

**COMPARISON OF GF AND LONG INTERNODE BREEDS
ALONG WITH HIGH WOOD DENSITY CLONES
PLANTED AS SHELTERBELTS – ESTABLISHMENT
REPORT**

J.D. Tombleson¹ & D.J. Bell²

¹*Forest Research*, ²Wellington Regional Council (Wairarapa Division)

Report No. 78

May 2001

**FOREST & FARM PLANTATION
MANAGEMENT COOPERATIVE**

FOREST & FARM PLANTATION MANAGEMENT COOPERATIVE

EXECUTIVE SUMMARY

COMPARISON OF GF AND LONG INTERNODE BREEDS ALONG WITH HIGH WOOD DENSITY CLONES PLANTED AS SHELTERBELTS — ESTABLISHMENT REPORT

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Two trials were established during August 1996 to compare the Growth & Form breed and the Long Internode breed grown as shelterbelts. Trials were established on farm sites located at Welcome Bay, Tauranga and Featherston, Wairarapa. Each trial contains six paired plots of GF28 and LI25 physiologically aged cuttings. Tree growth and form along with branch size and internode length will be assessed for each of the treatments throughout the rotation. Of particular interest will be any differences in stem sinuosity and incidence of any stem breakage associated with the long internode plant material. In 1997 a further shelterbelt trial was established near Featherston, Wairarapa, containing twelve high wood density clones which are compared with cuttings of the Growth & Form breed. These trials represent extreme planting configurations on fertile farm sites. The genetic material established will provide an interesting resource for future tree growth and quality research.

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PART I — ESTABLISHMENT OF GF & LI BREEDS PLANTED IN SHELTERBELTS AT TAURANGA AND WAIRARAPA

INTRODUCTION

Of all the tree and log characteristics, increasing the internode length may have the potential to make the greatest contribution towards improving log quality and value of unpruned logs from shelterbelts. Because of the very large branch size produced by shelterbelts the unpruned logs are generally of low quality and value. This is considered to be the result of a combination of a highly multinodal (short internode) breed, grown on fertile farm sites, with large diameter growth, correspondingly large branch growth and with large whorl depths. Such trees do not produce any clear cuttings grades. However while there is clearly potential to utilise a breed with an extended internode length, the use of such a breed may negate the economic advantages due to increased stem breakage associated with larger branches and whorls.

This series of trials identifies and deploys a longer internode seedlot for subsequent evaluation and comparison with highly multinodal tree stocks in shelterbelt trials. The plant material is physiologically aged cuttings to take advantage of their improved tree form and stability compared to seedlings. The trials will be medium to long term and be initially focused on evaluating the growth performance and ability of longer internode material to tolerate exposure to wind without incurring a high incidence of stem breakage.

TRIAL LOCATIONS

1. Featherston trial

The Featherston trial is located near Wharekauhau on an elevated terrace overlooking the Palliser Coast (see Appendix I for location map) which is subjected to periodic northwest and southerly gales. The trial is located on the south margin of “Top Track” paddock (see Appendix II for farm location details) Soils are described as *Opaki brown stoney loam (76b)*.

The owner of the property is Mr WG (Bill) Shaw, Wharekauhau Farm Co Ltd, RD 3, Featherston. Ph 06 307 7581. Travel time from Masterton is approximately 1.25 hours.



GF and LI Shelterbelt Trial, rising 5 years of age, Whakekauhau, Wairarapa



GF and LI Shelterbelt Trial, rising 5 years of age, Welcome Bay, Tauranga

2. Tauranga trial

The Tauranga shelterbelt trial is located on a farm site, Kaiwha Road, Welcome Bay, Tauranga (see Appendix III for detailed location map). The fertile farm site is owned by the Nga Peke Land Trust (see Appendix IV for the detailed farm plan layout).

PLANT MATERIAL

Long Internode material:

A LI25 (18) seedlot comprising 3-year physiologically aged cuttings of specific crosses of the following 'best' 6 long internode parents has been deployed. See Appendix V for further details on seed certification.

870-613 x 870-529
870-568 x 870-529
870-609 x 870-562
870-567 x 870-609
870-529 x 870-567
870-588 x 870-609

Growth & Form, short internode material:

A GF28 seedlot comprising physiologically aged cuttings of specific crosses involving the following clones was deployed. See Appendix VI for further details on seed certification.

268- 41	268-405
62	494
65	532
109	539
323	543
345	622
547	
850- 55	875-954

TRIAL DESIGN

- Treatments 1. Growth and Form breed, 3yr aged cuttings, **GF 28**
 2. Long Internode breed, 3yr aged cuttings, **LI 25**

Trial design Single row of radiata pine
 Trees spacing within row = 2.0m (500 spkm) for the Featherston trial
 and 2.5m apart (400spkm) for the Tauranga trial.
 14 trees per replication (12 trees per measurement plot with an
 additional buffer tree at the end of each plot)
 Six paired plots (replications)

Trial lay-out for each of the two trials each incorporating six paired plots of the growth & form versus long internode plant material is as follows:

1. Featherston trial

Peg No 1	GF	LI	GF	LI	GF	LI	LI	GF	GF	LI	LI
-------------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------

(Eastern end)

The trial incorporates three additional rows to that of the radiata pine with a between row spacing of 1.5m. From south to north they are:

1. Native hardwoods
2. Leyland cypress “Haggerston Grey”
3. Radiata pine (trial)
4. Native hardwoods

2. Tauranga trial

LI	GF	LI	GF	LI	GF	GF	LI	LI	GF	LI	GF	Peg No 1
-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-------------

(Southern end, uphill) (Northern end)

This trial does not contain a supplementary species. The trial is located adjacent to a stand of E. nitens planted in the same year as the shelterbelt.

Each plot is laid out as follows. Each plot contains 14 trees of the same plant type, 12 of these trees are measurement trees which are located between the pegs. One tree is located at each end of the plot to act as a buffer.

■ X 0 ■ 0 0 0 0 0 0 0 0 0 0 0 0 ■ 0 X ■ X

■ = peg

○ = tree position

X = tree position

FUTURE MEASUREMENTS

At the commencement of the first pruning lift, for the Tauranga trial, and at approximately age four years for the Featherston trial, measurement trees will have an aluminium tree tag stapled just above the DBH measurement height of 1.4m. Trees will be remeasured for diameter and height on an annual basis until pruning is complete. Thereafter measurements will be carried out on a two-yearly basis.

FUTURE MANAGEMENT

The Tauranga trial will be conventionally pruned to a height of approximately 6.0m commencing when the trees are four to five metres in height. The Featherston trial will be trimmed (versus conventionally pruned) to provide shelter in what is a highly exposed site.

PART II — ESTABLISHMENT OF HIGH WOOD DENSITY CLONES COMPARED WITH THE GROWTH & FORM BREED PLANTED AS A SHELTERBELT, WAIRARAPA

Trial Location: The trial is located on the property of P & S Warren, “Cranford Farm”, RD 2, Featherston. Grid reference NZMS260 S27 955 832

The trial was established in September 1997 and is split over two paddocks, “Peninsula” and “Triangle” (see map, Appendix VII)

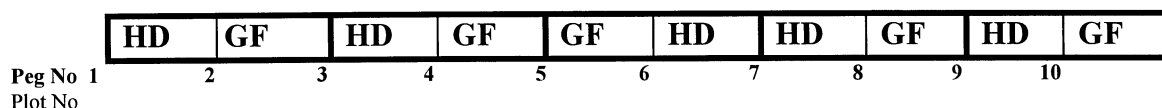
Site Description: The shelterbelt is planted on the upper edge of a small scarp marking the transition from downland *Pirinoa silt loam* (29) soils of loessial origin, to *Ahikouka silt loam* (2) soils on the adjacent flat lands which are derived from alluvium.

Treatments: 1. High wood density clones x 12
2. Growth and Form breed, juvenile cuttings, GF 30 (95/290)
(Seed Certificate is contained in Appendix VIII)

Trial design: Single row of radiata pine
Five paired plots (replications) see below for lay-out
Tree spacing within row = 2.5m (400 spkm)
Each plot contains 12 measurement trees with an additional buffer tree each end of the plot

Length of belt: 350m

Trial layout



Plot layout



■ = peg

○ = Plot tree (either GF or HD)

0 = buffer tree

X = Plot tree (either GF or HD)

x = buffer tree

The five replications are laid out as per the above lay-out. Plots 1 & 2 and 3 & 4 are in “Peninsula” paddock, while plots 5 & 6, 7 & 8, and 9 & 10 are located in “Triangle” paddock.

The plantation trees located below the trial are GF 27 aged cuttings.

The 12 high wood density clones were planted in each of the following four plots in the following order. Tree No 1 is always located next to the tagged peg, while tree No 12 is located at the end of the row next to the non-tagged peg.

	Plot 1	Plot 3	Plot 6	Plot 7	Plot 9
Tree No. 1	16/12	16/12	19/6	10/8	14/11
2	9/8	12/13	12/13	2/1	12/9
3	14/11	3/6	12/9	16/12	9/8
4	10/8	19/6	2/1	1/6	3/6
5	7/12	1/6	7/12	19/6	1/8
6	12/13	1/8	3/6	14/11	1/6
7	12/9	7/12	1/6	12/13	2/1
8	1/8	2/1	16/12	7/12	16/12
9	3/6	14/11	9/8	12/9	10/8
10	1/6	9/8	10/8	1/8	12/13
11	2/1	10/8	14/11	9/8	7/12
12	19/6	12/9	1/8	3/6	19/6

16/12 = family No. (specific cross) / Clone No.

The clones are from an elite breeding population selected for high wood density from the 850, 268, 875 and 880 series. Further details can be obtained from *Forest Research* Work Plan 2628.

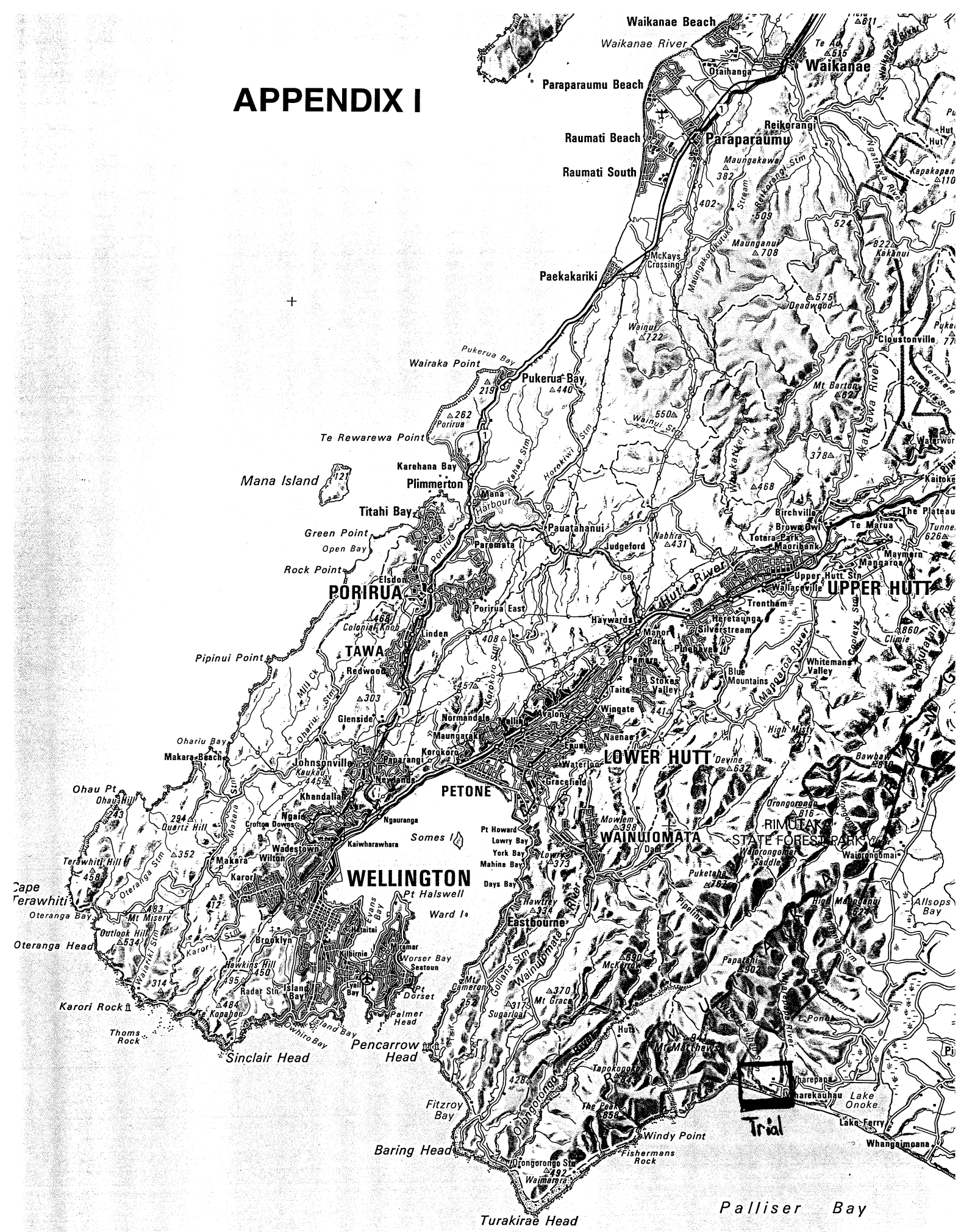


High Wood Density breed planted as a shelterbelt, rising four years of age,
Pirinoa, Wairarapa

FUTURE MEASUREMENTS

At the commencement of the first pruning lift, measurement trees will have an aluminium tree tag stapled just above the DBH measurement height of 1.4m. Trees will be remeasured for diameter and height on an annual basis until pruning is complete. Thereafter measurements will be carried out on a two yearly basis.

APPENDIX I



45'

175°00'

5

0

5

10

15

20

APPENDIX II

Palliser Bay

Location of GF28 / L125

"WHAREKAUHAU"

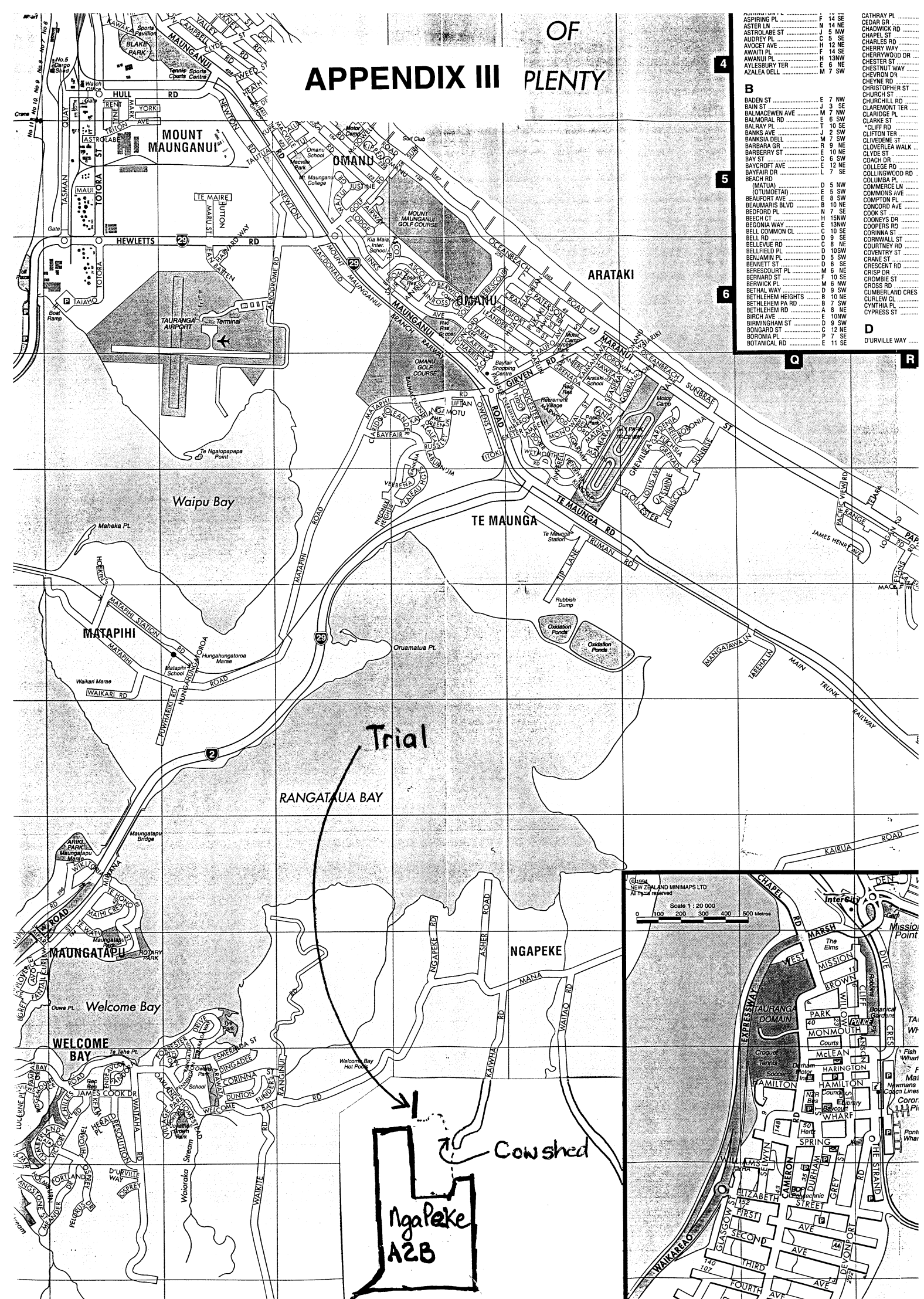
Ref. A/S9736 Scale 1:13000 Flown 14.9.85

NORTH



PLENTY

D
D'URVILLE WAY



A2B ML

Disused milking shed

LOT 3
36.50 ha.

Trial

1J2B2B2 ML 21797

PROPOSED PARTITION OF

APPLICATION FOR SEED CERTIFICATION



NAME AND ADDRESS
OF PERSON OR AGENCY
REQUESTING CERTIFICATION

APPENDIX V

DATE 18/7/94

A

SPECIES *P. radiata*

INTENDED PURPOSE
PROPOSED BREED OR SEED REGION

YEAR OF COLLECTION AND COLLECTION No. 94 707

DETAILED LOCATION OF SEED SOURCE

QUANTITY COLLECTED, OR

QUANTITY OF SEED EXTRACTED kg

Long Hill orchard 1989
pollination season

NATURAL STAND, OR
YEAR ESTABLISHED

LOCATION NAME

B

USE THIS
BOX FOR:

NATIVE SPECIES OR NON-ORCHARD LOTS

PARENT STAND SEEDLOT No.
REGISTERED SEED STAND No. or PARENTAGE

No. OF TREES FROM WHICH SEED WAS COLLECTED
(Under 20 state number, Over 20 estimate)

No. OF TREES IN PARENT STAND

SIZE OF COLLECTION AREA ha

SPECIES NEIGHBOURING SEED COLLECTION AREA ARE

MIXED OR PURE STAND

IF MIXED SPECIES STATE OTHER SPECIES OR
FOREST ASSOCIATION

ALTITUDE m

LATITUDE ° LONGITUDE °

Supply a map of the seed collection area and surrounds with
this application if this would aid certification.

USE THIS
BOX FOR:

CLONAL SEED ORCHARDS OR CONTROL-POLLINATED SEED

C

CLONAL SERIES No. OF CLONES PLANTED

No. OF CLONES REMAINING AFTER THINNING OR
ROGUING

No. OF CLONES FROM WHICH SEED WAS COLLECTED

DATE ORCHARD WAS LAST ROGUE

DISTANCE FROM EXTERNAL POLLEN SOURCE m

OPEN-POLLINATED OR CONTROL-POLLINATED

SEED PARENTAGE DESCRIPTION OR CLONE NUMBERS
OF PARENT TREES

870.529 x 870.567 (206) seeds

567 x 609 (313)

569 x 529 (903)

588 x 609 (503)

609 x 562 (86)

613 x 529 (625)

List both female and male parents for control-pollinated
seedlots (Female First)

D

HAS SEED FROM THIS SOURCE
PREVIOUSLY BEEN CERTIFIED?

IF YES, SHOW THE CLASSIFICATION AND SEEDLOT
No. PREVIOUSLY CERTIFIED

HAS ANYTHING BEEN DONE TO THE SEED SOURCE THAT
WARRANTS A CHANGE IN CLASSIFICATION?

IF YES, STATE CHANGES

THE FOREGOING INFORMATION GIVES A CORRECT
DESCRIPTION OF THE SEEDLOT COLLECTED

Signed

Designation

Send Original to:

The Secretary
SEED CERTIFICATION SERVICE
Forest Research Institute
Private Bag
Rotorua

CERTIFIED BY THE SEED CERTIFICATION
SERVICE AS:

SPECIES: *Pinus radiata*

CODE: *LI25(18)*

COLLECTION No.: *94 707*

PROVENANCE OR
CLONE NAME:



SPECIAL COMMENTS

Manager

19-7-94

Date

Received:

Register:

BOX E FOR USE BY CERTIFICATION SERVICE ONLY

ENTERED

APPLICATION FOR SEED CERTIFICATION



NAME AND ADDRESS
OF PERSON OR AGENCY
REQUESTING CERTIFICATION

PROSEED NZ

DATE 20.9.91

A

APPENDIX VI

IRPOSE

SPECIES PINUS RADIATA

PROPOSED BREED OR SEED REGION

YEAR OF COLLECTION AND COLLECTION No. 91 298

DETAILED LOCATION OF SEED SOURCE

QUANTITY COLLECTED, OR

QUANTITY OF SEED EXTRACTED kg

NATURAL STAND, OR

YEAR ESTABLISHED 1980-86

LOCATION NAME AMBERLEY

B

USE THIS
BOX FOR:NATIVE SPECIES
OR NON-ORCHARD LOTS

PARENT STAND SEEDLOT No.
REGISTERED SEED STAND No. or PARENTAGE

No. OF TREES FROM WHICH SEED WAS COLLECTED
(Under 20 state number, Over 20 estimate)

No. OF TREES IN PARENT STAND

SIZE OF COLLECTION AREA ha

SPECIES NEIGHBOURING SEED COLLECTION AREA ARE

MIXED OR PURE STAND

IF MIXED SPECIES STATE OTHER SPECIES OR
FOREST ASSOCIATION

ALTITUDE m

LATITUDE ° LONGITUDE °

Supply a map of the seed collection area and surrounds with
this application if this would aid certification.

USE THIS
BOX FOR:CLONAL SEED ORCHARDS
OR CONTROL-POLLINATED SEED

C

CLONAL SERIES 268 859 No. OF CLONES PLANTED

No. OF CLONES REMAINING AFTER THINNING OR
ROGUING

No. OF CLONES FROM WHICH SEED WAS COLLECTED 14

DATE ORCHARD WAS LAST ROGUED

DISTANCE FROM EXTERNAL POLLEN SOURCE m

OPEN-POLLINATED OR CONTROL-POLLINATED CP

SEED PARENTAGE DESCRIPTION OR CLONE NUMBERS
OF PARENT TREES

MIX OF CROSSES INVOLVING THE FOLLOWING
CLONES:

268.41 62 65 109 323 345

405 494 532 539 543

547 622 850 55 875 954

List both female and male parents for control-pollinated
seedlots (Female First)

D

HAS SEED FROM THIS SOURCE
PREVIOUSLY BEEN CERTIFIED?

IF YES, SHOW THE CLASSIFICATION AND SEEDLOT
No. PREVIOUSLY CERTIFIED

HAS ANYTHING BEEN DONE TO THE SEED SOURCE THAT
WARRANTS A CHANGE IN CLASSIFICATION?

IF YES, STATE CHANGES

THE FOREGOING INFORMATION GIVES A CORRECT
DESCRIPTION OF THE SEEDLOT COLLECTED

Signed

Designation

Send Original to:

The Secretary
SEED CERTIFICATION SERVICE
Forest Research Institute
Private Bag
Rotorua

CERTIFIED BY THE SEED CERTIFICATION
SERVICE AS:

SPECIES: PINUS RADIATA

CODE: CP 28

COLLECTION No.: 91 298

PROVENANCE OR

CLONE NAME:



SPECIAL COMMENTS

Chairman

Date

Received:

Register:

BOX E FOR USE BY CERTIFICATION SERVICE ONLY

APPENDIX VII

96

1

APPLICATION FOR SEED CERTIFICATION



APPENDIX VIII

NAME AND ADDRESS
OF PERSON OR AGENCY
REQUESTING CERTIFICATION

PROPOSED NEW ZEALAND

PRIVATE BAG 3020

DATE 14-9-95

A

...ROTORUA

SPECIES PINUS RADIATA

INTENDED PURPOSE

PROPOSED BREED OR SEED REGION

YEAR OF COLLECTION AND COLLECTION No. 95/290

DETAILED LOCATION OF SEED SOURCE

QUANTITY COLLECTED, OR

AMBERLEY 3C, 4C, 8E, 8F, 8G, 8I, 9F, 9G, 9I, 11F, 12G

QUANTITY OF SEED EXTRACTED

kg 12I, 14F, 14G, 15E, 15G,

WAIKUKU 3A, 3B, 3E, 4F, 5, 6

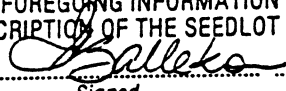
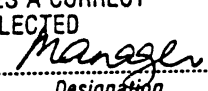
NATURAL STAND, OR


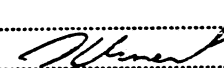
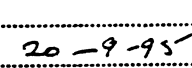
YEAR ESTABLISHED 1986-1992

LOCATION NAME AMBERLEY AND WAIKUKU

B	USE THIS BOX FOR:	NATIVE SPECIES OR NON-ORCHARD LOTS
PARENT STAND SEEDLOT No. REGISTERED SEED STAND No. or PARENTAGE		
No. OF TREES FROM WHICH SEED WAS COLLECTED (Under 20 state number, Over 20 estimate)		
No. OF TREES IN PARENT STAND		
SIZE OF COLLECTION AREA ha		
SPECIES NEIGHBOURING SEED COLLECTION AREA ARE		
MIXED OR PURE STAND		
IF MIXED SPECIES STATE OTHER SPECIES OR FOREST ASSOCIATION		
ALTITUDE m		
LATITUDE ° LONGITUDE °		
Supply a map of the seed collection area and surrounds with this application if this would aid certification.		

USE THIS BOX FOR:	CLONAL SEED ORCHARDS OR CONTROL-POLLINATED SEED	C
CLONAL SERIES 268 875 No. OF CLONES PLANTED		
850 880		
No. OF CLONES REMAINING AFTER THINNING OR ROGUING		
No. OF CLONES FROM WHICH SEED WAS COLLECTED 9		
DATE ORCHARD WAS LAST ROGUED		
DISTANCE FROM EXTERNAL POLLEN SOURCE m		
OPEN-POLLINATED OR CONTROL-POLLINATED CP		
SEED PARENTAGE DESCRIPTION OR CLONE NUMBERS OF PARENT TREES		
MIX OF CP CROSSES INVOLVING 17 PARENTS		
List both female and male parents for control-pollinated seedlots (Female First)		

D	HAS SEED FROM THIS SOURCE PREVIOUSLY BEEN CERTIFIED?
IF YES, SHOW THE CLASSIFICATION AND SEEDLOT No. PREVIOUSLY CERTIFIED	
HAS ANYTHING BEEN DONE TO THE SEED SOURCE THAT WARRANTS A CHANGE IN CLASSIFICATION?	
IF YES, STATE CHANGES	
THE FOREGOING INFORMATION GIVES A CORRECT DESCRIPTION OF THE SEEDLOT COLLECTED	
 	
<div style="display: flex; justify-content: space-between;"> Signed Designation </div>	

E	CERTIFIED BY THE SEED CERTIFICATION SERVICE AS:
SPECIES: PINUS RADIATA	
CODE: GF 30	
COLLECTION No.: 95/ 290	
PROVENANCE OR CLONE NAME:	
	
SPECIAL COMMENTS	
 	
<div style="display: flex; justify-content: space-between;"> Manager Date 20-9-95 </div>	
Received: Register:	

Send Original to:

The Secretary
SEED CERTIFICATION SERVICE
Forest Research Institute
Private Bag
Rotorua

BOX E FOR USE BY CERTIFICATION SERVICE ONLY

ENTERED