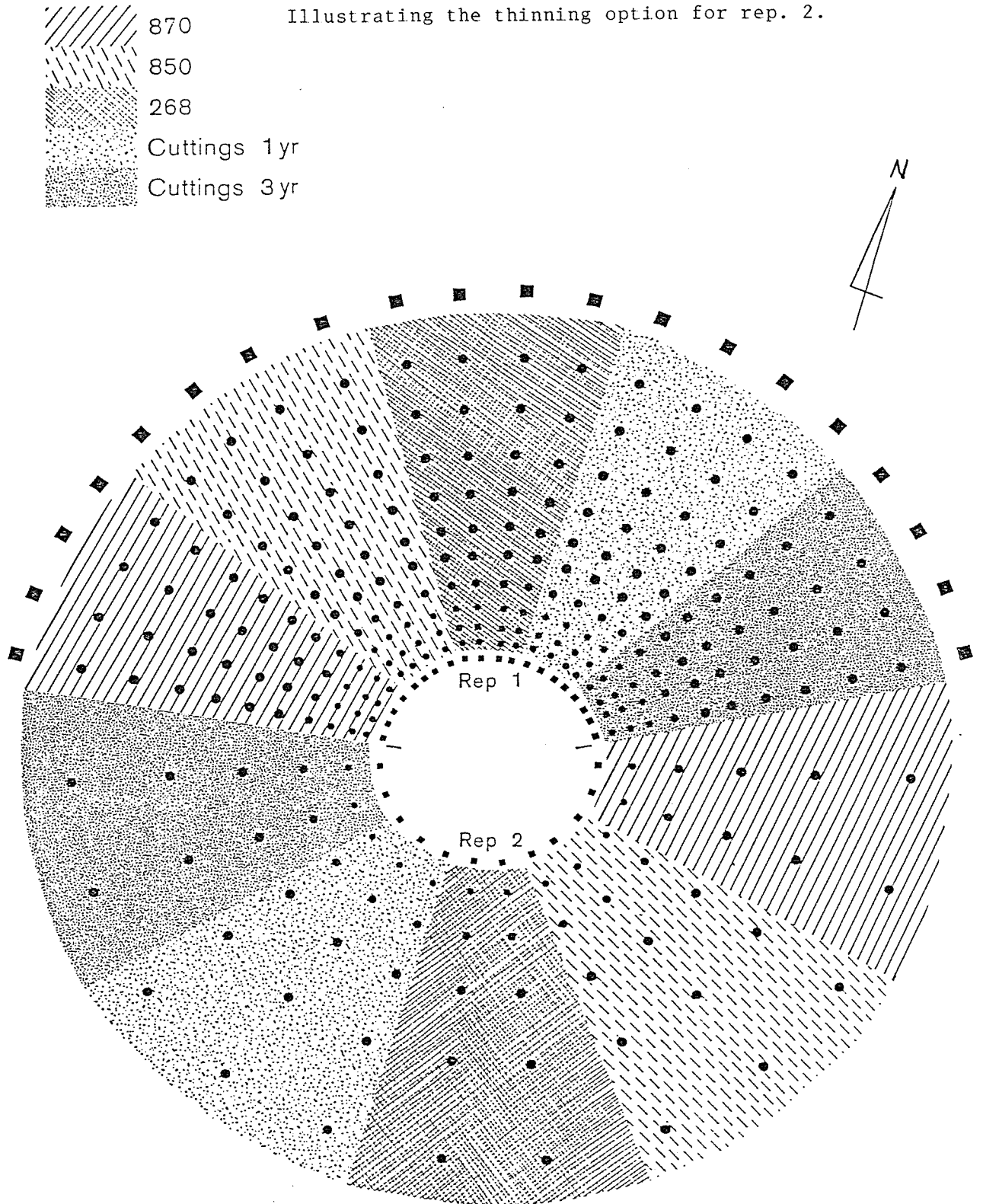
	870	"best-5" clones C.P. (9/3/86/166)
	850	GF 14 OP. (3/3/87/01/3)
	268	GF 22 "best-16" clones CP. (6/6/87/21)
	Cuttings 1yr	GF 19 C11 "268" "best-16" clones OP. (2/6/86/29)
	Cuttings 3yr	GF 17 C31 "268" "best-25" clones OP. (9/0/83/096)



Established July 1988 on the Kaingaroa ex-nursery site. As a result the area is very clean from weeds.

KAINGAROA

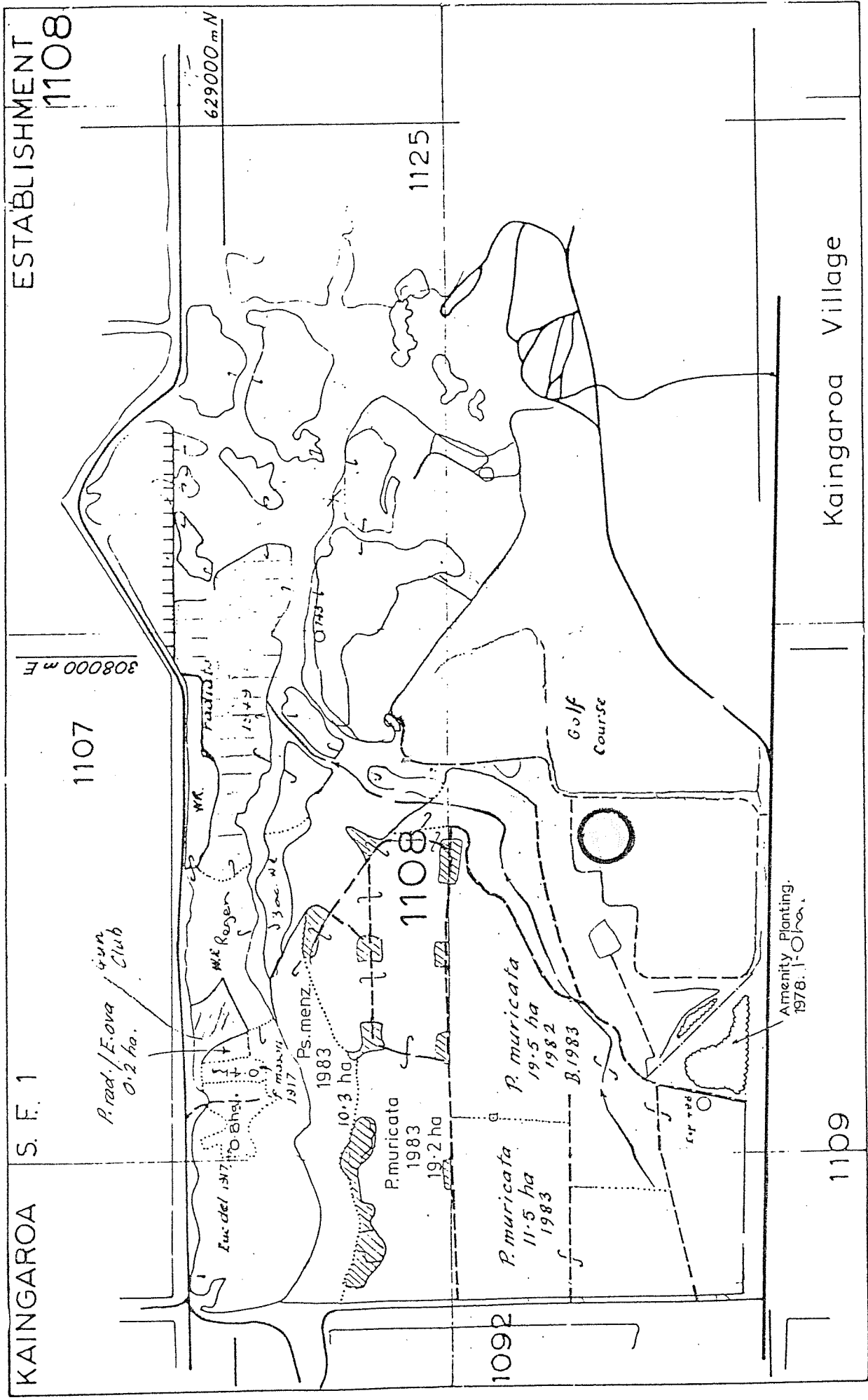
Illustrating the thinning option for rep. 2.



KAINGAROA FOREST



Nelder established on Kaingaroa ex-nursery site.



5. LAKE ROTOAIRA FOREST

NZ Timberlands Ltd

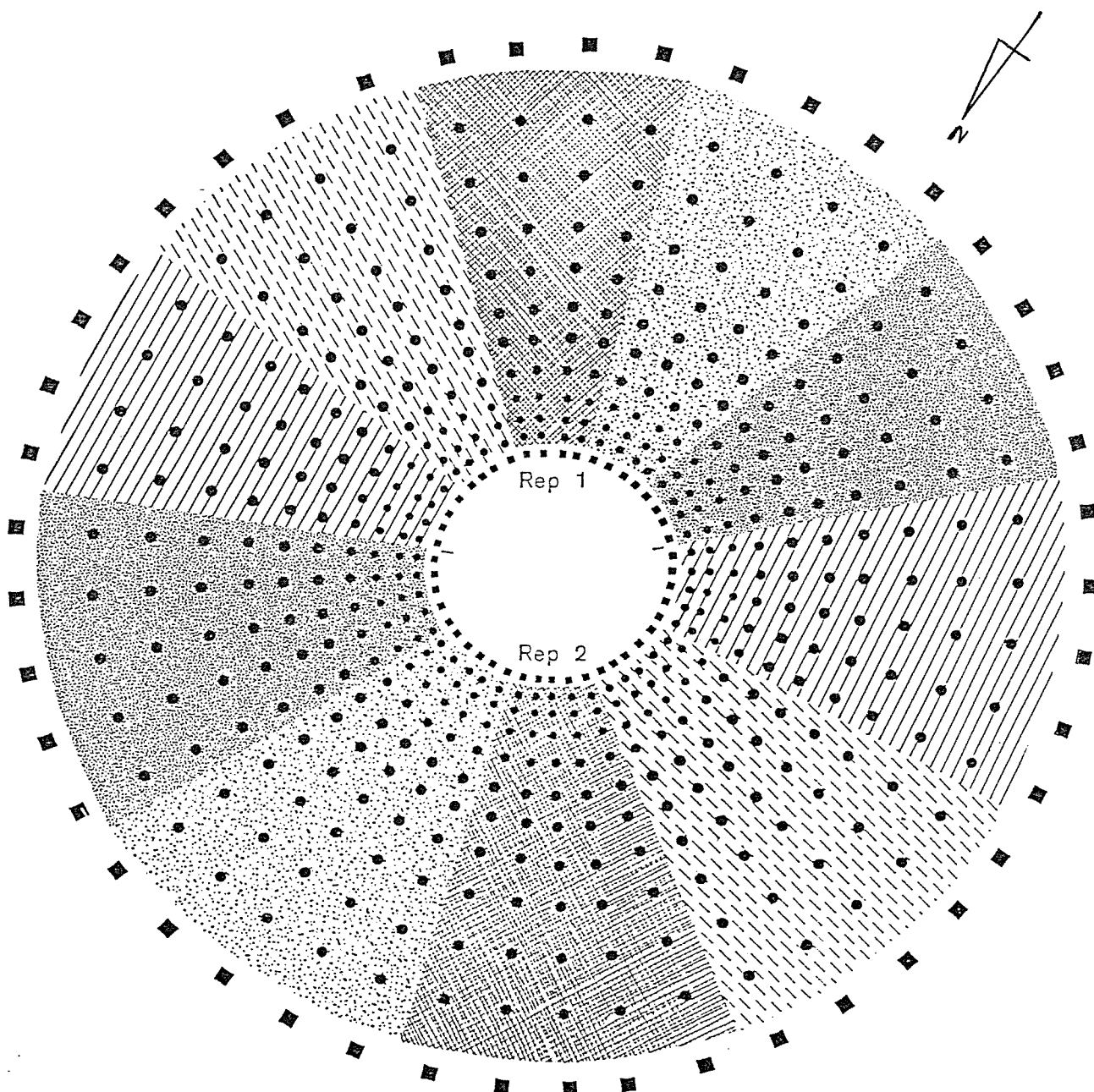
Exp. No. FR 46

LAKE ROTOAIRA FOREST

ACCESS TRACK GATE

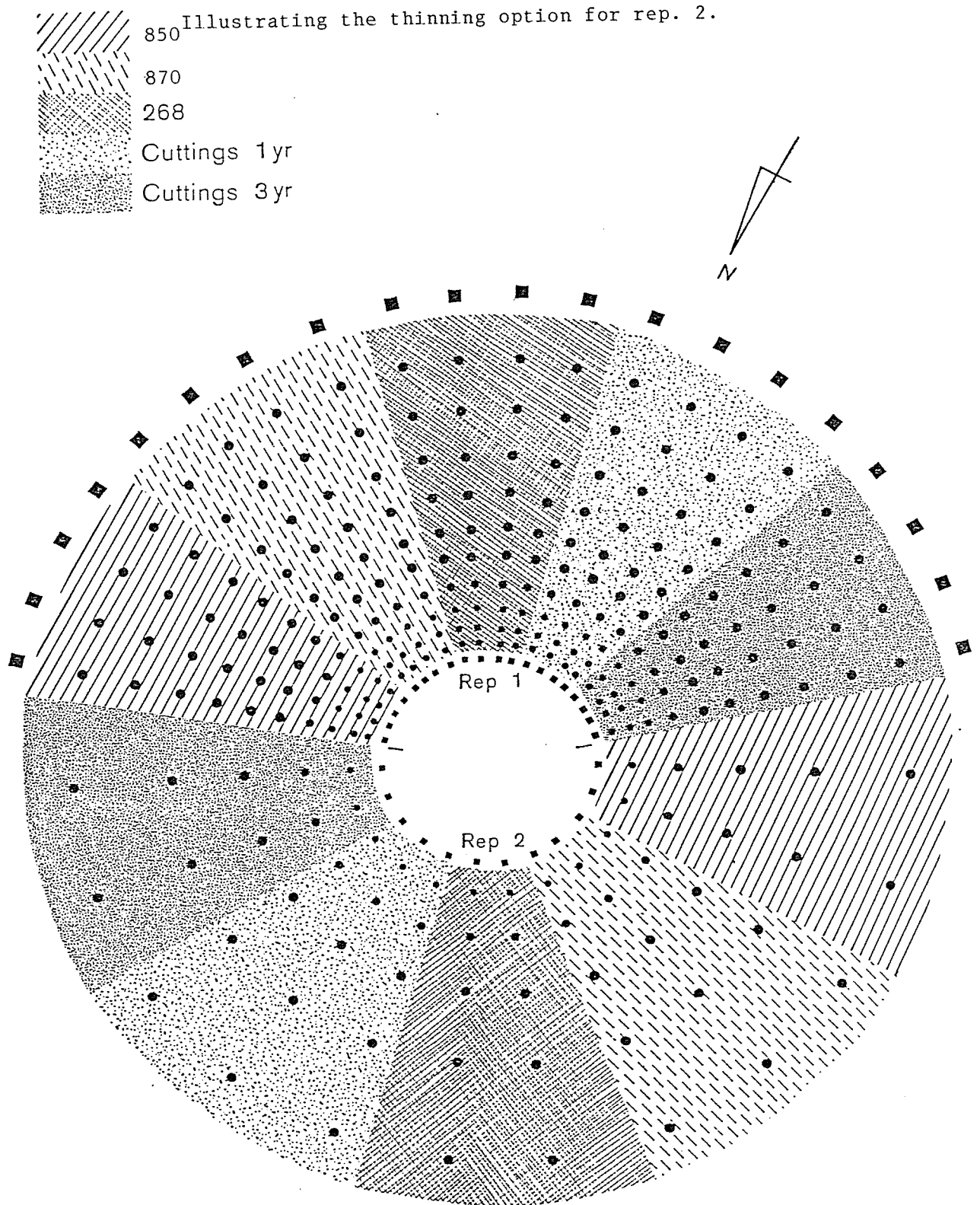
STATE HIGHWAY 47

850	GF 14 OP. (3/3/87/01/3)
870	"best-5 clones OP. (9/3/86/170)
268	GF 22 "best-16 clones CP. (6/6/87/21)
Cuttings 1yr	GF 19 C11 "268" "best-16" clones OP. (2/6/86/29)
Cuttings 3yr	GF 17 C31 "268" "best-25" clones OP. (9/0/83/096)



Nelder established July 1988 on an ex-farm site. The site had been "bedded" in preparation for standard forest planting. (see photographs)

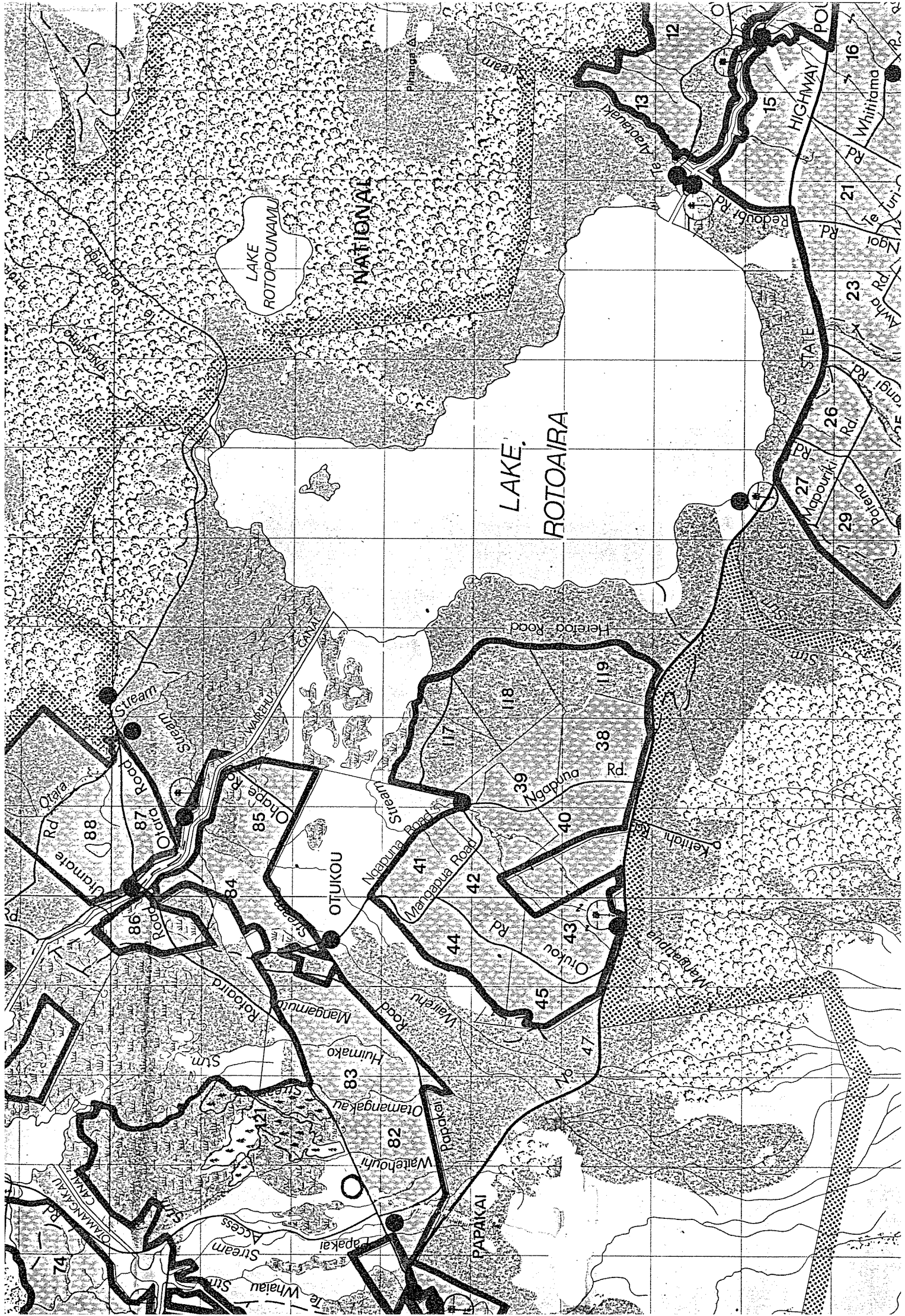
LAKE ROTOAIRA FOREST



LAKE ROTOAIRA FOREST



Nelder established on an ex-farm site








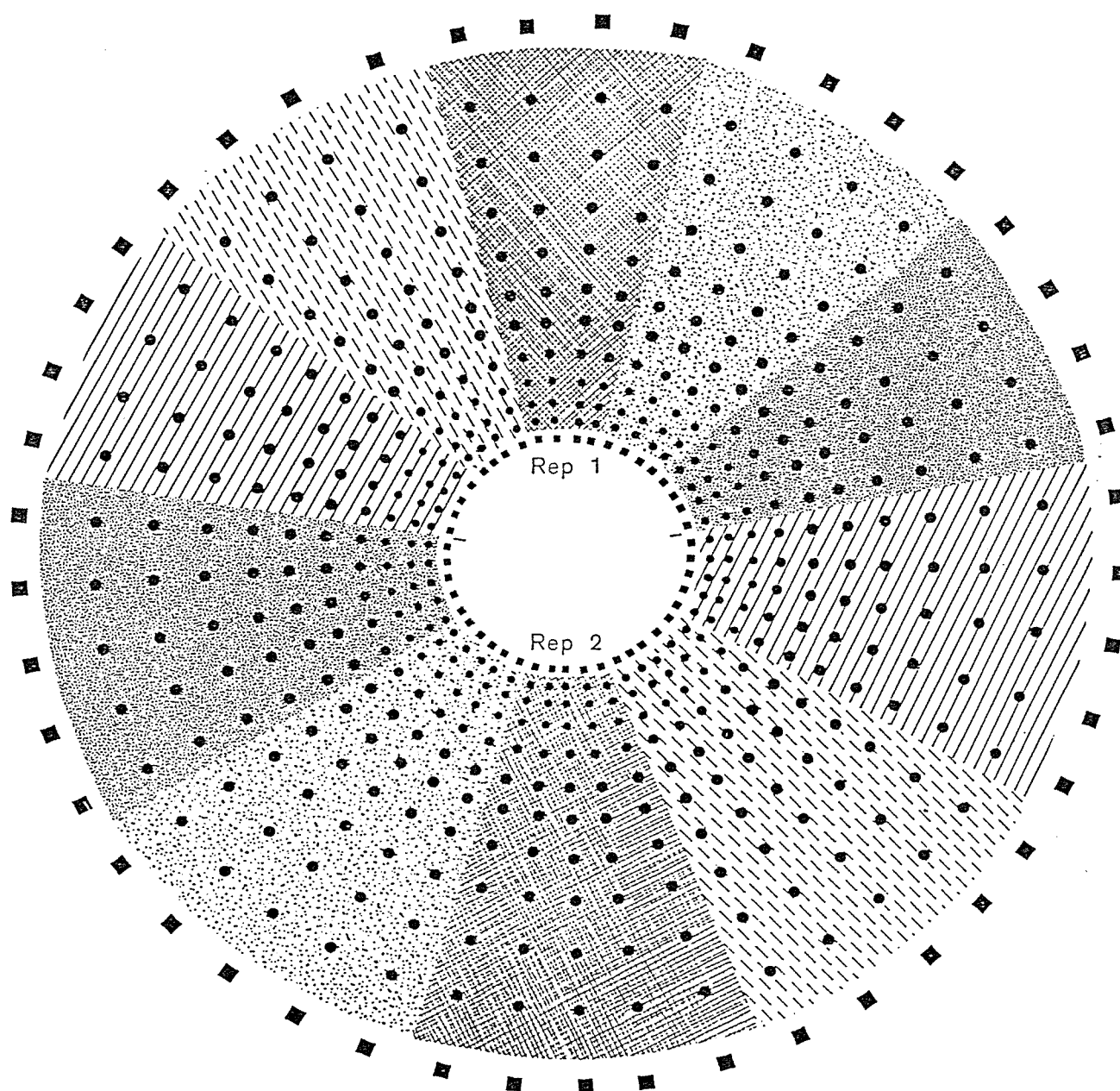
7. TIKOKINO, WAIPAWA

NZ Timberlands Ltd

Exp. No. FR 48

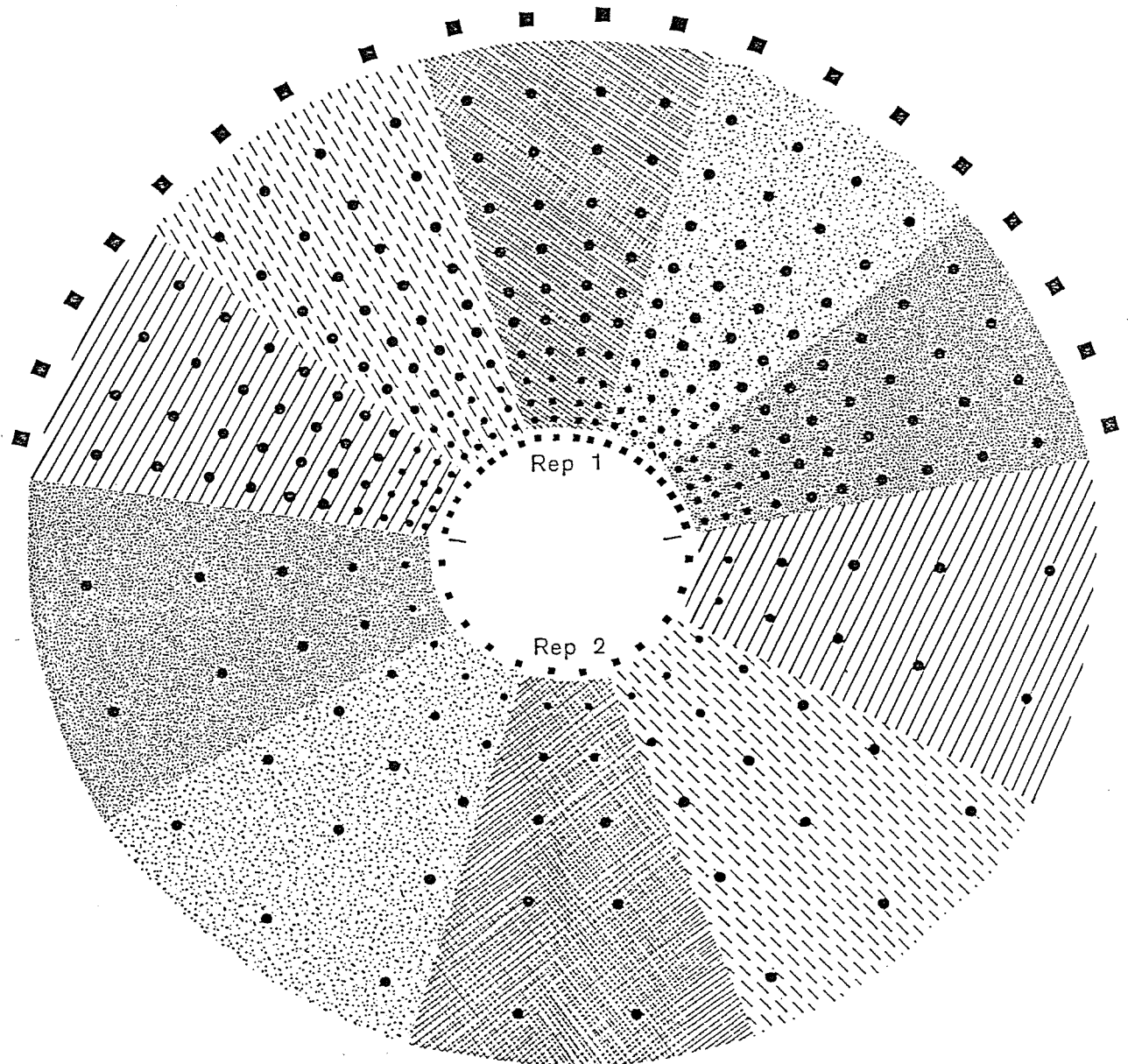
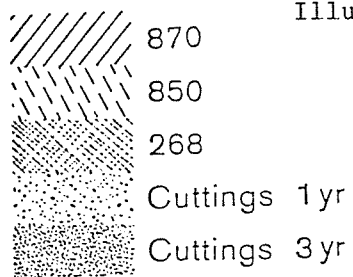
TIKOKINO

	870	"best-5" clones OP. (9/3/86/170)
	850	GF 14 OP. (3/3/87/01/3)
	268	GF 22 "best-16" clones CP. (6/6/87/21)
	Cuttings 1yr	GF 19 C11 "268" "best-16" clones OP. (2/6/86/29)
	Cuttings 3yr	GF 17 C31 "268" "best-25" clones OP. (9/0/83/096)

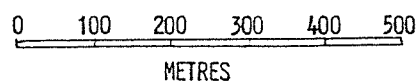
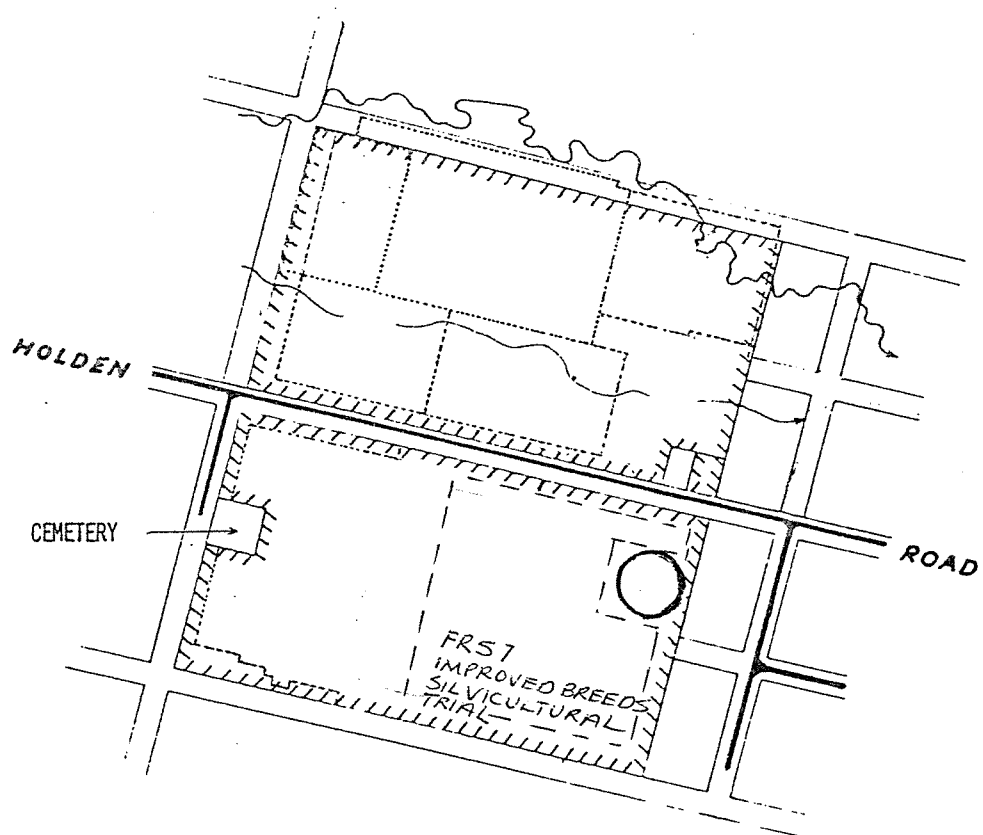


The Nelder was established August 1988. Site preparation involved rotary hoeing to a depth of approximately 20 cm. The trial received a post plant application of Velpar granules using "Weed-a-Metres" on the 19th of October.

Illustrating thinning option for rep. 2.



Tikokino (FR 48)

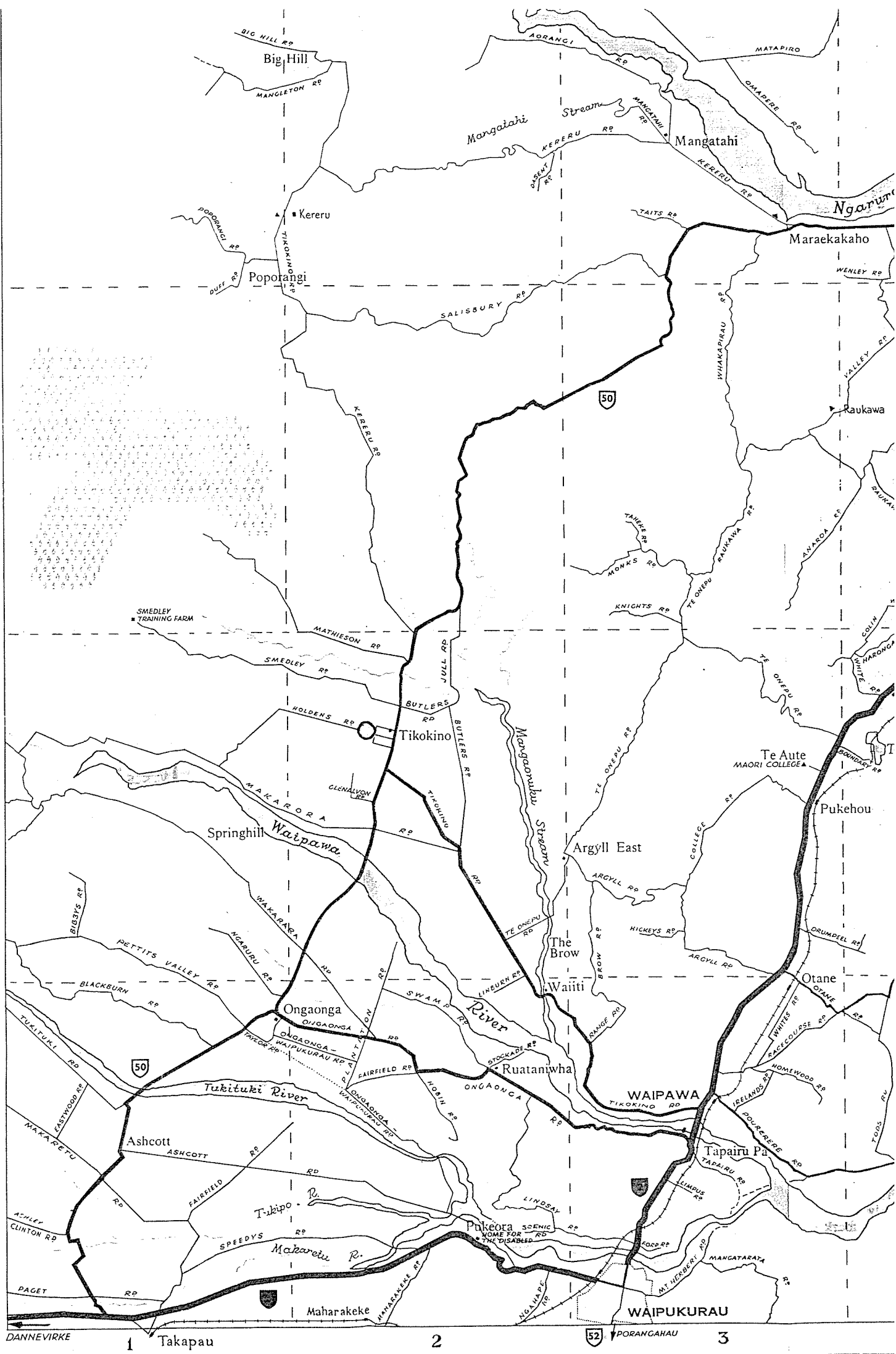


D

E

F

G

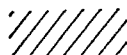






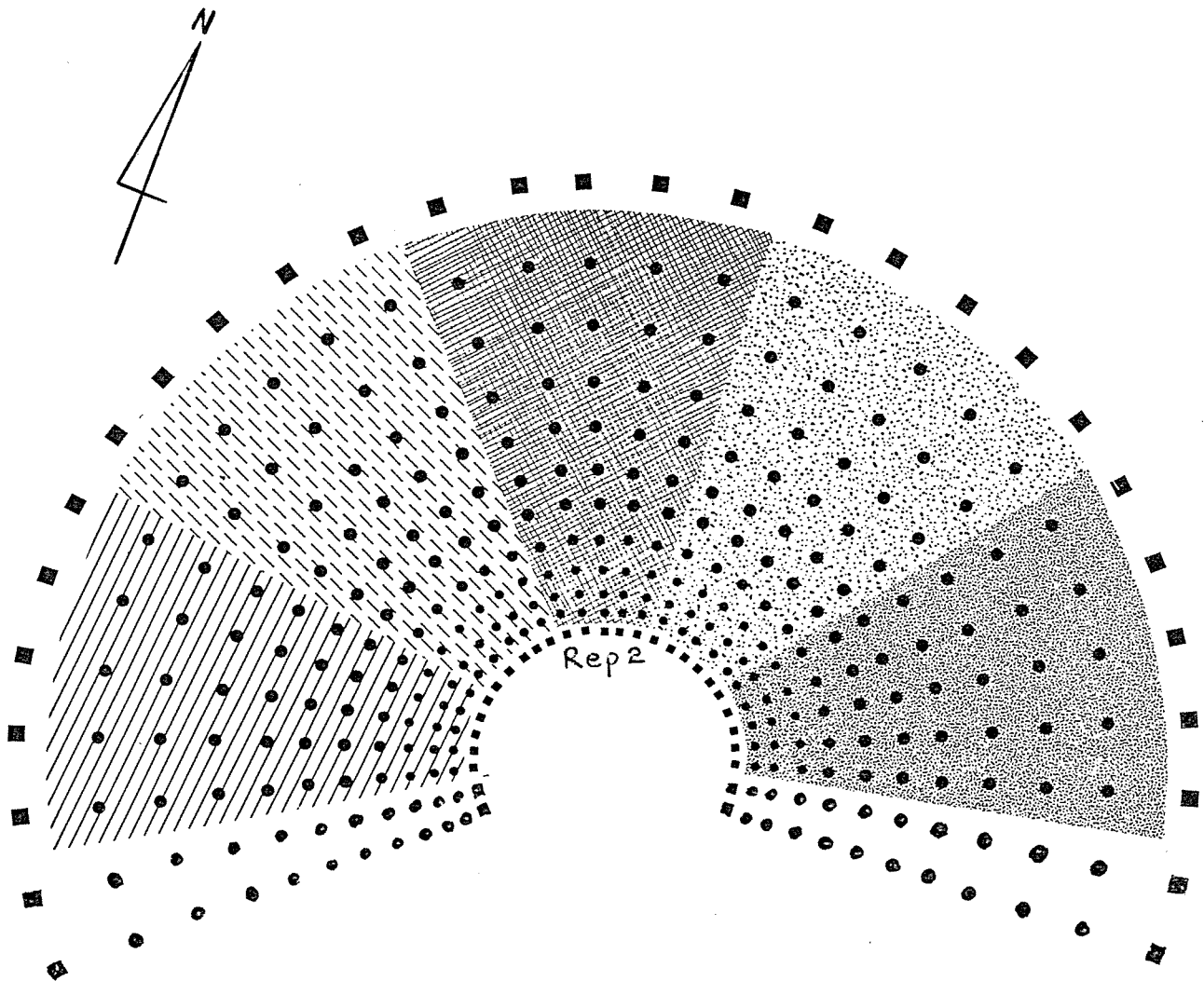
9. ASHLEY FOREST

NZ Timberlands Ltd

Exp. No. FR 50

ASHLEY FOREST

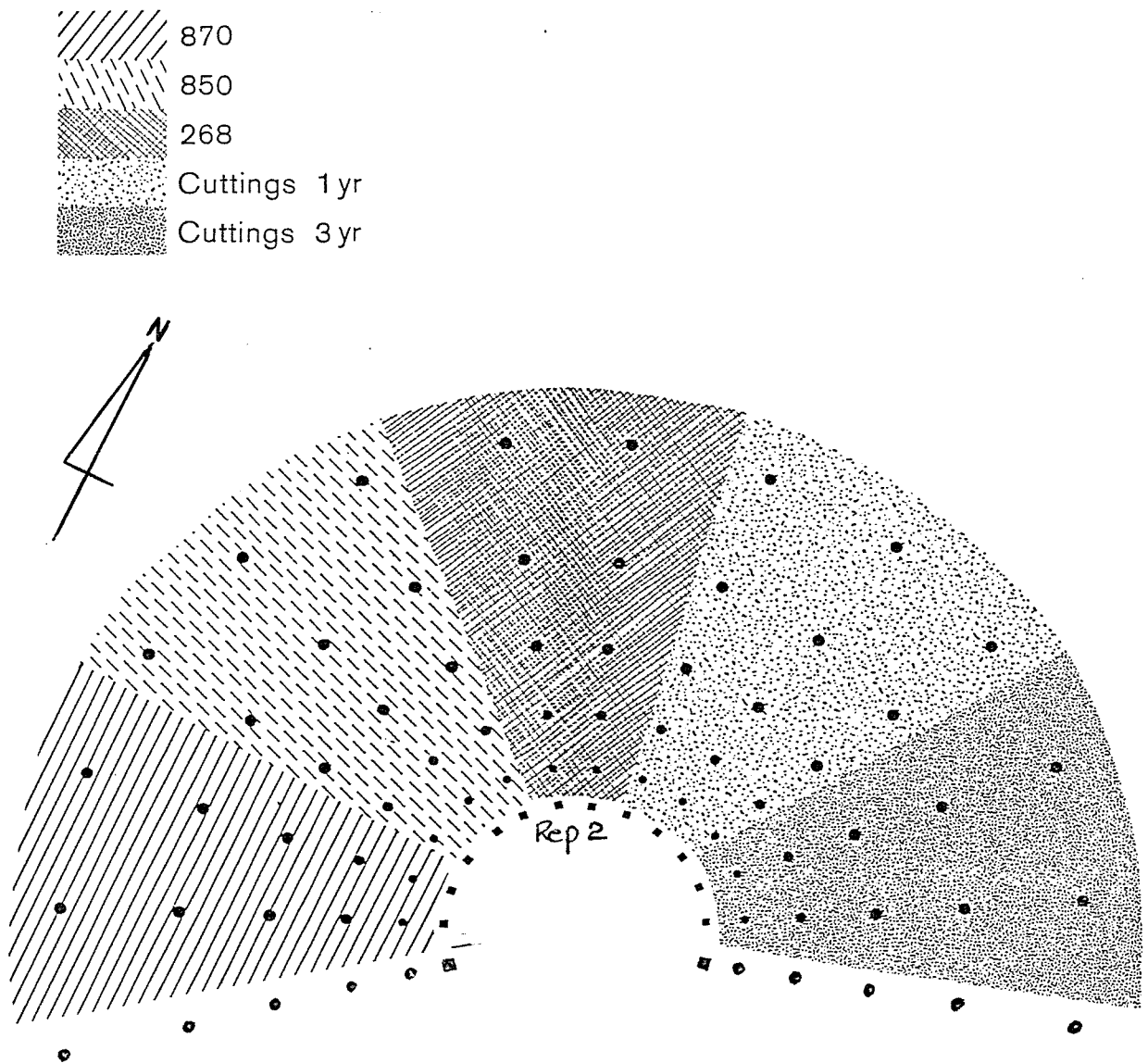
	870	"best-5" clones OP. (9/3/86/170)
	850	GF 14 OP. (3/3/87/01/3)
	268	GF 22 "best-16" clones CP. (6/6/87/21)
	Cuttings 1yr	GF 19 C11 "268" "best-16" clones OP. (2/6/86/29)
	Cuttings 3yr	GF 17 C31 "268" "best-25" clones OP. (9/0/83/096)



Note: The buffer spokes contain the same tree stocks as the adjacent treatment.

ASHLEY FOREST

Illustrating thinning option.



ASHLEY FOREST

Exp. No. FR 50

A half Nelder was established June 1988 on a sloping radiata pine cutover site at Ashley Forest.

Notes

Soils: Makerikeri 22 hH. compact stony silt loam over greywacke gravel silts and clays.

Forest surround planting: radiata pine GF 22 (6/6/87/21)

CORRECT AS AT 31-MAR-88 INITS *PRK*

284 000

285 000mE

746 000mN

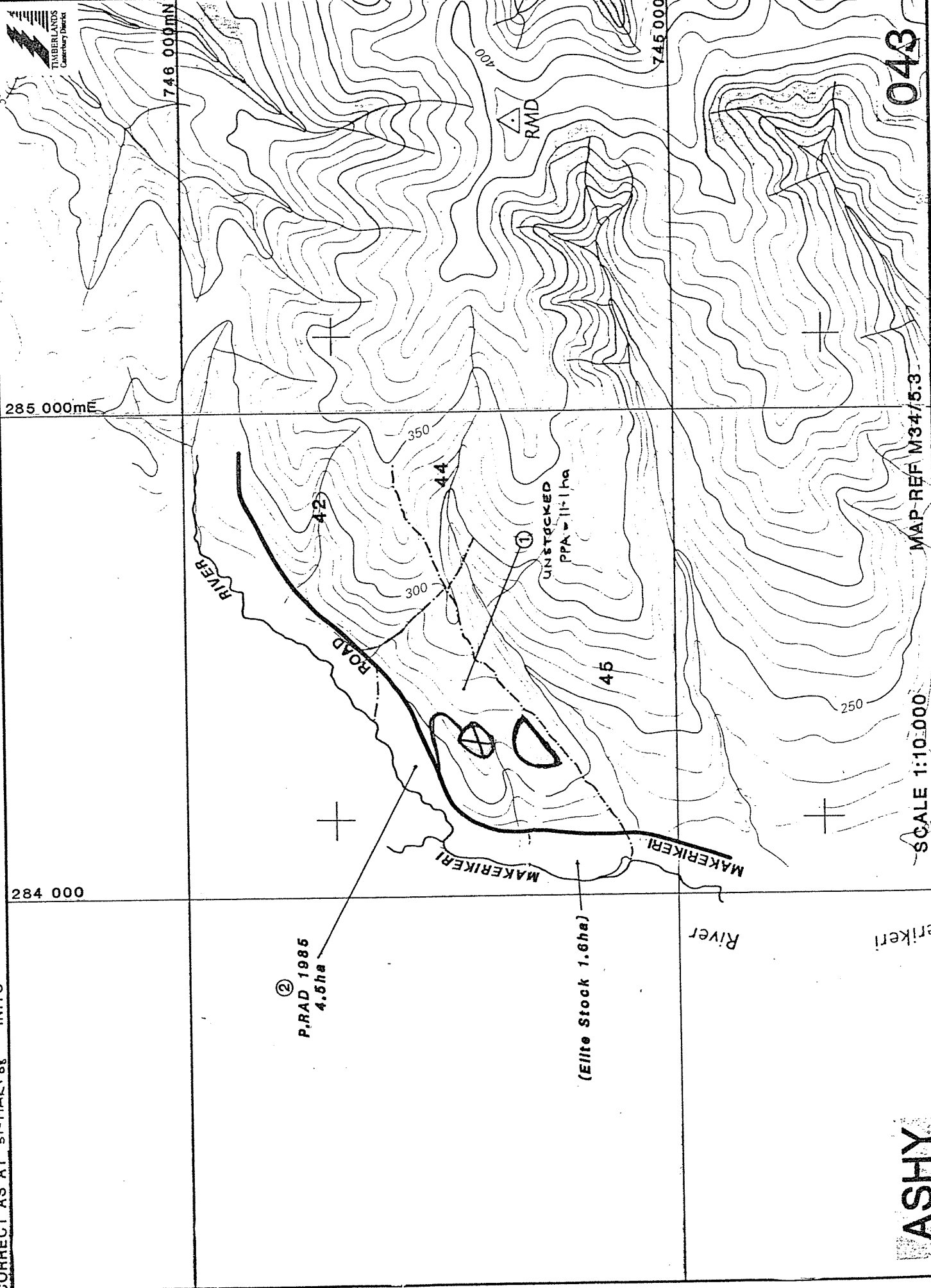
745 000

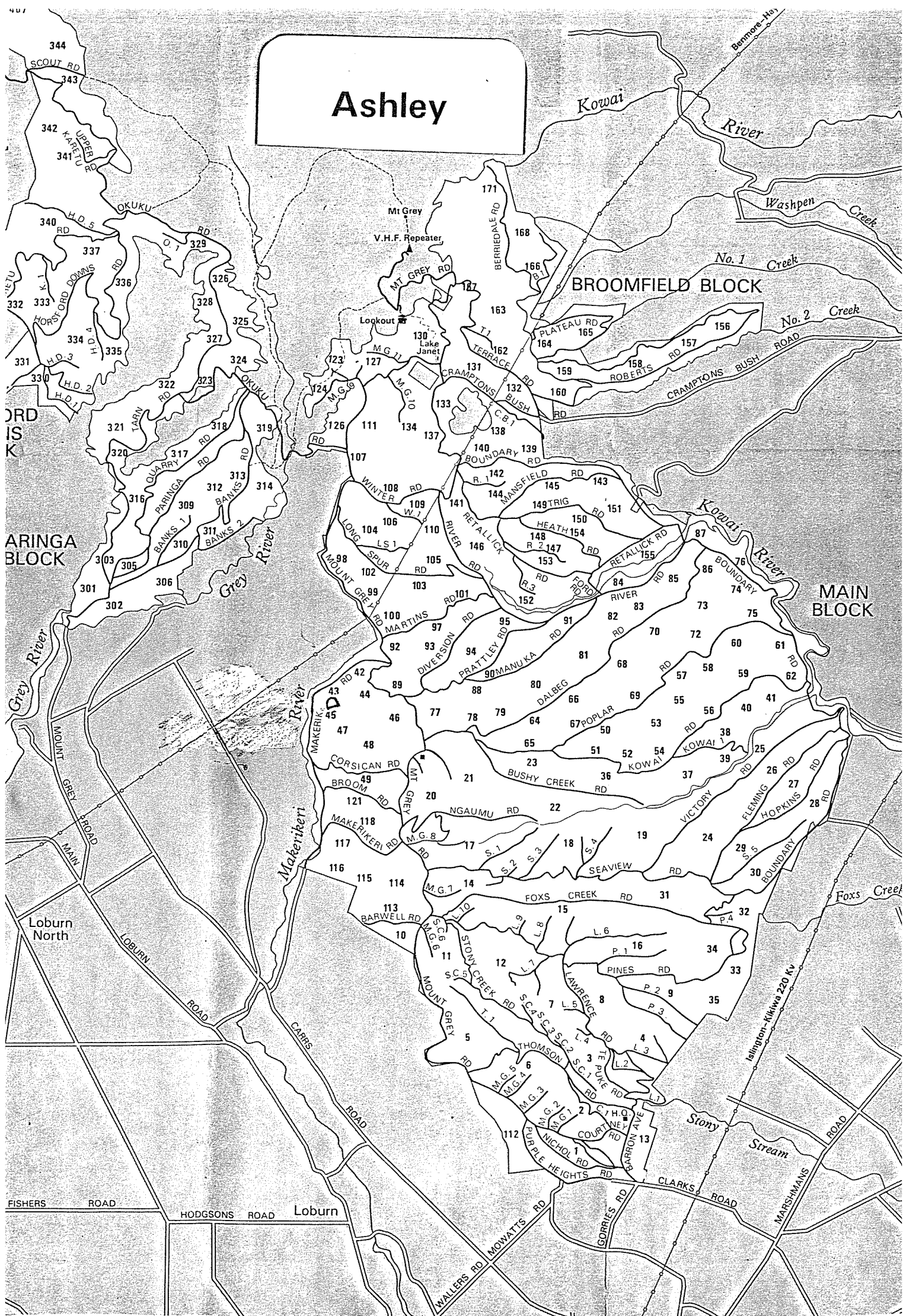
043

MAP REF M34/5.3

SCALE 1:10 000

ASHY



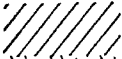

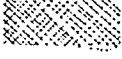


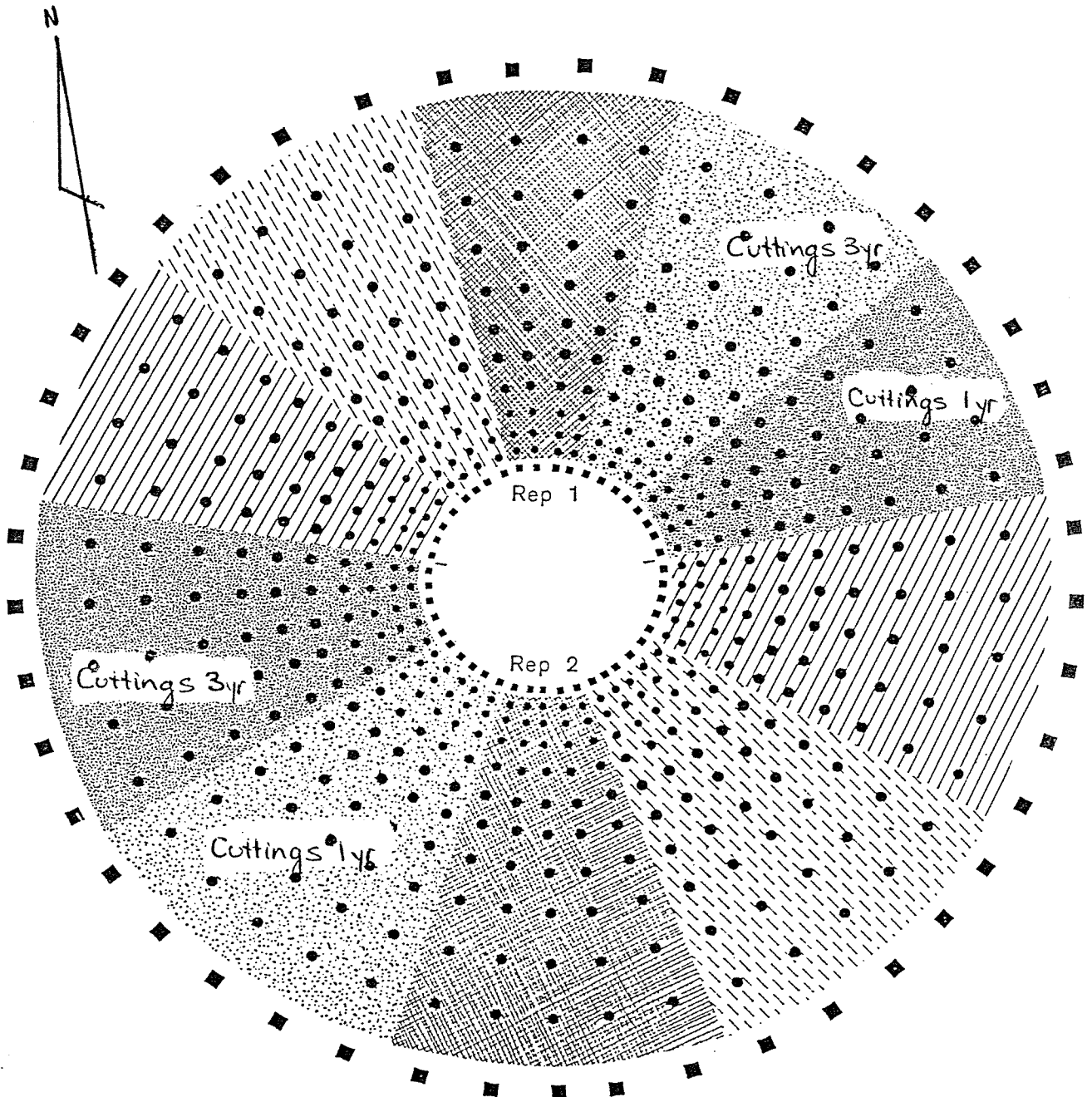
10. BURNHAM

Selwyn Plantation Board

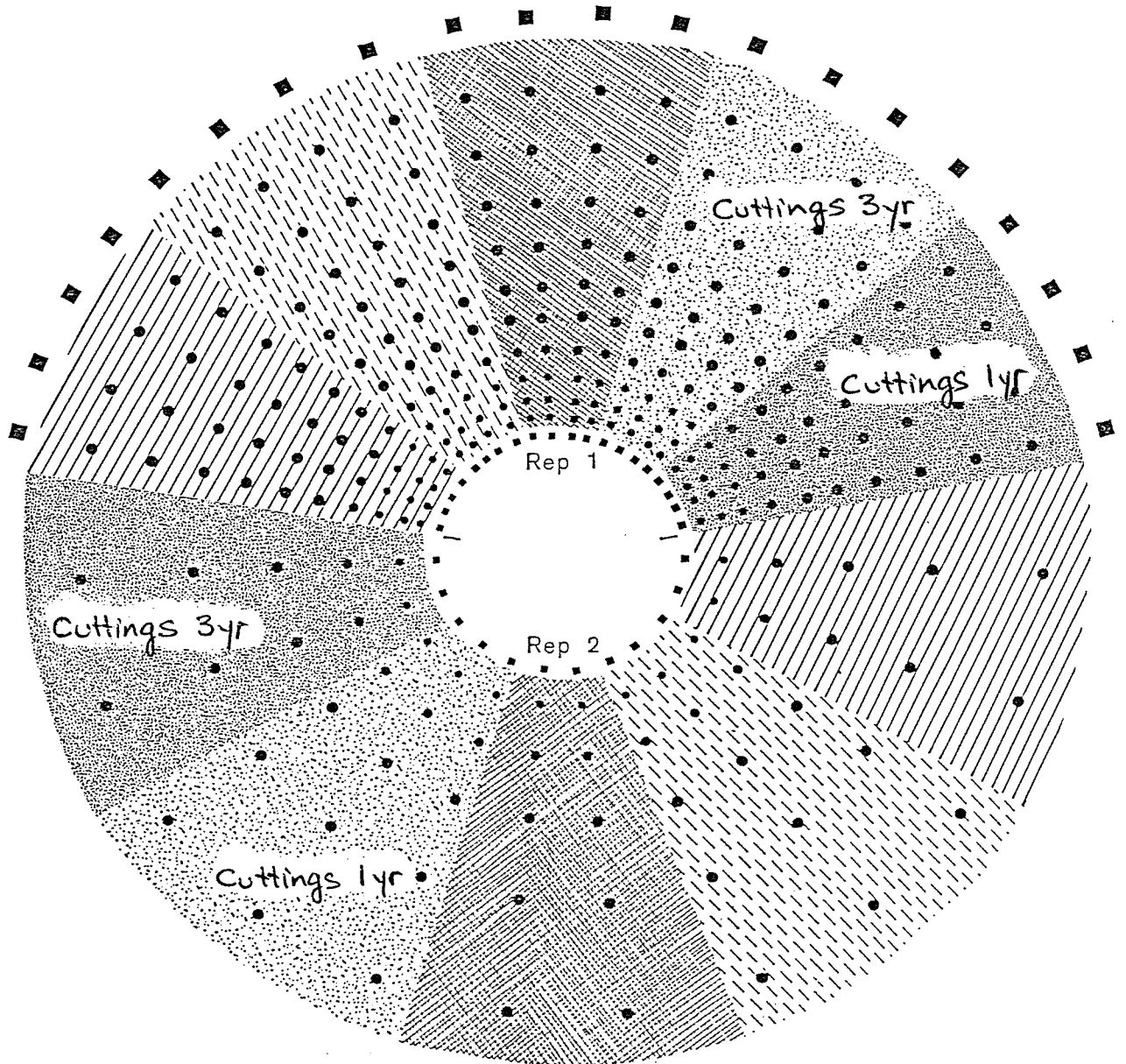
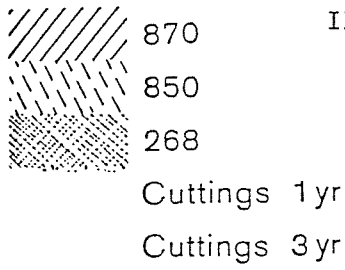
Exp. No. FR 51

BURNHAM

	870	"best-5" clones OP. (9/3/86/170)
	850	GF 14 OP. (3/3/87/01/3)
	268	GF 22 "best-16" clones CP. (6/6/87/21)
	Cuttings 1yr	GF 19 C11 "268" "best 16" clones OP. (2/6/86/29)
	Cuttings 3yr	GF 17 C31 "268" "best-25" clones OP. (9/0/83/096)2



Illustrating thinning option for rep. 2.

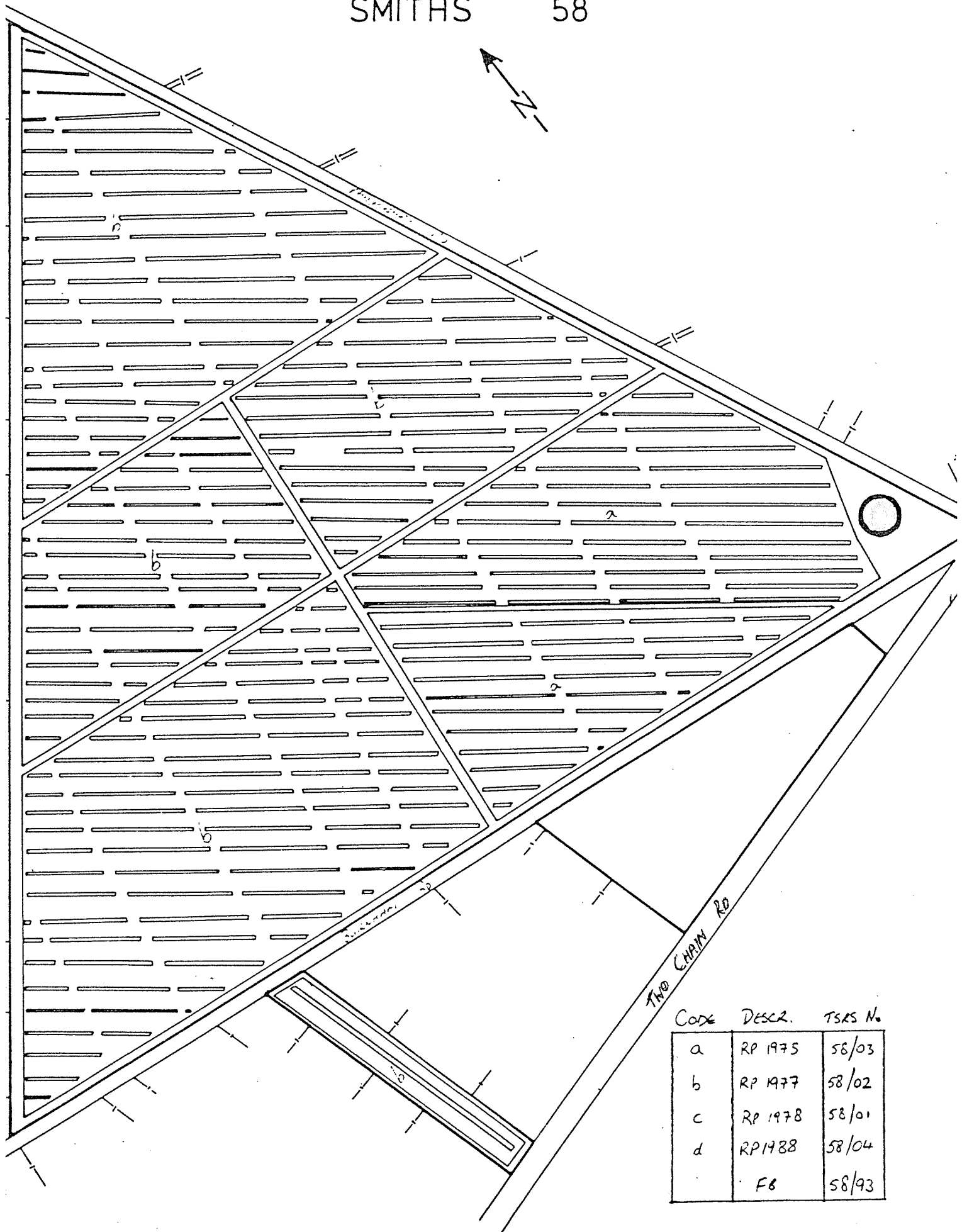


BURNHAM - Selwyn Plantation Board

Exp. No. FR 51

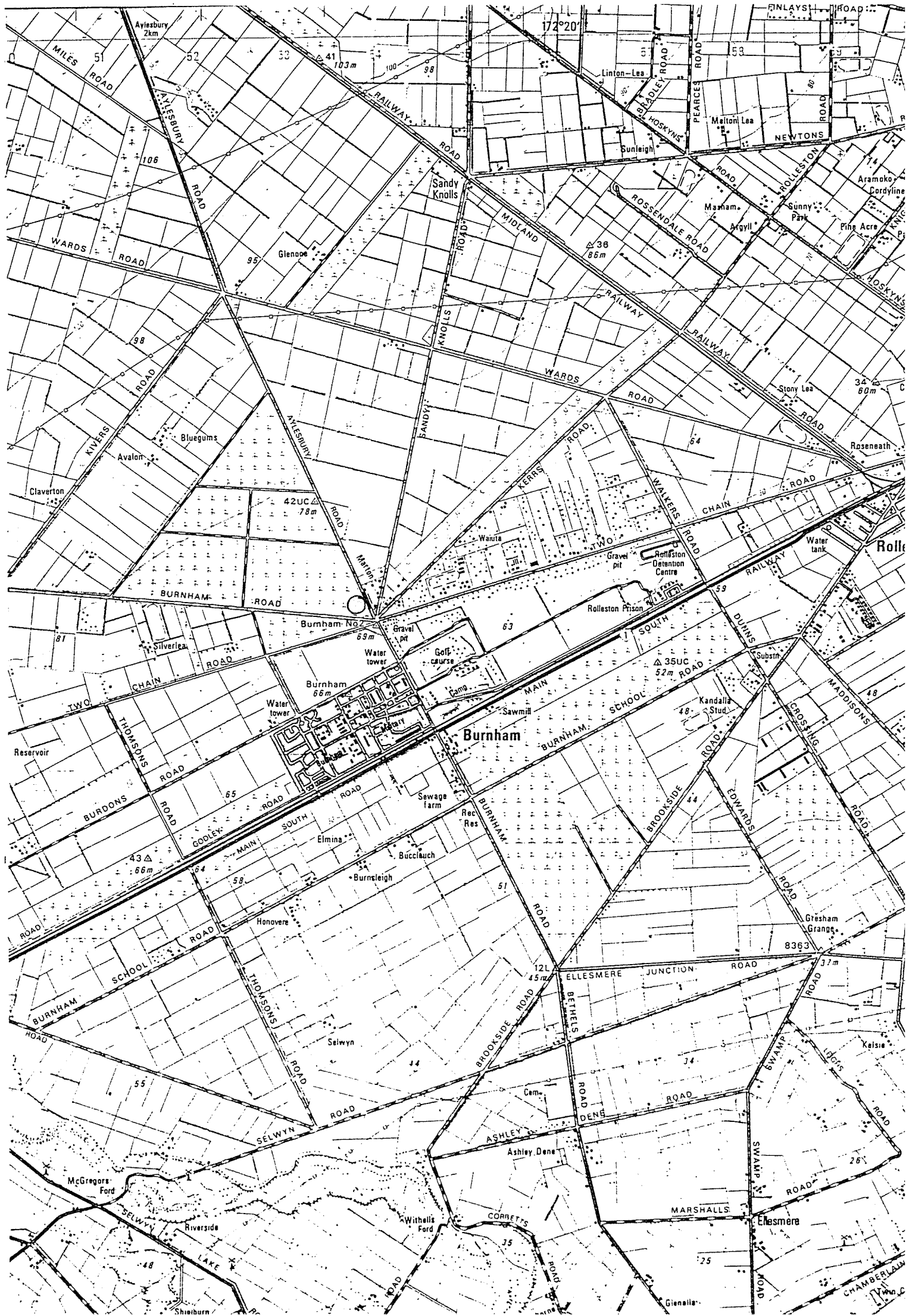
The Nelder was established late August 1988 on Selwyn Plantation Board land approximately 1.5 km north west of the Burnham Military Camp. The site, an open paddock, contained some concrete foundations of an old house which along with some surrounding shelter trees were removed. Once the Nelder was marked out each spoke was ripped using a wing-tine to a depth of 1 m.

Latitude	43° 36.5'
Longitude	172° 17.75'
Altitude	70 m
Slope	0°
Aspect	flat
Soil type	Lismore stony silt loam



SCALE 1 12500

0 100 200 300

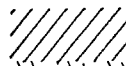
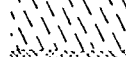





11. TOKOITI FOREST, MILTON

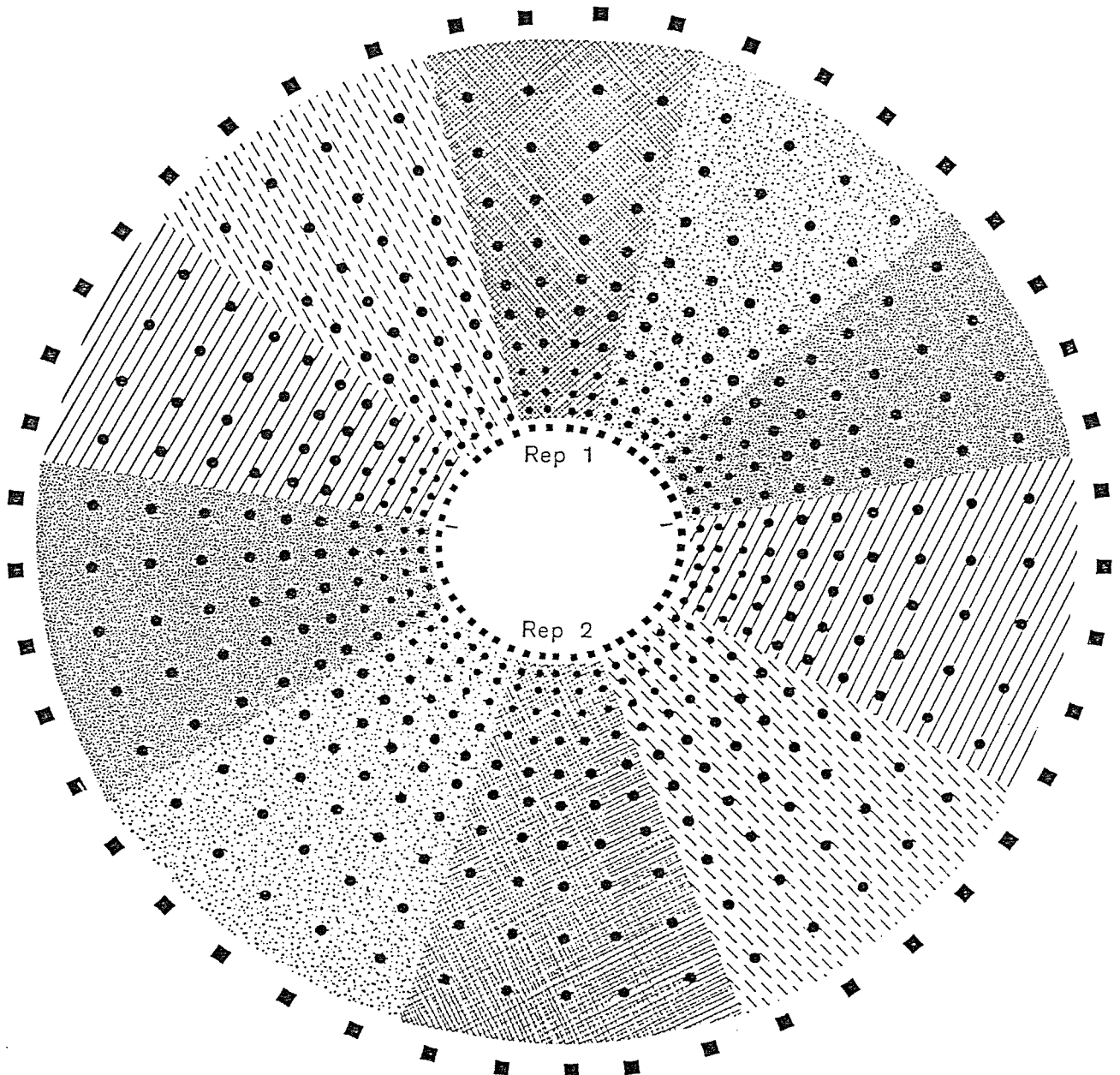
Dunedin City Council

Exp. No. FR 52

TOKOITI FOREST

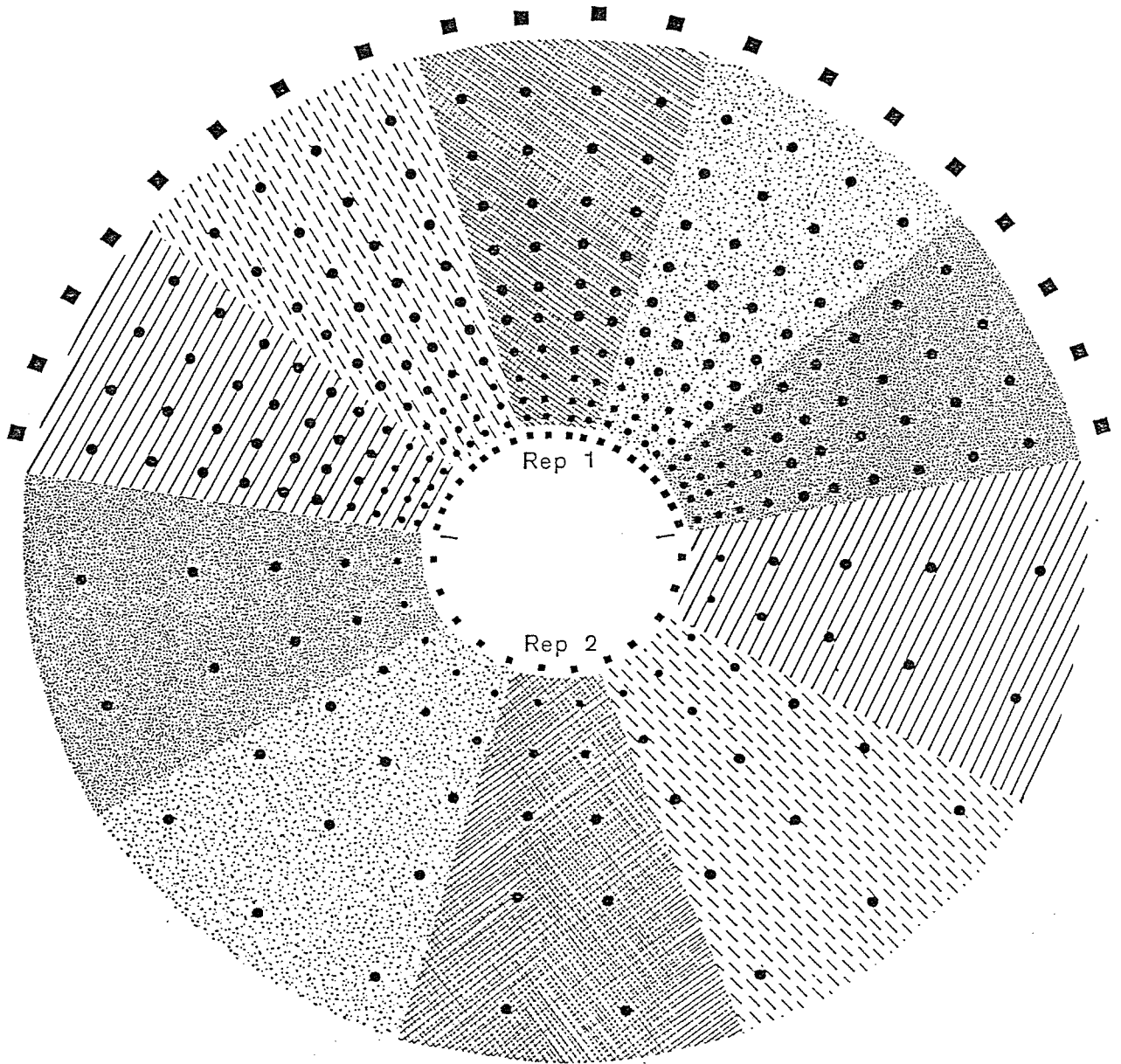
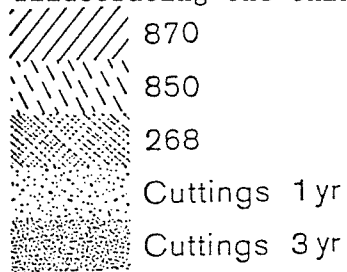
	870	"best-5" clones OP. (7/3/86/170)
	850	GF 14 OP. (3/3/87/01/3)
	268	GF 22 "best-16" clones CP. (6/6/87/21)
	Cuttings 1yr	GF 19 C11 "268" "best-16" clones OP. (2/6/86/29)
	Cuttings 3yr	GF 17 C31 "268" "best-25" clones OP. (9/0/83/096)

(Forest surround GF 16)



TOKOITI FOREST

Illustrating the thinning option for rep. 2.



NELDER TRIAL DCC FORESTRY
ESTABLISHED AUGUST 1988

Location

Exp. No. FR 52.

Tokoiti Forest Cpt 20 DCC Forestry.

Aspect

0-4 degree slope facing NE aspect.

Soils & Geology

The area is dominated by soils of the Kaitangata Hill type of the lowland yellow/grey to yellow/brown earth integrades. These soils which are derived predominantly from schist and greywacke are well suited to exotic forestry. There are no obvious nutrient deficiencies for tree growth.

Climate

The site is situated approximately 3km from the coast and as such experiences a littoral climate.

Rainfall averages 770mm per annum. It is distributed relatively evenly over the 12 months. Frost, although not generally severe, can be expected from April through to November. Snowfalls are normally restricted to higher elevations and rarely cause any significant damage.

Overall the climate is considered favourable for tree growth with no climatic extremes.

Altitude

The site is located at approximately 140 m.a.s.l.

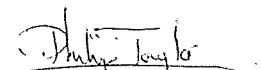
Site Productivity

The site index is considered high at 24m.

Establishment

The trial area was deep ripped (30cm) three months prior to planting. Establishment at planting would be considered better than average. The site was release sprayed for grass competition in late September, early October.

Blanking for mortality and physical injury (namely hares) is continuing. Overall establishment and survival to date must rate as excellent.


Philip Taylor
FORESTER

19 October 1988

TOKOITI FOREST, MILTON



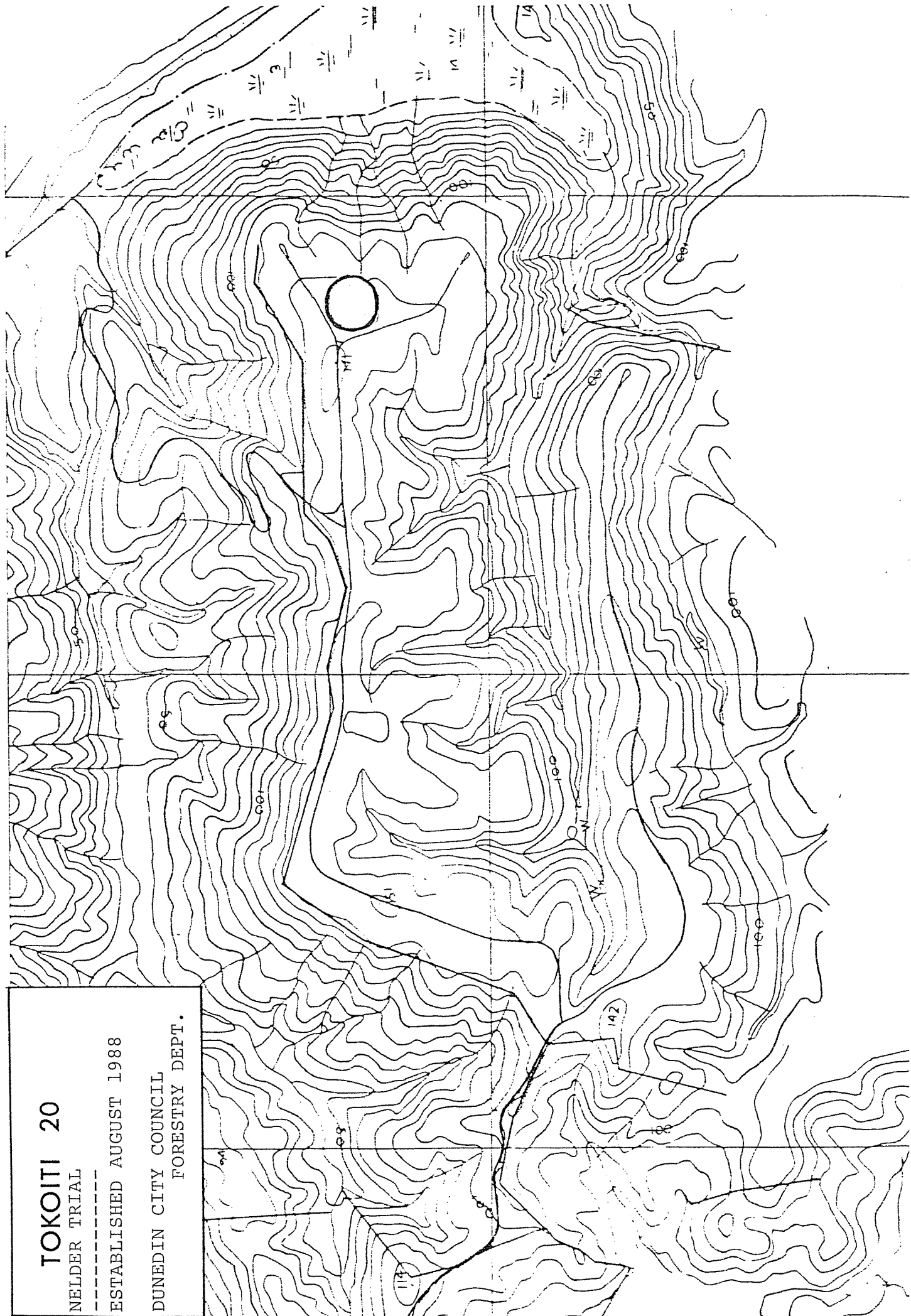
Marking out the Nelder in preparation for ripping.

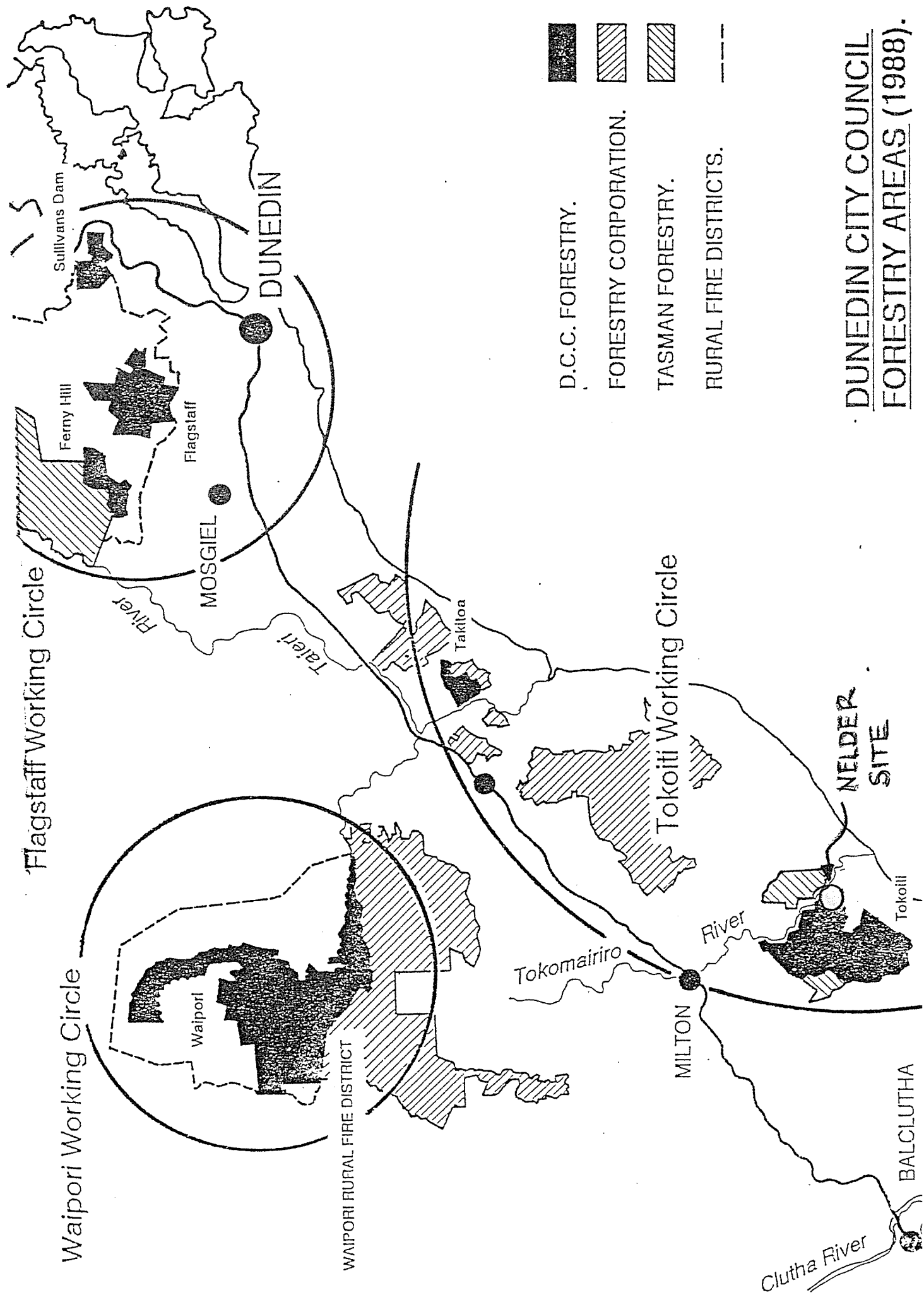
TOKOITI 20

NELDER TRIAL

ESTABLISHED AUGUST 1988

DUNEDIN CITY COUNCIL
FORESTRY DEPT.





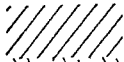



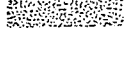
**DUNEDIN CITY COUNCIL
FORESTRY AREAS (1988).**

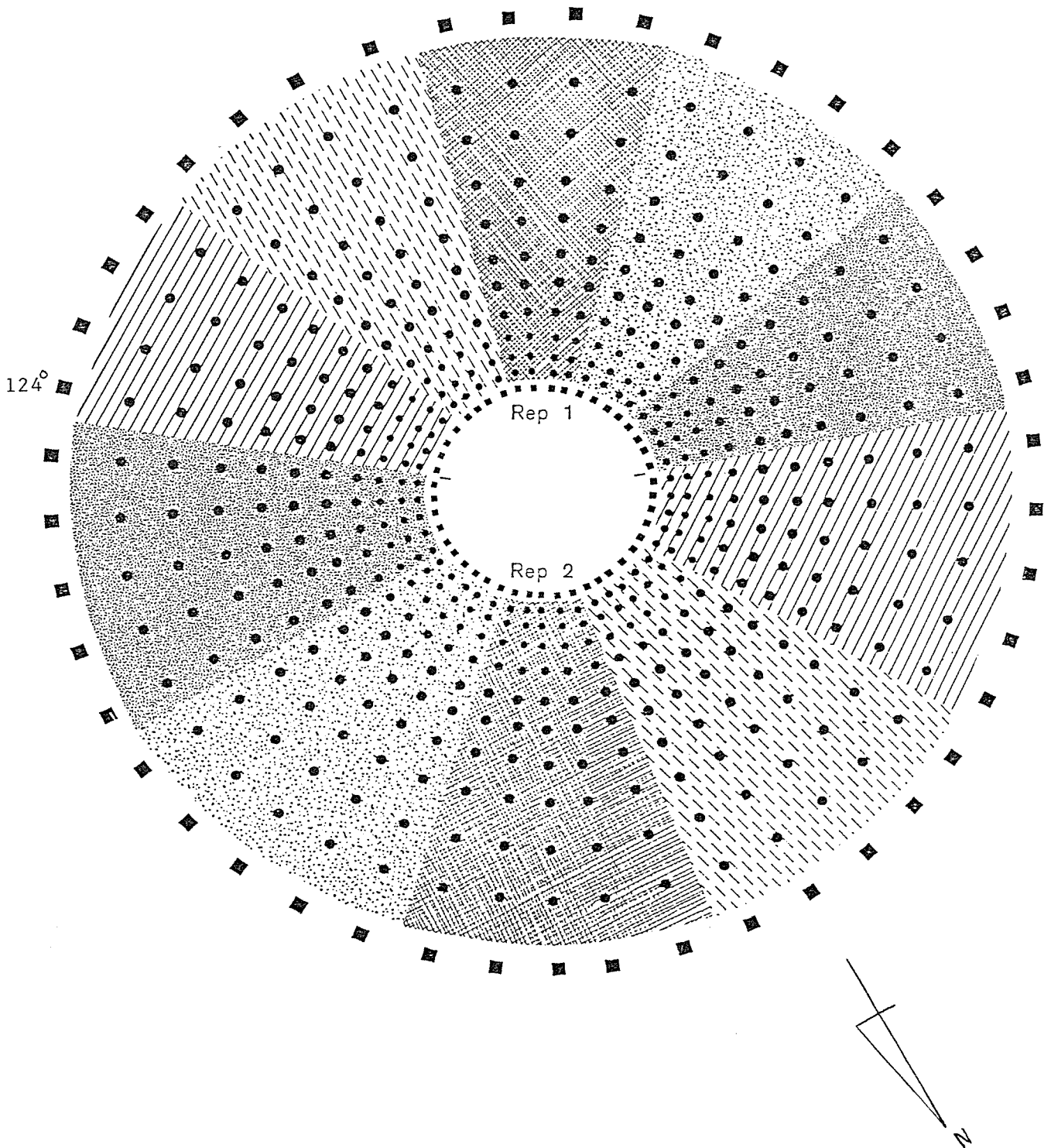
12. DUSKY FOREST

N.Z. Timberlands Ltd

Exp. No. FR 53

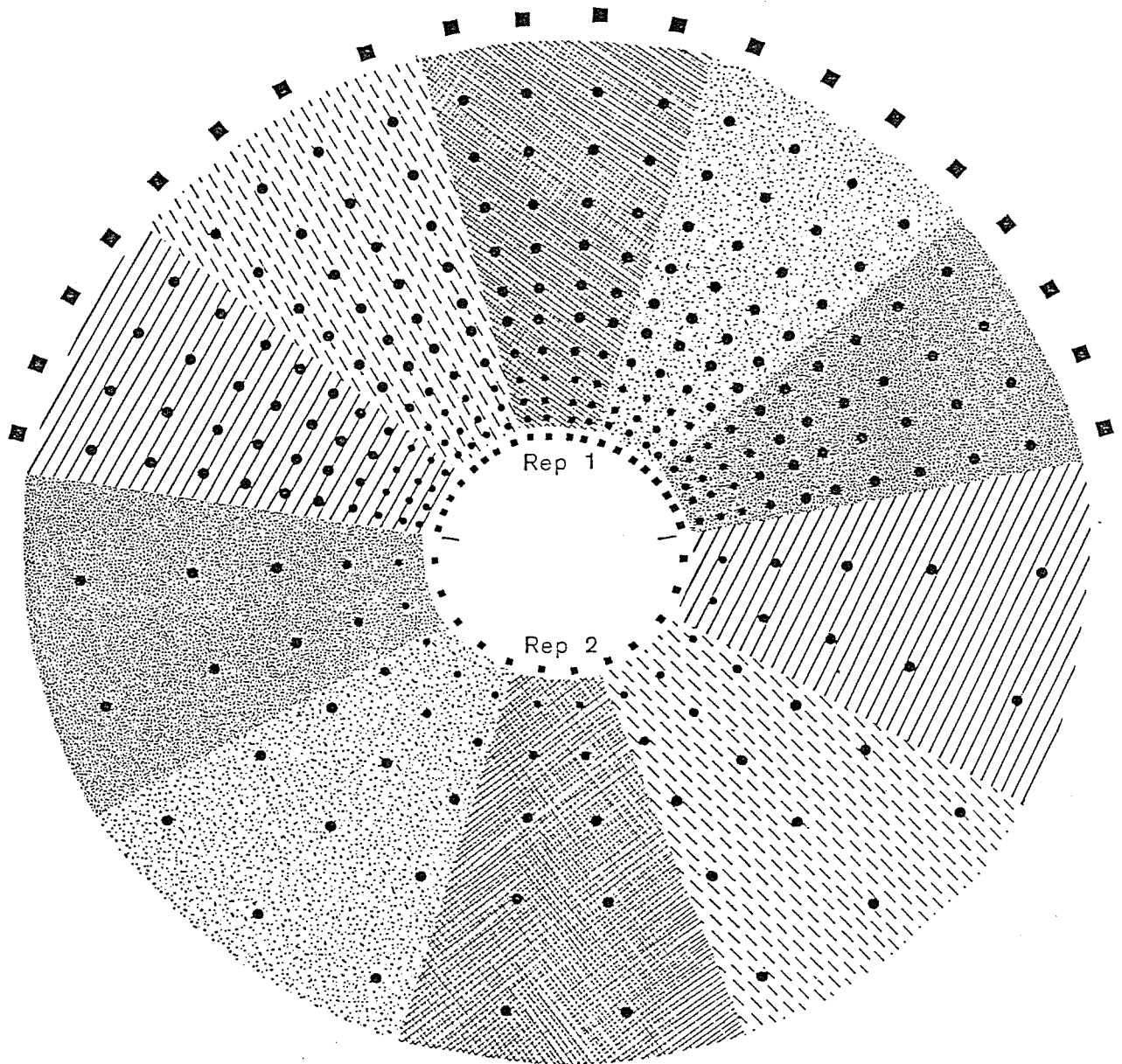
DUSKY FOREST

	870	"best-5" clones OP. (9/3/86/170)
	850	GF 14 OP. (3/3/87/01/3)
	268	GF 22 "best-16" clones CP. (6/6/87/21)
	Cuttings 1yr	GF 19 C11 "268" "best-16" clones OP. (2/6/86/29)
	Cuttings 3yr	GF 17 C31 "268" "best-25" clones OP. (9/0/83/096)



DUSKY FOREST

- 870 Illustrating the thinning option for rep. 2.
- 850
- 268
- Cuttings 1yr
- Cuttings 3yr



DUSKY FOREST, NZ TIMBERLANDS LTD

Experiment No: FR53

Planted: July 1988

Comments: This trial has been established on the site of the Ex-Woodsman School, and more specifically a paddock which contained they Clydes-Dale horses. Prior to the establishment of the Woodsman School the area had a long history of farming. Although tree growth may be a little impeded by the damp area on the lower and northern part of replication one, this Nelder site is considered to be particularly fertile.

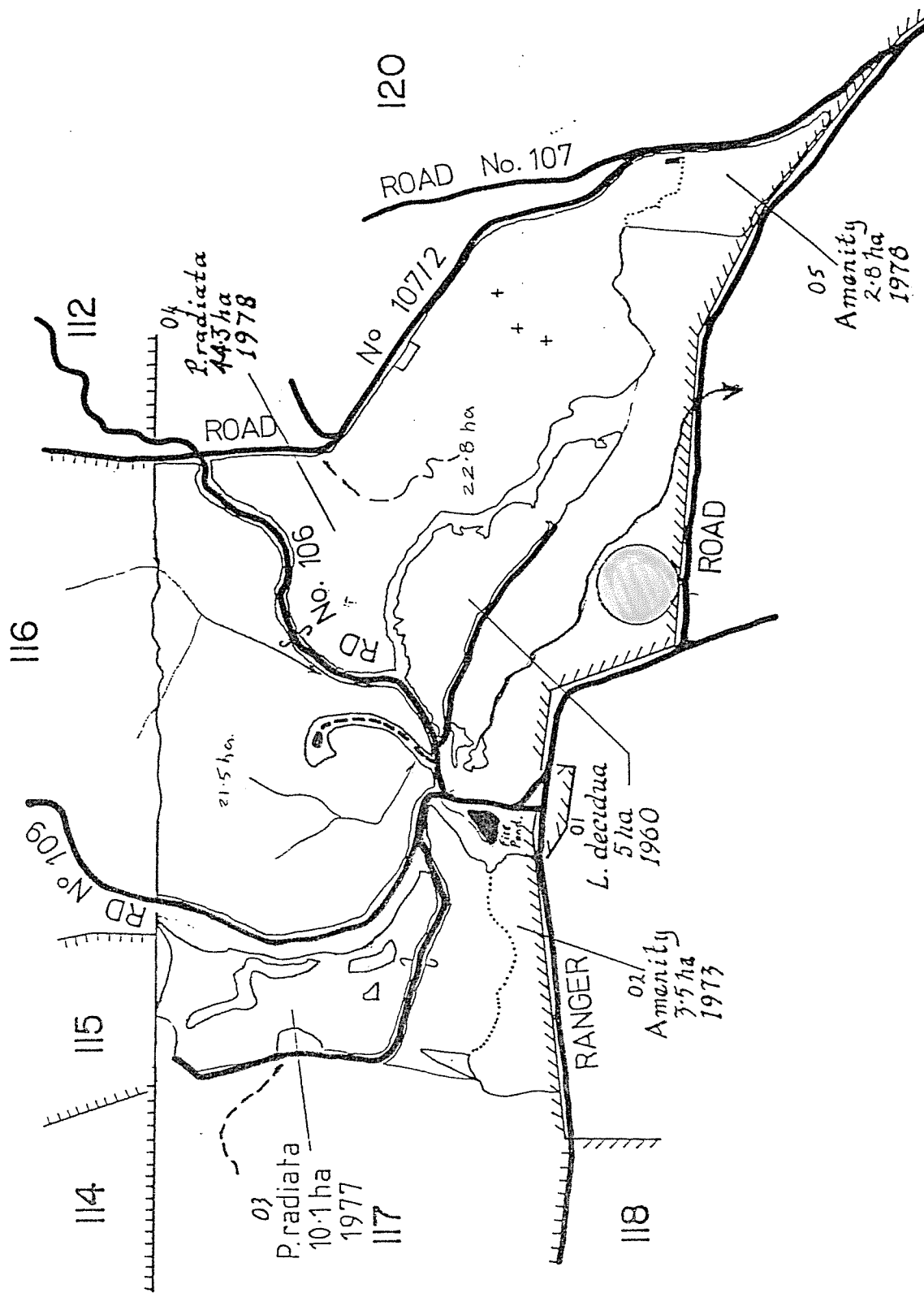
Replication one has been purposefully oriented to the south to act a buffer (from the prevailing winds) for replication two which may be systematically thinned.

DUSKY FOREST

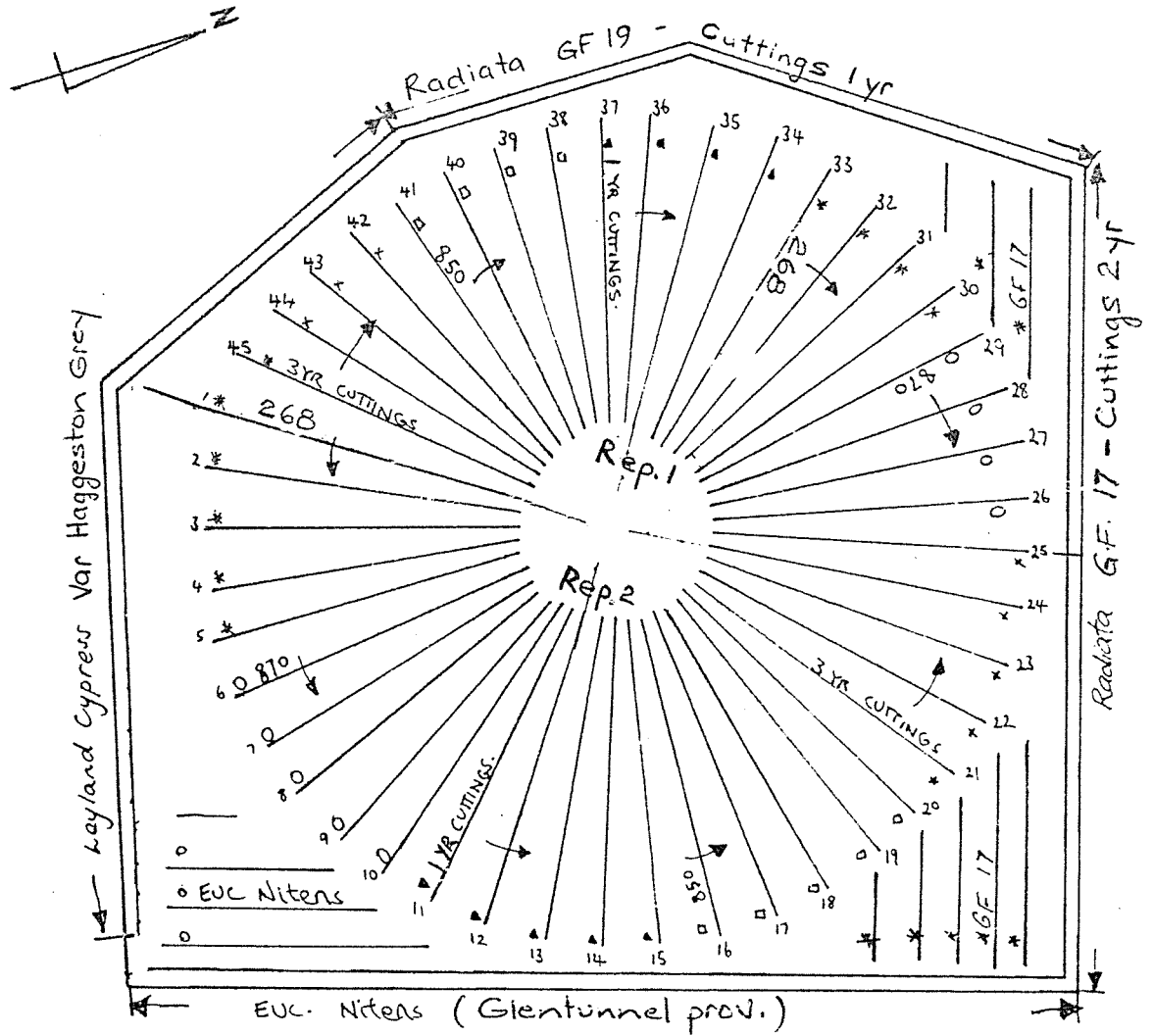


Nelder located on the old Woodsman School site -
in readiness for planting





NELDER LAYOUT



SEEDLOTS

870	Best 5 CP. (9/3/86/166)
850	GF 14 OP. (3/3/87/01/3)
268	GF 22 Best 16 CP. (6/6/87/21)
Cuttings 1 yr	GF 19 C11 "268" Best 16 OP.
Cuttings 3 yr	GF 17 C31 "268" Best 25 OP.

The trial was established August 1988 on Mr D. T. Archbold's property "Lowry Hills", North Canterbury.

The site is a flat terrace, with 20 cm of topsoil over gravels. It was ripped to a depth of 60 cm with a winged tine ripper and pre-plant sprayed with Roundup/Gardoprim at a rate of 5 and 15 litres/ha respectively.

A single row shelterbelt of different species was planted around the trial. The species included Leyland Cypress (var Haggiston Grey), E. Nitens, (Glentunnel provenance) and radiata pine cuttings (GF 17 and GF 19) from 2 and 1 year old material respectively. See attached trial layout for details.

The three "corners" of the trial area were planted as per map and several radiata pine cuttings, 1 year, GF 19, were planted within the center area of the Nelder.

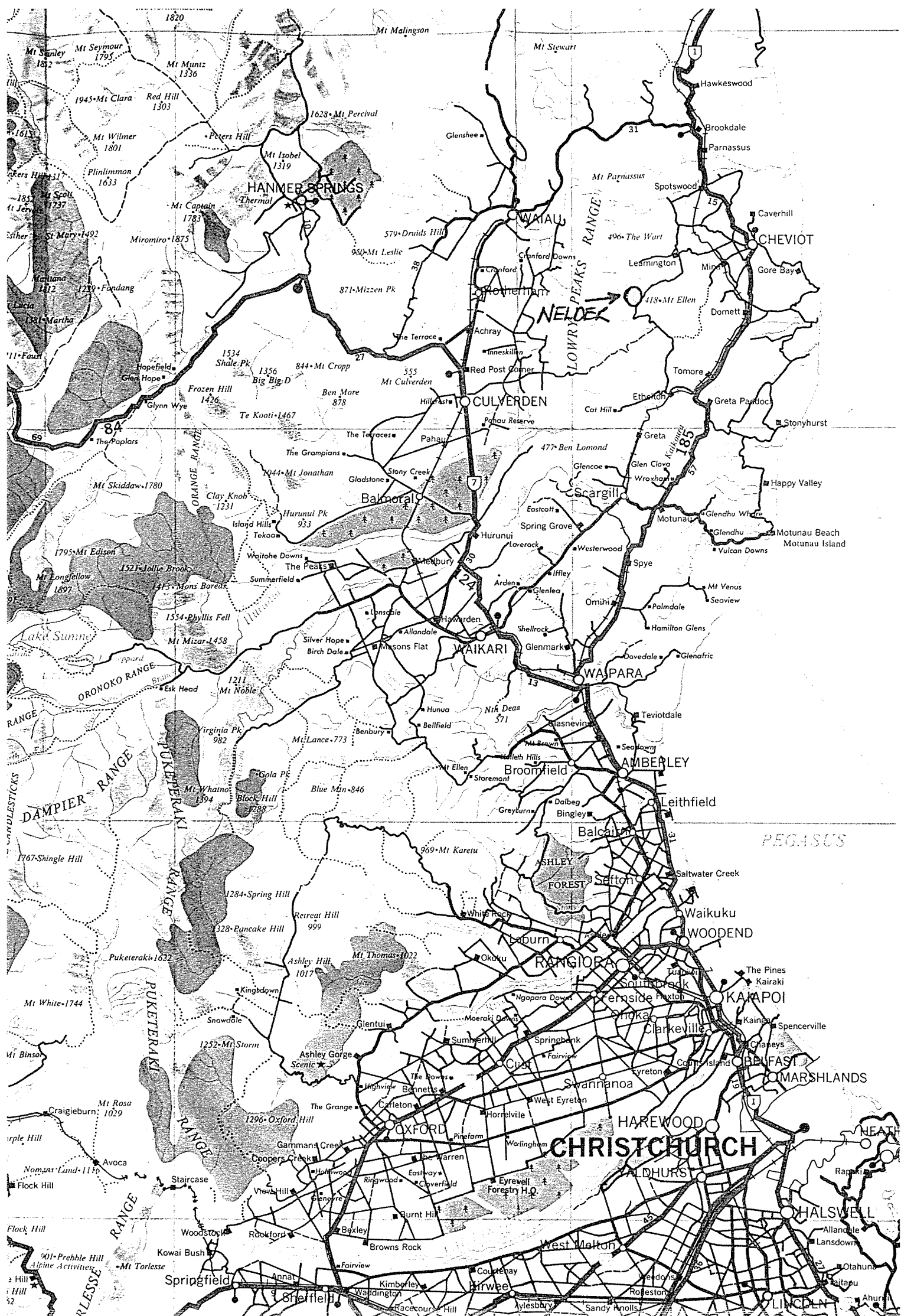
Contact person:

Patrick Milne

Forest Research Centre

Box 31-011

CHRISTCHURCH



APPENDIX 2 : Multinodal "268", Uninodal "870"

Nelder Trials, Work Plan 771

The following multinodal and uninodal Nelder spacing trials were established in 1986 on six forests throughout New Zealand. Each of the six Nelders is comprised of the following two radiata pine seedlots.

"268" open-pollinated, Best 25

"870" long internode, open pollinated, Best 20

Experiment No.	Forest	Location
AK 965	Pouto	Cpt 11
RO 2047	Kaingaroa	Cpt 15 Ex Golf Course
WN 366	Kaweka	
NN 523	Golden Downs	Gibbs Rd, opp. Cpt 38
CY 583	Eyrewell	Cpt 15
SD 676	Silver Peaks	