

Ngatawhai Group Forest

Forest Management Plan

Summary

This Report sets out the Radiata pine forest management plan for a forestry Managed Investment Scheme to be managed by Forest Enterprises Limited called the Ngatawhai Group Forest Investment.

The assumptions and calculations in this Report have been independently reviewed by Forme Consulting Group Limited and commented upon in their separate Forestry Audit Report (included in the Offer Register of the Product Disclosure Statement). The financial consequences of the forest management plan and the projections have been incorporated into the financial cashflow for the investment set out in the Offer Register of the Product Disclosure Statement.

Disclosure

Forest Enterprises Limited, specifically Mr HE Hughes, the CEO and Forestry Director, has given and before distribution not withdrawn, his written consent to the inclusion of this Report as part of the Offer Register of the Product Disclosure Statement for the Ngatawhai Group Forest Investment. Mr HE Hughes is a New Zealand Institute of Forestry Registered Forestry Consultant, a New Zealand Institute of Directors Chartered Director, and a director of Forest Enterprises Limited, the licenced manager for the investment.

Forest Description

Location and Access

The Ngatawhai Group Forest consists of 4 properties (or blocks): Jacksons Creek, Ngatawhai, Seaview, and Te Wharau.

These properties are located about 40km south-east of Masterton in the Te Wharau district. Access from Masterton is via Te Wharau Road, all of which is sealed. An additional 3km section of gravel road (Kaiwhata Road) is used to access the Seaview block.

The properties are bordered by a mixture of farmland, naturally regenerating scrub and forest, and pine plantations; including plantation forest managed by Forest Enterprises.

All four blocks are well served by internal roads formed for harvesting the first rotation of trees. These roads will provide excellent access for re-establishment and tending operations as well as for forest inspection, maintenance and protection during the second rotation. Whilst they will require some upgrading work prior to harvesting the re-established tree crop, this will be of lower cost than that required for the harvesting of the first rotation of trees.

Legal Descriptions

<u>Jacksons Creek</u>	Te Wharau Road, 258.1894ha - CT WN26A/360
<u>Ngatawhai</u>	Te Wharau Road, 397.495ha - CTs WN18A/449, WN20B/1493, WN27C/841, WN32A/228, WN32A/227
<u>Seaview</u>	Kaiwhata Road, 176.0028ha - CT WN953/84
<u>Te Wharau</u>	Te Wharau Road, 77.5395ha - CT WN31D/696

Adjacent to the Ngatawhai Block are 1.84 hectares in title WN19D/1359, of which 1.67 hectares has been planted by Ngatawhai Forest Partnership. Although a part of the original Ngatawhai Farm, this parcel of land was not transferred when the land was purchased by Ngatawhai Forest Partnership from Ngatawhai Farm Limited in 1987. This small area of land automatically vested in the Crown when Ngatawhai Farm Limited became an inactive company and was removed by the Registrar from the Companies Register.

There is potential to apply for this land to be transferred into Ngatawhai Group Forest ownership, but this is a complicated and expensive process. There are unlikely to be any challenges to the Forest's ownership of the trees, some 30 years after Ngatawhai Farm Limited legally ceased to exist, and after the Crown, notwithstanding the vesting, has gazetted a disclaimer of any interest in the land.

Previous Status of the Properties

The blocks were originally planted in Radiata pine, mostly between the early 1980s and early 1990s. These original tree crops have now been largely harvested and replanted, with the last of the harvesting completed in 2019 and the last of the replanting (about 153.5ha or 25% of the expected total stocked area) to occur in 2019 and 2020.

Gross and Commercially Stocked Forest Area

Area Definition

Area measurement has been taken from a Geographic Information System (GIS) maintained by Forest Enterprises, using orthorectified aerial imagery and Land Information New Zealand (LINZ) Primary Parcel data.

Estimated current stocked areas of commercial Radiata pine plantation forest and the areas that are to be replanted are:

Forest Block	Planted	Further Plantings
Jacksons Creek	85ha planted 2012-2017	62.7ha to be planted in 2019 and 2020
Ngatawhai	232.8ha planted 1998-2018	37.7ha to be planted in 2019 and 2020
Seaview	87.6ha planted 2013-2018	53.1ha to be planted in 2019 and 2020
Te Wharau	68.4ha replanted 2012-2017	

The total net stocked area of the combined forest estate is expected to be 627.3ha at the end of the 2020 planting season. This includes 5.3ha of 'take' areas that are outside the legal boundary of the forest properties and within neighbouring properties, and the 1.67ha planted on title WN19D/1359. These are currently not secured by Registered Forestry Right, but we will look to do so in the foreseeable future provided the process is not cost-prohibitive.

The difference between the total gross legal title area of 909.2ha and the 627.3ha of stocked forest (which is the commercial tree crop component of the Ngatawhai Group Forest Investment), comprises natural scrub and forest, riparian reserve, boundary setbacks, roads and landings, the take areas referred to above, and approximately 1.1ha of old crop trees that are uneconomic to harvest and will be left as they are.

Block	Year Established													
	1998	2002	2003	2005	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Jacksons Creek	0.0	0.0	0.0	0.0	46.3	22.5	12.6	0.0	0.0	3.6	0.0	55.0	7.7	147.7
Ngatawhai	10.8	8.9	14.6	1.1	0.0	0.0	11.3	0.0	44.2	80.6	61.3	32.6	5.1	270.5
Seaview	0.0	0.0	0.0	0.0	0.0	42.2	17.5	0.0	0.0	0.0	27.9	9.3	43.8	140.7
Te Wharau	0.0	0.0	0.0	0.0	4.5	0.0	3.2	32.0	11.9	16.8	0.0	0.0	0.0	68.4
Total Area (Hectares)	10.8	8.9	14.6	1.1	50.8	64.7	44.6	32.0	56.1	101.0	89.2	96.9	56.6	627.3

Areas are based on recent aerial photography and mapping. Updated photography and mapping is undertaken during the life of a forest and it is usual for the measured net stocked area to change with each update, and the changes can be material.



Topography, Altitude, Soils and Climate

- The properties are easy to medium hill country, dissected by a steep gorge in places, with the aspect tending mostly to the north. They all drain into the Kuamahanga Stream before entering the Wainuioru River.
- The range in altitude is from 186m above sea level to a high point of 382m (within Seaview), and the mean altitude of the properties is 328m.
- Soils are entirely brown orthic soil over a mix of sedimentary (sandstone, mudstone) and greywacke rock. Brown soils are very common in New Zealand and occur in locations that do not typically experience either severe summer drought or extreme winter rains. They are naturally fertile for forestry use without impervious pans that can restrict tree root growth. Their capacity to support high levels of tree growth and yield is borne out by the production results of the first rotation of forest, and this will be enhanced with the genetic improvement (based on tree selection and breeding, not genetic modification) of the tree stocks used to replant the forest.
- Average annual rainfall in this area is approximately 1,200mm-1,400mm.

Forecast Forest Productivity

Forest productivity is expressed using a measure known as the 300 Index. This is a measure of volume productivity in *cubic metres per hectare per year* (m³/ha/yr) for a defined reference regime.

Based on information from the first rotation forests, we have assessed an area weighted average 300 Index¹ for Ngatawhai Group Forest of 25.9m³/ha/yr. This is from first rotation trees of approximately GF15². The improved average 300 Index using genetically improved GF Plus (gr 25) treestock is assessed as 29.0m³/ha/yr.

Local Authorities and Land Use Environmental Consents

The main influence of local authorities on forestry activities is in the area of environmental management. This includes the granting of resource consents which may have various conditions attached to them, and the monitoring of permitted and consented forestry activities. This process has recently undergone significant change with the implementation on 1 May 2018 of the National Environment Standards for Plantation Forestry (NES-PF). These standards recognise ten different forestry activities, from land preparation to harvesting, and seek to standardise the treatment of forestry as a land use throughout New Zealand.

As part of the NES-PF, all land in New Zealand has been classified and mapped in terms of its erosion risk. There are four risk classes, or zones, recognised: Green (low risk), Yellow (moderate risk), Orange (high risk) and Red (very high risk). Whether a certain activity requires a resource consent, and the type of consent required, depends on the nature of the activity and the erosion risk of the land where it is planned to be undertaken. The key forestry activities impacted by the erosion susceptibility class of the underlying land are earthworks and harvesting. Earthworks can be controlled by the Greater Wellington Regional Council where they are large in scale and on Red and Orange erosion zone land. Similarly, harvesting can be controlled on Red Zone land.

The Ngatawhai Group Forest consists of 18.7% Orange Zone, 23.3% Yellow Zone and 58.0% Green Zone.

Earthworks will be much smaller in terms of the volume of material moved than in the road and landing construction for the harvesting of the first rotation tree crop, and will be subject to a Restricted Discretionary Resource Consent over part of the total forest area (Orange Zone). This is a standard requirement for the large majority of Forest Enterprises' current earthworks activity in preparation for harvesting and is not at all problematic.

Any environmental controls imposed on forestry activities planned as part of this investment are not onerous and are part of normal and routine forest planning and management. Resource planning costs have been incorporated in the cashflow forecast of the investment.

¹ 300 Index is a forestry term used to express the productivity of a site in terms of volume growth. It is the mean annual volume increment in cubic metres per hectare of a 300 stem per hectare Radiata pine stand at age 30 years. As a measure of productivity used in modelling and forecasting tree growth and stand yield it is relevant even where crops are not intended to be grown to age 30.

² 'GF' stands for Growth and Form and is a rating system used to compare treestocks. In general terms, the higher the GF rating, the higher the assessed projected performance in terms of the growth and form of the resulting trees.



Forest Management

Forest Enterprises specialises in the management of Radiata pine plantation forests. Radiata pine accounts for over 90% (1.5 million ha) of all plantation forests established in New Zealand. It displays very good growth rates and can be managed to produce high value clearwood³ logs and small branch sawlogs⁴ in a relatively short rotation of 25 to 30 years. It is particularly well suited to the Wairarapa as evidenced by the first rotation growth and yield of nearby forests.

Forest Audits

All forests are audited annually by Forme Consulting Group Limited to ensure that approved management plans are completed to specification and quality standards and that management is consistent with good forestry practice.

Establishment

Genetically improved GF Plus seedlings have been planted to date and are ordered for the remaining planting in 2019 and 2020. This high-quality stock produces high growth trees of extremely good form in terms of straightness and branch size.

The trees have been (and will be) planted at a square spacing of 3.2m by 3.2m to produce a target planting density of 1,000 stems per hectare. The square spacing results in relatively even growth, branch size control, assists tree selection for the tending operations resulting in less exposure to wind after thinning.

The trees will be release sprayed⁵ in the spring following planting to remove competing weed growth. Prior to winter, a survival survey of the previous year's plantings will determine if any blanking⁶ of failed trees is required. Provision has been made in the cashflow for blanking (and subsequent release spraying) of 3% of the total planted area. However, normally less is required.

Maintenance

Existing roads used for harvesting the first crop rotation will be used for all establishment and tending operations. Annual maintenance will be required to keep the watertables and culverts clear.

Silvicultural Regime

It is proposed to apply a silvicultural regime consistent with achieving the maximum volume of high value pruned logs and small branch sawlogs at harvest. Pruning is planned to take place in two lifts to a final pruned height averaging 6.0m, with one thinning to a final crop stocking of 375 stems per hectare.

There will be a natural spread in growth rates within the forest, influenced by altitude and aspect. As noted earlier, we have assessed the average forest 300 Index as 29.0m³/ha/yr.

Age	Tending Program	Target Mean Top Height	Target Stems per Hectare
5.0/6.0	Prune to average height 3.0 metres	7.0 metres	375
7.0/8.0	Prune to average height 6.0 metres	9.5 metres	375
8.0/9.0	Thin to final crop	10.0 metres	375
Slight timing variations may result from the optimum scheduling of tending.			

The growth models in Forecaster⁷ will be used to schedule the tending to ensure the optimum timing of each operation. The objective is to restrict the diameter of the defect core and maximise the volume of clearwood produced in the sawing or peeling of the pruned log, and at the same time produce quality sawlogs above the pruned zone.

³ Clearwood is the forestry term for wood which is free of knots and other defects.

⁴ Sawlog is the forestry term for unpruned logs which can be processed into sawn lumber, generally the higher quality unpruned logs.

⁵ Releasing is removing competing weed growth from around young trees, normally by spraying.

⁶ Blanking is the forestry term used to describe the planting of replacement trees in areas where it is assessed that insufficient trees have survived to ensure adequate selection for the final crop.

⁷ Forecaster is a suite of computer models for Radiata pine developed by SCION, the New Zealand Crown Research Institute for forestry.



Forest Enterprises is a member of key forest industry organisations⁸ and fully utilises the information and research findings that membership provides. Changes to the tending program may be proposed if new research indicates such changes would, on a cost-benefit analysis, enhance the projected rate of return from the forest.

Records, Mapping and Inventory

Forest Enterprises uses the Geographic Information System (GIS) ArcGIS in conjunction with the stand record system called GeoMaster. GeoMaster is the repository of stand records that can be interrogated to supply specified data and reports, and ArcGIS is the means by which a wide range of maps are produced; both support forest planning, management and reporting. These are industry standards for mapping and record keeping in forestry, and are comparable with the general ledger in the financial sense. These systems have been used to produce the maps and data underlying the analyses in support of the Product Disclosure Statement.

Aerial imagery in support of mapping and updating area records is captured throughout the life of the tree crop or stand. The capture of aerial imagery uses a range of methods broadly outlined as follows:

- At about tree age 4 years, once planted tree crops are well established and growing and are clearly visible from the air, undertaken in support of tending operations - often using a drone.
- Immediately prior to the mid-rotation inventory at about age 12-14 years, undertaken in support of planning, valuation and reporting - using aerial photography or lidar technology⁹.
- Immediately prior to the pre-harvest inventory at about age 23-25 years, in support of harvest planning - using aerial photography or lidar.
- Regularly during the harvesting phase to monitor and report production and crop yields - using a drone.
- Prior to re-establishment of the next rotation of trees in support of the necessary planning for land preparation and planting activities - using a drone.

Forest Protection

There are a number of risks to forests that can be significantly reduced through good management practice and relevant insurance cover.

Fire

Fire risk is not great as there is little uncontrolled access with forest gates remaining locked except during the day when forestry operations are in progress. The forest is insured against fire as part of the group policy set out in more detail below. Response to vegetation fires is managed by Fire and Emergency New Zealand.

Wind

Young trees with rapid initial foliage growth, which is not always matched by root development, can be at risk of toppling¹⁰. Re-standing and remedial pruning have proven to be very effective corrective methods to address toppling events. Windthrow¹¹ after thinning can also occur. Wind loss insurance cover details are set out below.

Animals

Allowance has been made in the early years for hare and rabbit control. As part of an animal health program, regular possum monitoring and control is carried out in this region by Greater Wellington Regional Council.

⁸ Forest Enterprises belongs to many industry organisations including the New Zealand Forest Owners Association, the New Zealand Farm Forestry Association and the New Zealand Institute of Forestry (NZIF).

⁹ Lidar is a relatively new remote sensing survey method that can be used to complement ground-based inventory and reduce the overall cost of obtaining area and crop condition data and information.

¹⁰ Toppling is a forestry term to describe the leaning over of young trees within a socket of soft ground following strong wind events associated with heavy rain.

¹¹ Windthrow is the forestry term to describe when trees are pushed over or uprooted by wind.



Security

Public trespass is not expected to be a problem because there is limited vehicular access to the forest blocks and the road gates will be locked.

Disease

Dothistroma, a fungal disease that causes loss of foliage (pine needles), is a rare occurrence in the Wairarapa, historically not reaching levels where control would be required. Scattered patches of *Cyclaneusma* needle cast have sometimes been seen in Wairarapa forests but this is not a serious risk to growth. Red Needle Cast is present in the Wairarapa and affects most forests sporadically, causing some loss of growth in the years when Red Needle Cast occurs. This has been taken into account in the modelling by calibrating against first rotation yields.

Insurance

The forest will be insured under a special purpose group forest insurance scheme for Forest Enterprises managed forests, with fire, wind and snow cover included. The value of the cover is an agreed sum per hectare for like areas in each forest. Forest Enterprises identifies the like areas based upon the age classes present and their treatment.

The group policy functions on a 'first loss' basis. The agreed value per hectare will be paid up to a total for all events for the 12 months insured. The total first loss limitation is \$30 million for defined events including fire. The total first loss limitation of \$30 million also includes \$6 million for wind, \$1 million for snow, and \$5.1 million for replanting.

The policy is organised by Insurance Facilitators Pty Ltd, an Australian based specialist forestry and crop insurance provider, and is underwritten by SJ Catlin & Others Syndicate 2003 at Lloyd's of London. The overall Lloyd's market has a Standard & Poor's rating of A+ (Strong) as at August 2018.

Forest Health

Forest Health is monitored by the Forest Biosecurity System which is funded by the Harvested Wood Products Levy¹².

Growth and Yield

Harvest is anticipated when the trees are in their 26th year. The volume estimates were calculated from Forecaster for GF Plus (growth 25) rated treestocks using the 300 Index growth model. This produced a total recoverable volume of 622 cubic metres per hectare, which has been converted to tonnes per hectare using a conversion factor of 0.959m³/tonne¹³.

The assessed breakdown of the recoverable volume by log at harvest is as follows -

Log Type	Tonnes per Hectare	% of Total Recoverable Volume
Export P40	87	13%
Domestic P35	81	13%
Domestic M30	150	22%
Domestic M20	95	14%
Export A	111	18%
Export K	40	6%
Export KI	33	5%
Export Pulp	42	8%
Domestic Pulp	9	1%
Total Recoverable Volume	648 t/ha	100%

¹² Applied to all harvested wood products and is deducted at harvest. Payable to the Forest Growers Levy Trust.

¹³ Source: Ellis and Crawley 2014, Practical Log Scaling Guide, Pg 24.



Forecaster Growth Model Settings¹⁴

Model	Setting	Model	Setting
Growth Model	GM300Index	Sweep Model	Generic
Monthly Adjustment Model	8	Forking Model	Generic
MAPD	0.35	Tree Volume Table	163
MMPA	30	Tree Taper Table	163
Regional Drift	0.05	Breakage Table	1
Height Age Table	112	Branch Model	Generic
DOS Function	DOS1999	BIX Model	KnowlesKimberley1997

Attrition

Area attrition or loss between planting and harvesting has been allowed for at a rate of 2%. This means that from a planted area of 627ha, we expect to harvest 614ha (98%). This is to provide for the common loss of stocked area of forest between establishment and harvest. This occurs for reasons such as land slips and small localised areas lost to wind events and is a normal occurrence throughout the life of a forest crop. Area attrition is provided for in the cashflow by reducing the area that is eventually harvested by 2%. This is a conservative approach as it assumes costs throughout the rotation for the entire established area, but harvest yield from only 98% of that area.

Natural tree mortality within the forest is also allowed for by assuming that only 337 stems per hectare are harvested of the 375 stems per hectare that remain after thinning. This is provided for in the forecast yield at harvest, and therefore harvest revenues.

Calculation of Harvest Receipts

Markets

A range of markets have been included in the analysis based on point of sale during the current first rotation harvest. Export logs will be exported through Port of Wellington, with Domestic logs destined for mills in Masterton, Dannevirke and Napier.

The intensive tending silvicultural regime selected is directed towards production of a spread of log types with a bias towards high quality large pruned logs and small branch sawlogs. This regime will provide the greatest spread across the range of log markets at harvest, as well as the opportunity to sell down into lower grade markets should this be required. This reduces exposure to any one market and consequently market risk.

Log Production Costs

Based on the soon-to-be-completed first rotation harvest, the Ngatawhai Group Forest harvest has been assessed to be 81% ground-based extraction and 19% cable hauler extraction. Harvesting and transportation costs are historical averages based on the first rotation harvest with an adjustment factor to match current market rates. The following average costs have been calculated to the point of sale -

Activity	Costs per Tonne
Logging & Loading	\$ 30.65
Internal Roads & Landings	\$ 3.87
Cartage to point of sale	\$ 26.50
Management & Marketing	\$ 5.24
Other Costs and Contingency	\$ 0.83
Total Average Production Cost	\$ 67.09

¹⁴ MAPD – Mortality Additive Percentage Adjustment

MMPA – Mortality Multiplier Percentage Adjustment



Revenue

Log prices used in the revenue projection are the average prices for the last 36 months to 30 June 2019, achieved by Forest Enterprises (for the Southern North Island).

Log Type Grades	Point of Sale	Spot Price as at 30.06.19	FE 36 Month Average Price	Prices Used (\$/t)
Export P40	Wellington	\$ 171	\$ 183	\$ 183
Domestic P35	Dannevirke	\$ 175	\$ 177	\$ 177
Domestic M30	Waingawa	\$ 124	\$ 120	\$ 120
Domestic M20	Waingawa	\$ 109	\$ 105	\$ 105
Export A	Wellington	\$ 115	\$ 136	\$ 136
Export K	Wellington	\$ 102	\$ 121	\$ 121
Export KI	Wellington	\$ 96	\$ 113	\$ 113
Export Pulp	Wellington	\$ 87	\$ 98	\$ 98
Domestic Pulp	Waingawa	\$ 31	\$ 31	\$ 31

Projected Net Stumpage per Hectare

Based on the assumptions set out in this document, and using the average prices for the last 36 months to 30 June 2019, the projected net stumpage per hectare for all stands planted from 2012 onwards is \$42,905 as detailed below.

Log Type Grades	Gross Price per Tonne	Total Costs per Tonne	Net Return per Tonne	Tonnes per Hectare	Contribution To Stumpage
Export P40	\$183	-\$74.04	\$ 109	87	\$9,503
Domestic P35	\$177	-\$76.50	\$ 100	81	\$8,159
Domestic M30	\$120	-\$57.73	\$ 62	150	\$9,331
Domestic M20	\$105	-\$57.39	\$ 48	95	\$4,536
Export A	\$136	-\$72.96	\$ 63	111	\$7,036
Export K	\$121	-\$72.60	\$ 48	40	\$1,927
Export KI	\$113	-\$72.44	\$ 41	33	\$1,349
Export Pulp	\$98	-\$72.07	\$ 26	42	\$1,074
Domestic Pulp	\$31	-\$32.28	-\$ 1	9	-\$11
			Total	648	\$42,905

Using spot prices set out in the Revenue table above as at 30 June 2019 the projected net stumpage per hectare would decrease from \$42,905 to \$38,494.

The 35.4ha of trees planted between 1998 and 2005 have a projected net stumpage per hectare of \$28,532. This lower stumpage is due to these stands being a mixture of pruned and unpruned trees as well as a higher proportion of hauler harvesting resulting in a higher logging cost.



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