

MANGAMINGI FOREST

LANDCORP FARMING LTD

FSC® Forest Management Plan

For the period 2019 / 2023



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1. Introduction

Principles and Criteria

Landcorp Farming Ltd is committed to adopt the Forest Stewardship Council (FSC) Principles and to meet their Criteria and the FSC standards of good forest management. These standards include ecological, social and economic parameters.

Landcorp Farming Ltd is committed to the PF Olsen FSC Group Scheme that is implemented through the Group Scheme Member Manual and associated documents.

About this Plan

This document provides a summary of the forest management plan and contains:

- Management objectives;
 - A description of the land and forest resources;
 - Environmental safeguards;
 - Identification and protection of rare, threatened and endangered species;
 - Rationale for species selection, management regime and harvest plan and techniques to be used;
 - Appropriate management of unstocked reserve areas;
 - Maps showing plantation area, legal boundaries and protected areas;
 - Provisions for monitoring and protection.
-

2. Forest Landscape Description

Overview

This section describes the physical and legal attributes of the land on which the forest is located. Included in this section are discussions of:

- Location and access;
 - Topography;
 - Soils;
 - Climate;
 - Legal ownership and tenure.
-

Legal ownership

The forest is legally described as follows:

Section 1 SO58805
 Section 1 SO58775
 Section 9 Block XI Ngongotaha SD

The tenure is freehold.

Location and access

Mangamingi forest is located off Mangamingi Road, which in turn is located off Tutukau Road, off state highway 5 north of Taupo. The station office is 6.8km up Mangamingi Road. Internal farm tracks provide access to all parts of the forest.

The location of the forest in relation to potential markets is listed in the Table 1 below and shown in Map 1.

Table 1: Distances from forest to log markets

Potential Market or Export Port	Distance from Forest (km)	Log Market Type
Tauranga	112	Export
Taupo	39	Domestic
Kinleith	82	Pulp

Topography

The topography of the forestland is predominantly rolling to steep contour.

Whilst this is not all difficult harvesting terrain, parts are very uneven due to volcanic protrusions and the highly erodible pumice soils mean wet weather poses challenges for lower cost harvesting options.

Harvesting is to be targeted for the drier period of the year, specifically October to April period and much of the area requires cable harvesting systems. Remaining portions will be suitable for ground-based machine extraction with and without tracking.

Altitude is 316 to 657m above sea level.

Soils

There are two major soil types that comprise Mangamingi station. The easier country comprises Oruanui hill soils, silty sand and the steeper areas of the farm are Tauhara steepland soils. Both soil types are yellow brown pumice soils from Taupo pumice.

Erosion risk of these soils on steep slopes is high, and consequently the land of many forested areas is already subject to a soil conservation covenant.

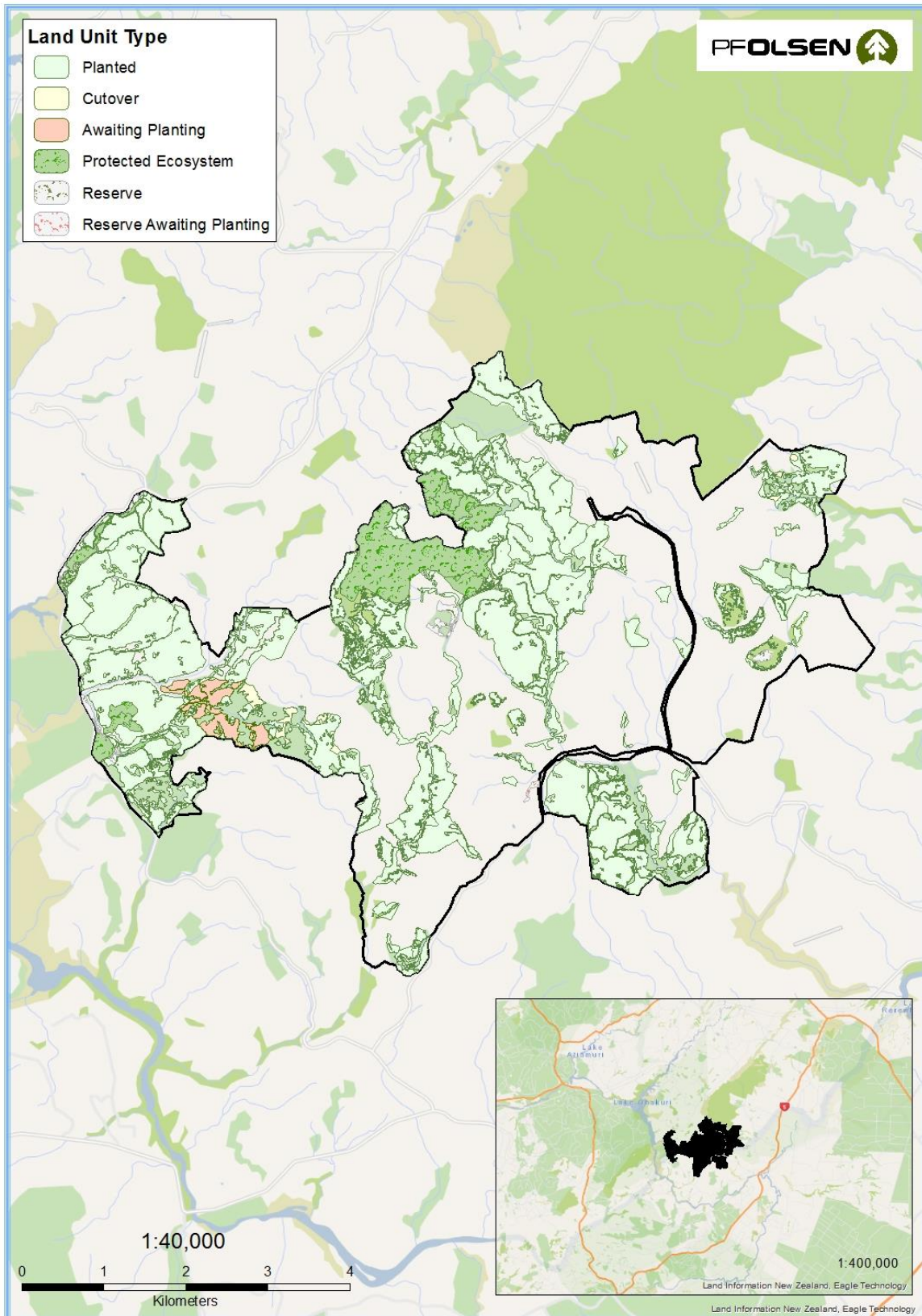
Harvesting and roading methods will need to consider the erosion risk in operational management. In particular these soils contain unconsolidated pumice bands that once exposed are easily dislodged under rain impact or “floated” if subject to exposure to moving bodies of water. The consequence can be large runnels and channels formed in single rainstorm events with substantial sediment deposition. Careful water control techniques to prevent water accumulation and lower flow velocities are critical as well as protection of surfaces from unnecessary disturbance or rectification of damage.

Climate

Rainfall: The average rainfall at nearby Atiamuri power station is about 1340mm per year and is relatively evenly distributed during the year. January to March is the driest period.

Temperature: The mean annual temperature is around 18.1 degrees Celsius. Ground frosts can occur throughout the year (except January and February) with an average of 53 ground frosts per year.

Map 1 – Forest Location Map



3. The Broader Landscape

Ecological landscape

The area containing the Mangamingi forests is on the southern end of the Paeroa range. This range is a tilted rift ridgeline of volcanic origin running more or less NE – SW from Rotorua, the upper slopes remaining clothed in relatively lightly disturbed indigenous tall forests.

This formation ends at Mangamingi as does most of the indigenous forest with only a few remnant patches remaining within the farmland matrix. The whole Paeroa formation and forest is isolated from other large tracts of indigenous forest by farmland though close proximity to exotic forests at the Rotorua end probably assists in maintaining this area as a potentially important corridor and refugia within an otherwise heavily modified environment.

The total landscape falls within the Atiamuri Ecological District which is typified¹ by complex relief, traversed by Rotorua-Taupo Graben, groups of rhyolite domes, the tilted ignimbrite Paeroa Range (to 900m a.s.l.) with pumice tuffs, breccias, alluviums on lowlands. Soils are coarse textured volcanic ash soils, Taupo tephra being very significant. There was extensive, Polynesian clearance, with remnant forests on domes and range, now widely logged. Today only approx. 8.2% of the total original 220,439 ha of native vegetation cover remains.

Protective Status Table 3 shows vegetation types as required by the National Standard for Plantation Forest Management in New Zealand revised in 2013.

Table 3: Protective status of the ecological landscape

LENZ type	LENZ F6.2	LENZ F7.1
Original (pre-Maori) percentage of ecosystem type in Ecological District within land title	342,713 ha 100%	494,186 ha 100%
Natural ecosystem area remaining	323,178.4 ha 94.3%	75,601.5 ha 15.3%
Proportion of remaining natural ecosystem under protection	229,133.5 ha 70.9%	59,807.9 ha 79.1%
Protection by certificate holder	0.7 ha	154.6ha
Protected area/s as a % of management estate	0.05%	10.6%
Protected areas as a % of the aggregated Group Scheme management estate by Ecological District	11.7%	

¹ http://www.bush.org.nz/ecologicaldistrict/16_01.html

**Historic and
archaeological
sites**

Records of known archaeological and historical places are maintained in the NZ Archaeological Association (NZAA) Site Recording Scheme. The Archaeological Site Probability model published by the Department of Conservation² provides further guidance on the probability of pre-European archaeological evidence existing based on the geographical location of the forest and historical occupation of the local area.

The site recording scheme has revealed no known sites within Mangamingi Forest. If a site is found or suspected on any block, the protocols specified in PF Olsen’s EMS, and any others specifically developed in conjunction with Heritage New Zealand (HNZ) and Iwi or other stakeholders must be observed. Where such circumstances require, an ‘Authority to Modify or Destroy’ will be sought from HNZ. Such authorities are similar in function to a resource consent and, if granted, normally come with conditions that must be met. The process to apply for authorities is documented in PF Olsen’s EMS.

Note also that Authorities to Modify an archaeological site may sometimes be required from the local District Council and sites of cultural significance are often included in schedules of places and sites of significance in District Plans. Update checks for any sites will be required before any harvesting or related earthworks commences.

**Threatened
Environments
Classification**

The Landcare Threatened Environments Classification (TEC) is a measure of how much indigenous vegetation remains within land environments, its legal protection status, and how past vegetation loss and legal protection are distributed across New Zealand’s landscape. The TEC is a combination of three national databases:

- Land Environments New Zealand (LENZ)
- Landcover Database 2
- Protected Areas Network

The TEC uses indigenous vegetation cover as a surrogate for indigenous biodiversity, which includes indigenous ecosystems, habitats, and communities; the indigenous species, subspecies and varieties that are supported by indigenous vegetation; and their genetic diversity. It uses legal protection as a surrogate for the relative vulnerability of indigenous biodiversity to pressures such as land clearance, extractive land uses, and the effects of fragmentation. The TEC is therefore most appropriately applied to help identify places that are priorities for formal protection against clearance and/or incompatible land uses, and for ecological restoration to restore lost species, linkages and buffers.

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² Arnold, G.; Newsome, P.; Heke, H. 2004: Predicting archaeological sites in New Zealand. *DOC Science Internal Series 180*. Department of Conservation, Wellington. 24 p.

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Table 4 shows the threatened environments classifications as they pertain to Mangamingi Forest (Map 2). The rarest threatened environments (< 10% indigenous cover left) make up 306.3ha of Mangamingi Forest, while the remaining area is split between less threatened land classes.

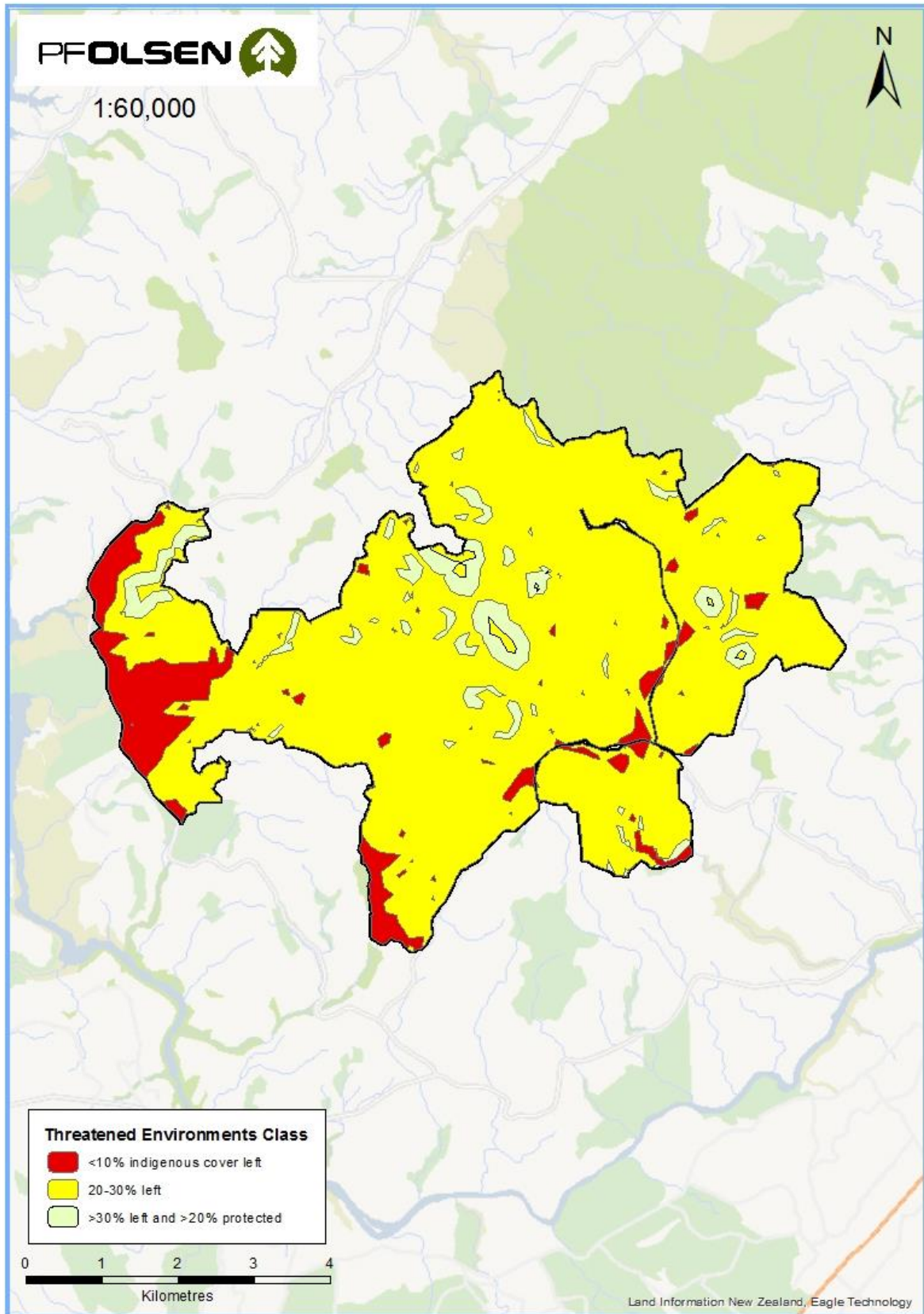
Table 4: Reserve areas by Threatened Environments Classification

Category	Area (ha)	Area (%)
< 10% indigenous cover left	306.3	8.5%
10 - 20% left		
20 - 30% left	3,057.86	85.3%
> 30% left and < 10% protected		
> 30% left and 10 - 20% protected		
> 30% left and > 20% protected	220.80	6.2%
Total	358.96	100.0%

The TEC status of the small reserves reflects the history of intensive pastoralism in the area. The reserves thus have value due to their paucity in the overall landscape.

Map 2 - Forest by Threatened Environment

Classifications



4. Socio-economic profile and adjacent land

Forest history

Mangamingi station is a sheep and beef pastoral farming operation.

Forestry has been established on the station primarily for the purpose of soil conservation, but also as shelter for stock and alternative species for farm aesthetics.

Areas established in forestry were predominantly low productivity sites in agricultural terms, due to the instability of the slopes.

Current social profile

The forests on Mangamingi station are an, intermittent, incremental contributor to the social profile of the area. The forests are very small in comparison to large forestry players in the region. The land and forests are privately owned and contribution to the local economy by way of added incremental employment and infrastructure is relatively low although there has been a near continuous period of harvest in recent years.

Combining data from the Atlas of Deprivation (Ministry of Health) and average income from Statistics NZ, it is apparent that wealth varies widely across the region. The area of the region where Mangamingi Forest is located appears to be one of the lesser deprived areas in the region. Age and family statistics for the Waikato region are very similar to national averages.

Table 5. Key statistics as summarised from 2013 Census³ data

Census Category	Waikato	New Zealand
Ethnicity: European	77.4%	74.0%
Ethnicity: Māori	21.9%	14.9%
Formal qualifications	75.3%	79.1%
Unemployment	7.5%	7.1%
Dominant occupation	Managers	Professionals
Median income	\$27,900	\$28,500
Family with children	39.3%	42.1%
Internet access	72.5%	76.8%
Home ownership	62.7%	64.8%

³ http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-about-a-place.aspx?request_value=13631&tabname=

Associations with Tangata Whenua The land at Mangamingi is freehold. However, iwi associated with the region where Mangamingi is located is Ngati Tahu and Ngati Whaoa. No specific concerns in respect of this land title are currently known.

Tenure & resource rights The land tenure is freehold. A search of the Maori Land Online website (<http://www.maorilandonline.govt.nz/gis/map/search.htm>) returned no results.

Neighbours Neighbours to the forest estate boundaries have a special interest in the management of the forest. Activities within the forest may positively or negatively impact upon their quality of life or businesses in a number of ways, while inappropriately managed operations could create risks of adverse health, safety and environmental hazards. Neighbours may use the forests for recreational purposes or place reliance on the forests for provision of water quality or quantity services. Boundary issues such as weed and pest control, access and boundary alignment issues may also involve neighbours.

Table 6 lists the forest neighbours and their primary activities ([Appendix 1](#)). Some or all of these parties should be consulted when operations are proposed in forest areas adjacent to their boundaries.

Table 6: Forest neighbours

Not Publicly Available

Regulatory Environment and Risk Management

5. The Regulatory Environment

Regulatory considerations

Forestry operations throughout New Zealand are undertaken within the context of a regulatory framework that aims to ensure wider economic, social and environmental goals are achieved for the populace as a whole.

Failure to meet regulatory requirements is a key business risk that must be managed. The following section summarise key regulatory requirements and risk management controls exercised over forestry operations in the forest.

Health and Safety at Work Act 2015

Leadership, a constant focus on health and safety, and the strong message that safety rates as the number one priority ahead of any other business driver are all highly important for PF Olsen management. The company also takes the following steps to ensure worker health and safety:

- Contractor selection process including emphasis on:
 - safety systems and track record;
 - worker skills and training; and
 - equipment types and standard.
- Work planning.
- Contractor induction.
- Monitoring, including random and reasonable cause drug testing, safe work practices and PPE.
- Incident investigation and reporting, including investing in software, training and processes development to enable good transparency on lag and lead indicators.
- Regular reporting to and interaction with the Client on matters related to safety.
- Regular (annual) review and update of the critical risks as identified in PF Olsen data sets and from Industry indicators. Such a review shall focus on incidents that have caused harm and/or loss, any known cause factors and mitigations and revised controls.

Resource Management Act

Mangamingi Forest is subject to the provisions of the Resource Management Act (RMA) 1991. The RMA sets up a resource management system that promotes the sustainable management of natural and physical resources and is now the principal statute for the management of land, water, soil and other resources in New Zealand. Table 7 lists the organisations relevant to Mangamingi Forest.

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Table 7: Regional and District Councils under Mangamingi Forest

Regional Councils ⁴	District Councils ⁵
Waikato Regional Council	Rotorua Lakes Council

Under the RMA, each Council has its own planning documents and associated rules that have been developed through public process. Any forestry operations must comply with the rules relevant to the Council area in which the operations are to take place. The contact details for the relevant councils can be seen in [Appendix 2](#).

**National
Environmental
Standard for
Plantation
Forestry (NES-PF)**

Coming into law on 1 May 2018, the NES-PF is a whole new rule hierarchy that applies the same rule set uniformly across most forestry operations in all parts of New Zealand. Operations will come under the legal force of this RMA instrument, though local Councils will retain the ability to regulate specific areas outside the NES-PF, e.g. Significant Natural Areas, Outstanding Landscapes, giving effect to the Coastal Policy Statement etc.

The underpinning the structure of the NES-PF is a rule hierarchy linked to the erosion susceptibility of the lands upon which forestry operations are to be conducted.

Work commissioned by the Ministry of Primary Industries led to the creation of a national spatial map, the ‘Erosion Susceptibility Layer’ (ESC) that classifies all of New Zealand into a series of four classes of erosion susceptibility from low (green) to very high (red).

The stringency of the rules hierarchy, i.e. whether consents are needed and the degree to which Councils can apply discretion to the conditions attached to a consent, is then tied closely to the recognised erosion susceptibility of the lands involved and the risks created by the operations. In the case of Mangamingi Forest, Table 8 below indicates the proportion of the forest by the respective ESC classes.

In broad terms, harvesting, roading (earthworks) and new afforestation operations will need consents in the red zone. Earthworks will need consents in orange, and in the green and yellow zones most operations will be permitted subject to conditions. The coverage of the erosion classes within the estate are illustrated in Map 4.

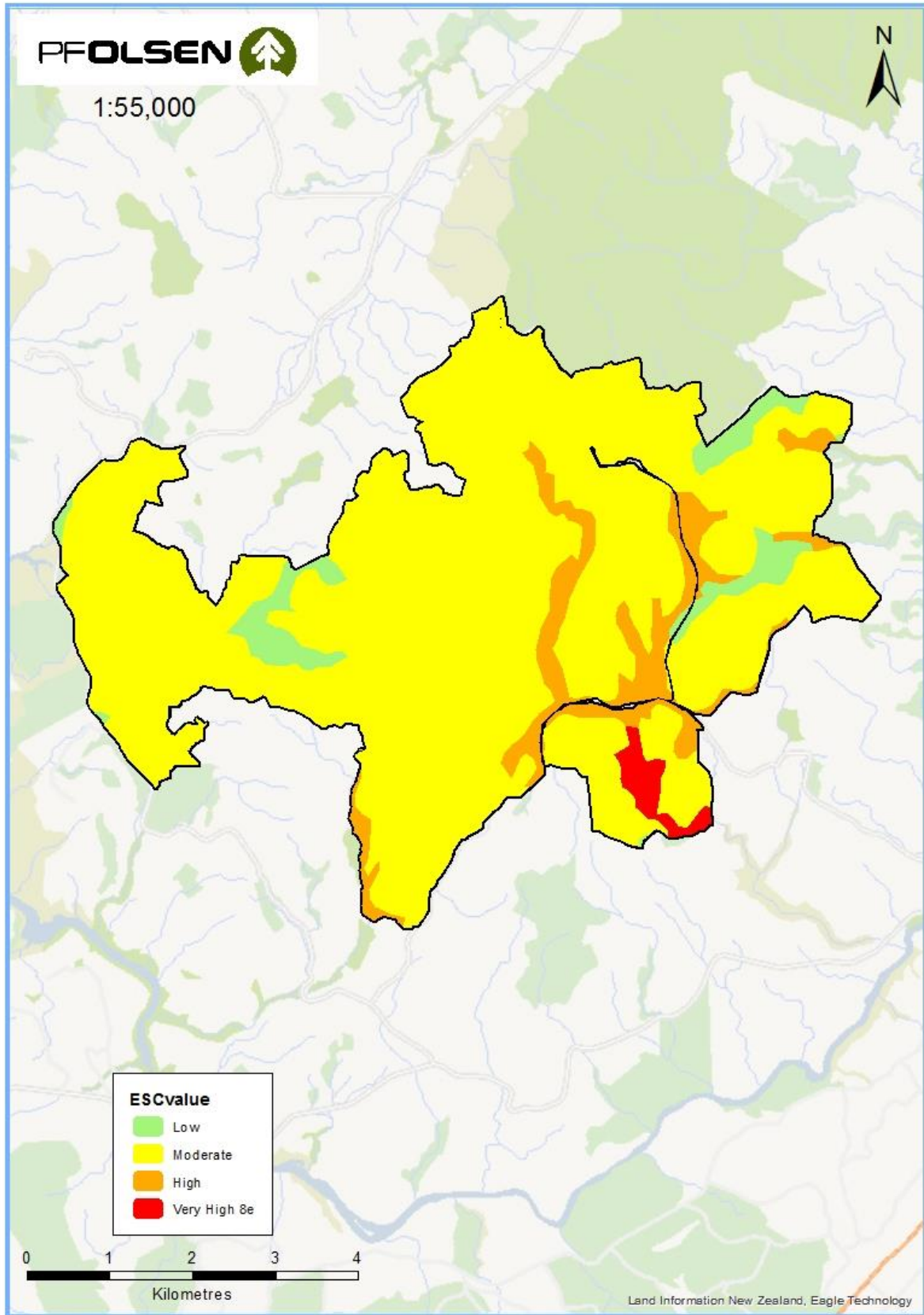
Table 8: ESC Classes (Erosion Risk) for Mangamingi Forest

	Low	Moderate	High	Very High	Very High (8e)	Undefined
Area (ha)	166.13	3090.69	281.09		47.67	
Area (%)	4.6%	86.3%	7.8%		1.3%	

⁴ Regional Councils responsible for soil conservation and water and air quality issues

⁵ District Councils responsible for land use and biodiversity issues

Map 3 – National Environmental Standard Erosion Susceptibility Classes in Mangamingi Forest



Heritage New Zealand Pouhere Taonga Act 2014

Under the Heritage New Zealand Pouhere Taonga Act 2014 it is the landowner’s responsibility to identify any historic sites on their land prior to undertaking any work which may disturb or destroy such sites. Records of archaeological and historical places are maintained in the NZ Archaeological Association (NZAA) Site Recording Scheme <http://www.archsite.org.nz/>.

If a site is found or suspected on any block, protocols specified in PF Olsen’s EMS, and any others specifically developed in conjunction with Heritage New Zealand (HNZ), archaeologists and Iwi or other stakeholders, will be observed and the necessary Archaeological Authorities obtained with HNZ, and if necessary the local Territorial Authority.

These responses may include, but are not limited to:

- Map and ground surveys to identify, mark and protect known heritage sites.
- Iwi consultation and surveys for unknown sites.
- Archaeological Authorities to modify sites if required.

Accidental Discovery Protocols to stop work and engage experts if sites are discovered during operations.

Consents & authorities held

A resource consent from Waikato Regional Council is currently held for harvesting and earthworks in Mangamingi Forest. Conditions include providing the council with an annual sediment and erosion control plan, inspecting works within 65 hours of a major storm event, full engineering plan required for works over 25 degrees and notifying the council of any non-compliance incidents within 72 hours of them occurring. This consent expires on 31 March 2020. Any future operations will be subject to the National Environmental Standard for Plantation Forestry (NES-PF) and will either be permitted activities or consents will be applied for under the NES. A full copy of the consent and conditions is held by PF Olsen Ltd.

There are no HNZ authorities that apply to Mangamingi Forest.

The Emissions Trading Scheme

Forests in New Zealand are governed by rules related to New Zealand’s Kyoto commitments to reduce the nation’s carbon footprint and contribution to associated climate change.

Mangamingi Forest was planted on ‘Kyoto compliant’ land that was vacant as at 31st December 1989. The forest has not been registered to participate in the NZ Emissions Trading Scheme and are not subject to the accrual of emissions credits and liabilities under that scheme.

**Other relevant
legalisation**

There are numerous other statutes and regulations that impact on forest operations. Forest owners can be held liable for breaches of these Acts and may be held responsible for damage to third party property. Management processes seek to manage and minimise these risks.

Other relevant legislation is listed in [Appendix 3](#).

6. Commercial Risk Management

Market access retention

It is a major focus of the Property Manager to ensure contracted products are delivered on time and in specification to ensure Landcorp Framing Ltd retains credible access to its markets.

Landcorp Farming Ltd maintains independent third party environmental certification for its estate under Forest Stewardship Council certification (FSC). PF Olsen Ltd acting under the instruction of its client will be responsible for the execution and maintenance of the required FSC certification elements of which this management plan forms an important component.

Log customer credit risk

There have been a number of NZ sawmills fail in recent years leaving log customers unpaid for the last month's deliveries. The PF Olsen Investment Manager manages customer credit risk exposure and mitigation measures for export markets while PF Olsen manages these risks for domestic log customers.

Infrastructure damage or service disruption

Mangamingi Forest is traversed by several powerline utilities. Risks around these are managed by:

- Identification on maps and on the ground any utilities at planning stage.
 - Early engagement with utility owner to plan operations to minimise risks.
 - Operational execution of agreed plans with parties specifically qualified for the tasks involved when working close to utilities.
-

Pests and diseases

Pests and diseases are managed according to any statutory obligations and best practices as identified by scientific research and past experience, with the type and intensity of treatment (if any) subject to what is at risk and the age of trees (see [Section 14](#)).

7. Environmental Risk Management

Environmental risk

Environmental risk is managed by PF Olsen as appointed property manager, through a cascade framework from high level 'intent' determined by the Forestry Rights owner, through PF Olsen's own environmental policies, thence through defined and documented processes constituting an Environmental Management System (EMS), supported by monitoring and reporting. PF Olsen's policies and Landcorp Farming Ltd's business objectives are considered to be well in alignment.

Environmental policy

PF Olsen Limited is committed to:

- *Sustainable forest and land management;*
- *Promoting high environmental performance standards that recognise the input of the community in which we operate;*
- *Supporting an environment of continuous improvement in environmental performance;*
- *Obtaining and retaining independent 3rd party forest certification in conformance with the Principles and Criteria of the Forest Stewardship Council and / or the Programme for Endorsement of Forest Certification as specified by forest owning clients, or in any case ISO:14001 Environmental Management Systems.*

In order to achieve these commitments **PF Olsen** (and PF Olsen Certification Scheme Members) will undertake the following:

- Where applicable to a particular forest, comply with the presiding **Certification Standards** as set out in any agreements between the forest owners and PF Olsen.
 - **Planning** of operations to avoid, mitigate or remedy degradation of **ecological, heritage** and **amenity** values;
 - Compliance with all relevant **legislation** and where appropriate exceed environmental statutory requirements;
 - **Training** for all employees and contractors to ensure an understanding of certification member's commitments to high standards of environmental performance, their responsibilities under the environmental legislation and to assist the implementation of sound environmental practices;
 - **Monitoring** environmental and socio-economic research and international agreements that may improve PF Olsen environmental and certification performance;
 - Regular environmental performance **audits** of operations;
 - Support for environmental **research**;
 - Undertake forest management in accordance with the principles and ethics of the **NZ Forest Accord the Principles for Commercial Plantation Forest Management in NZ**, and other relevant agreements, conventions and accords.
 - Promotion of the prevention of **waste** and **pollution**; and efficient use of **energy**;
 - Due regard for the well-being of the **community**.
-

Objectives, targets and monitoring

PF Olsen’s objectives, targets and monitoring categorised across 5 key aspects of the business:

1. Economic
2. Legal
3. Social
4. Health & safety
5. Environment

A systematic management approach ensures these objectives and targets remain the cornerstone of PF Olsen’s business, backstopped by monitoring processes that form a regular review of practices.

EMS framework

The Environmental Management System (EMS) is an integrated set of cloud based, defined and documented policies, processes and activities that govern the physical implementation of forest management activities. The EMS applies a systematic approach certified to ISO:14001 standards to ensure that prevention of adverse and harmful impacts is effective.

The framework is reviewed annually with the input of an Environmental Management Group (EMG).

Environmental Code of Practice

As a member of the New Zealand Forest Owners Association, all operations carried out on the property should be undertaken in conformance to the NZ Forest Owners Association ‘New Zealand Environmental Code of Practice for Plantation Forestry’. This publicly available document sets out guidelines that underpin the requirements for sound and practical environmental management.

Forest Road Engineering Manual

As a member of the New Zealand Forest Owners Association, roading and engineering techniques employed within the forest should conform to the industry best practice as outlined in the New Zealand Forest Owners Association publication, ‘NZ Forest Road Engineering Manual’, published 2012.

Assessment of environmental risks

Environmental risks arising from forest operations are assessed and managed on a site-by-site basis prior to execution. The relative probability and magnitude of adverse effect attributable to any particular operation on any particular site is highly variable.

Earthworks, planting and harvesting have the potential to destroy or damage any historic places that may be present. Native vegetation has the potential to be killed by harvesting into the reserve or spraying of the reserve. Water quality can be negatively affected by sediment runoff

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because of harvesting, stream crossing and earthwork operations. In addition, the entry of oil and fuel and fertilisers will reduce the quality of water.

The level of potential risk has been evaluated in the matrix as high ‘H’, medium ‘M’ or low ‘L’, or not applicable ‘NA’ and is thus indicative of the level of care that might need to be applied to ensure the potential for adverse effects is minimised (Table 9).

Table 9: Risk assessment for key aspects involved in forest management activities

Forestry Operational Activities	Environmental Values / Issues matrix												
	Erosion & Sediment Control	Water Quality	Soil Conservation & Quality	Air Quality	Aquatic Life	Native Wildlife	Native Vegetation	Historical & Cultural Values	Landscape & Visual Values	Neighbours	Public Utilities	Recreation Values	Threatened Species
Harvesting	H	M	M	L	M	L	L	L	M	H	L	L	H
Earthworks	H	H	M	L	H	L	L	L	H	L	L	L	H
Slash Management	H	M	L	L	M	L	L	L	L	L	L	L	L
Stream Crossings	H	H	L	L	H	L	L	L	L	L	L	L	L
Mechanical Land Preparation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	H
Burning	L	L	L	H	L	L	L	L	H	H	L	H	NA
Planting	L	L	L	L	L	L	L	L	L	L	L	L	L
Tending	L	L	L	L	L	L	L	L	L	L	L	L	L
Fertiliser Application	L	H	L	L	H	L	L	L	L	L	L	L	M
Agrichemical Use	L	H	L	L	H	L	H	L	L	H	H	H	H
Oil & Fuel Management	L	H	L	L	H	L	L	L	L	H	L	L	L
Waste Management	L	L	L	L	L	H	L	L	L	L	L	L	L
Forest Protection	L	L	L	L	L	L	L	L	L	L	L	L	L

Hazardous substances management

Hazardous substances are any substances, which may cause adverse environmental impacts and/or injury or health problems if incorrectly handled or used.

The hazardous materials which may be used within Mangamingi Forest are:

- Pesticides
 - Herbicides : for commercial and ecological weeds;
 - Fungicides : for forest fungal disease control ; and

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- Vertebrate or Invertebrate Toxins : used for control of pest mammals (e.g hares and possum or wasps).
- Fuels and oils
- Fire retardants : (only ever used if there is a fire)
- Surfactants: to increase herbicide efficacy

Transportation, storage and labelling of these hazardous materials must all comply with the provisions of legislative controls under the Environmental Protection Agency (EPA) and the NZS 8409:2004 Management of Agrichemicals code of practice.

During actual usage, the highest risks are associated with chemical trespass or bulk fuel spillages. These risks are managed by:

- Neighbour consultation over planned spray operations.
- Careful planning and timing of any aerial operations having regard to wind and spray drift.
- Unsprayed buffer strips on neighbour boundaries and riparian or other protected reserves.
- GPS flight path control and records.
- Monitoring and recording of weather conditions during the operation, including using smoke bombs and photos/video.
- Moving contractors into the use of double skinned bulk fuel storage tanks as the preferred method of containment for all larger capacity tanks.
- Tracking of all active ingredient usage within the estate.

Risk management includes active involvement in and review of technologies and research into alternative methods for the control of weeds, pests and diseases where these are effective and efficient.

Fuel use is directly related to the machinery used in forestry operations and the market locations. Using modern efficient machine technology is still the primary area where efficiency gains can be made. There is a steady programme to transfer chain bar oils to vegetable based low toxicity oils.

Highly hazardous chemicals

There are five agrichemicals that have been classified ‘highly hazardous’ (HH) by FSC that are used in forestry and conservation operations within PF Olsen group certified forests. All these five have recently been added to FSC’s HH list. Special derogations to continue usage of these chemicals, subject to conditions, are being applied for by PF Olsen as FSC Group Manager in conjunction with the wider NZ certified industry. The derogation process is run according to specific policies put in place by FSC, including extensive canvassing of stakeholder views. These chemical pesticides are listed in Table 10.

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All the classes of formulations used are registered and legally approved for in use New Zealand by the NZ Environmental Protection Agency, subject to various controls, and for the purposes to which they are applied as listed below.

Table 10: FSC Highly Hazardous chemicals used or potentially used in Mangamingi Forest

Active Ingredient	Purpose	Common Usage
Copper based Products	Fungicide	Needle cast control
Picloram	Herbicide	Establishment weed control
Carbaryl	Insecticide	Localised wasp control
Cholecalciferol	Vertebrate pesticide	Localised possum control
Pindone	Vertebrate pesticide	Rabbit and hare control
<i>Use subject to Animal Health Board emergency provisions only</i>		
Sodium Cyanide	Vertebrate pesticide	Animal Health Board only, ground based possum control
Sodium Monofluoroacetate (1080)	Vertebrate pesticide	Animal Health Board only, extensive aerial possum control

The Managed Plantation Estate

8. Commercial Plantation Estate

Productive Capacity strategy

Forest management is carried out to ensure the productive capacity of the Mangamingi Forest is not compromised. This encompasses multiple aspects that include:

- Pests and weeds and forest health: can reduce productivity
- Inventory: to feed into growth estimation, a core step in timing silviculture and formulating the cutting strategy
- Silviculture: to enhance the value of the resource
- Harvesting: achieving a successful harvest in terms of the forest owner’s health and safety, environmental and commercial objectives.

Forest area

The net stocked areas have been measured from a map produced by PF Olsen (Table 11, Figure 2).

Table 11: Mangamingi Forest Area (ha)

Gross area	Net Stocked Area	Area Awaiting Restocking	Reserves
1458.3	1240.5	47.5	170.3

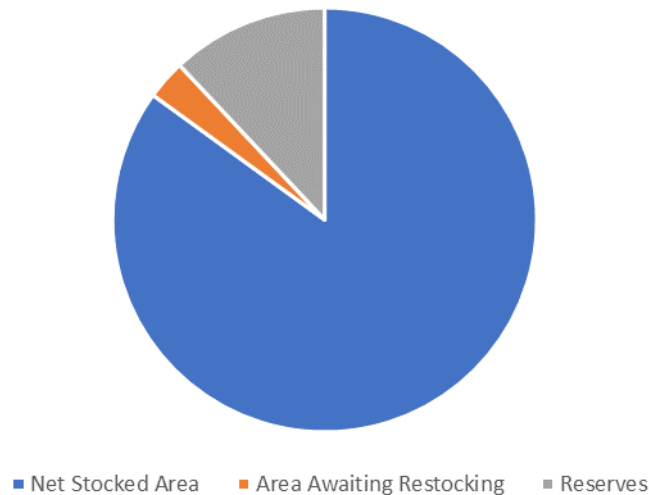


Figure 1: Mangamingi Forest Area (ha)

Current species

There are a range of species grown in Mangamingi Forest predominantly Radiata Pine (Table 12). These species have been chosen to best meet the management objectives set out above, given the characteristics of the forest land.

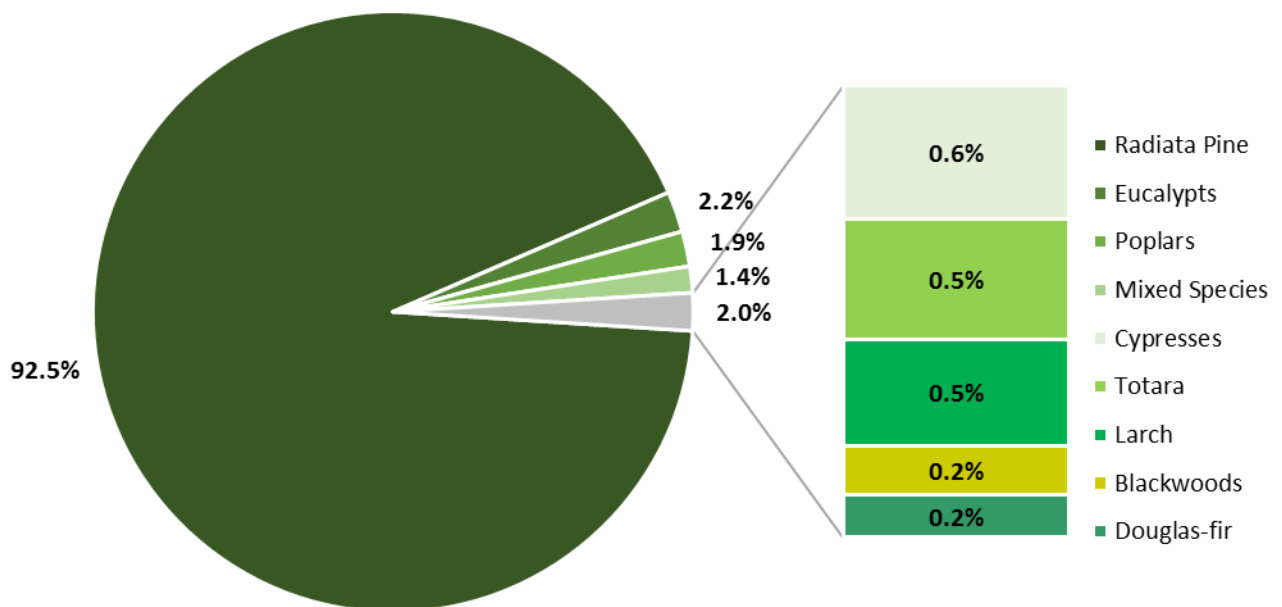
As all forests were purchased as existing planted and often semi-mature stands, the current ownership has inherited the historical decisions of past management. Radiata pine had been selected to best meet the management objectives of the previous owners. Subsequently purchased by the current owners, these forests were acquired because they generally continued to meet the investment criteria of the new owners.

Table 12: Species

Species	Net Stocked Area (ha)
Radiata Pine	1,127.3
Eucalypts	26.70
Poplars	23.0
Mixed Species	17.2
Cypresses	7.30
Totara	6.6
Larch	5.8
Blackwood	2.7
Douglas-fir	2.3

The species mix of Mangamingi Forest is Figure 3 below.

Figure 3: Species composition by area for Mangamingi Forest



Productivity indices

Site index is a measure of productivity of a site in terms of height growth of radiata pine. The parameter used is the mean height in metres of the largest 100 trees per hectare at age 20 years. Equations exist to predict this height given a measured height at any age.

The 300 index is another measure of productivity of a site based on stem volume growth (mean annual increment) of 300 stems per hectare.

The site index for Mangamingi Forest is between 30 – 37.5 m, while the 300 index is 30 – 32.5 m³ / ha / year.

Mangamingi Forest is at the higher end of site productivity in the general area for coniferous forestry sites.

Current crop status

Measurement data from the most recent inventories is summarised to give the current status of the crop ([Appendix 4](#)).

9. Commercial Crop Establishment and Silvicultural Operations

Introduction

The choice of species is the most important issue in plantation forestry. The species must be suitable for the site and meet the objectives of Landcorp Farming Ltd. Also important is to ensure that the planting material is of good quality.

Forest operations are implemented to ensure a good quality crop and maximum growth. These operations include land preparation, establishment, weed control, pest and disease control, fire protection, pruning and thinning and general property maintenance.

Forest management goals

Mangamingi Forest's owners are committed to ensure that the forest will be managed to:

- Grow trees and produce logs for the manufacturing of different wood products in New Zealand and overseas with a focus on 'fit for purpose' log production;
- Ensure that the productivity of the land does not decline;
- Ensure that environmental values are identified and maintained;
- Ensure that historic sites are identified and protected;
- Ensure that other forest values and products are identified, protected and where possible enhanced;
- Ensure that the forest estate's contribution to carbon cycles is maintained or enhanced;
- Harvest the trees as close as possible to their economic optimum age and achieve the best possible financial returns to the owners;
- Replant following harvesting where agreements require;
- Meet all statutory requirements and comply with forest industry best practice;
- Provide recreational opportunities where practical;
- Act as a good corporate citizen and neighbour; and
- Ensure all forest management practices are consistent with the principles of the Forest Stewardship Council and NZS AS: 4708:2014

These goals are further detailed in 'PF Olsen Key Aspects - Objectives, Targets and Monitoring' ([Appendix 5](#)).

Crop species

In Mangamingi Forest, the main crop species grown *Pinus radiata*.

Radiata pine, when intensively managed, will produce a range of different log types suitable for various processing options. The pruned butt log can be used to make knot-free veneer or decorative timber. The unpruned logs can be used for structural timber, for veneer or for feedstock for fingerjointing. The small logs and those with defects and excessive knots can be used for pulp and paper, MDF and other reconstituted wood products such as tri-board and particle board.

Radiata pine is the most common species processed in New Zealand and export markets are well developed for both finished products and logs.

In New Zealand radiata pine is also the main focus in terms of research and development. Past research and development have resulted in improvements in growth, form and wood characteristics as well as development of a range of finished products, building codes and timber standards.

Other species established as productive stands are Eucalyptus, *Acacia melanoxylon*, *Cupressus lusitanica*, *C. macrocarpa* and *Cryptomeria japonica*. Most have not been well tended so performance is variable.

Species established in soil conservation areas include the above species plus larch, Douglas fir, poplars and willows. These species will be incorporated into the managed stand records system over the duration of this plan.

Alternative species have been considered, but these did not meet the Landcorp Farming Ltd objectives.

**Pre-
establishment
considerations**

Prior to re-establishment of the tree crop, a review will be conducted to identify whether there are any rare, threatened or endangered species of flora or fauna within the area to be planted and what, if any, adjustments in planning may be required. A plantation crop is likely to confer beneficial habitat buffering rather than cause adverse effects.

**Unwanted pine
spread**

Re-establishment programmes will include a spread risk assessment using the Wilding Spread Risk Calculator to inform decisions about replant boundaries and monitoring or other control strategies if required. There is no intention to plant or replant in other species with known high spread risk. The use of the Calculator is also a requirement under the NES-PF, and this will be adhered to.

Re-establishment The establishment planned at Mangamingi Forest during the period of this management plan includes replanting of any harvested areas and the planting of some soil conservation areas in manuka.

Re-establishment will aim to use high quality treestocks suitable for the site and market. These will be investigated at time of establishment.

Tending The tending regime executed at Mangamingi Forest is mainly a framing regime. However, trees along fence lines and some of the smaller stands are pruned. The pruning of trees along fence lines and thinning of all stands for the framing regime will continue through the duration of this plan.

Tree nutrition The soils in Mangamingi Forest are not likely to be deficient in nutrients for healthy tree growth. However, there are soils within New Zealand that are deficient in one or more nutrients. The most common nutrient deficiencies are likely to be:

- **Magnesium** – Magnesium deficiency is a particular problem of the Central North Island and is associated with the phenomenon known as mid crown yellowing where the middle of the tree crown turns a yellow colour. Heavily pruned trees and some seedlots are more predisposed to the deficiency than others.
- **Boron** – Boron deficient trees can suffer dieback from the terminal buds and this symptom is closely associated with moisture stress and drought. Trees growing on the drier East Coast of both Islands and on the pumice soils of the Central North Island are prone to boron deficiency.

Foliar samples will be taken if nutrient deficiency symptoms are seen or expected. Fertiliser will only be applied if the health and the growth of the trees are significantly affected.

Site productivity and tree nutrition are actively researched components of industry research programmes in which PF Olsen is an active stakeholder and all harvesting entities are a financial contributor through the Forest Research Levy Fund.

10. Harvesting Strategy and Operations

Harvesting strategy As a plantation with a non-normalised age-class structure, the harvesting strategy employed at Mangamingi Forest is to harvest the forest or constituent stands as close as possible to the optimum economic age as practical. This is the age at which the growth in volume and improvement in quality is offset by the cost to maintain the forest for another year.

Of importance in this assessment is the actual growth of the tree crop, the market for the wood at the time of the harvest and the outlook then and for the near future. These factors, together with logistics such as the availability of suitable harvest contractors and the requirements of resource consents, will determine the actual harvest time.

Planning and preparing for harvest

Forward planning is essential when considering harvesting activities. Harvest planning should ideally commence two years before harvesting to enable roading infrastructure to be developed and any resource consents, archaeological surveys, etc. to be undertaken. This reduces the chance of hold-ups to the commencement of harvesting, which can be costly when log prices are fluctuating.

Harvest planning is conducted within a detailed structured framework controlled within the PF Olsen FIPS system. Planners are guided through a total of 100 elements involving environmental, cultural, community, infrastructural, and safety issues that must be addressed as well as direct operational and economic considerations, prior to the issuing of final prescriptions.

Harvesting operations will be undertaken by contractor and supervised by the forest manager.

Infrastructure

The roading and other infrastructure work proposed for the areas to be harvested in the first year are detailed in the Annual Cutting Plan.

Forest infrastructure includes roads, tracks, landings, bridges and culverts. Design specifications for these are outlined in the 'PF Olsen Standard Specifications for Road and Landing Construction'.

Typically, infrastructure within an early- to mid-rotation age 'greenfields' forest is limited to access for a 4WD vehicle. During harvest planning, upgrades of existing roads/culverts/bridges and planning for new roads, landings and crossings will be identified and scheduled. The type of infrastructure designed and constructed is influenced by topography, harvest duration and intensity of use.

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Once established, these require maintenance. The PF Olsen Asset Hazard Register is a GIS-linked database of forest assets that includes bridges, culverts and crossings under resource consent. This provides the framework for a record of the asset attributes, and its associated maintenance schedule, some of which are required under consent conditions.

Land hand back

The process for land handback is unique to each individual forest agreement. They can involve quite a few steps and vary from block to block.

Contractor management

Prior to engaging a new contractor, a comprehensive review of the contractor’s safety systems, safety record, systems of work organisation and equipment is carried out. With regard to crew configuration, where topography and terrain allows, mechanised felling, extraction and processing is a mandatory requirement. PF Olsen as the Property Manager must be satisfied on this review, regardless of the tendered price.

Upon appointment all new contractor crews undergo a comprehensive safety and environmental induction, while PF Olsen Ltd, in conjunction with its contractors and NZQA training providers NorthTec, runs a comprehensive programme of training to ensure the workforce is competent for the work they are required to perform. The formal NZQA qualifications are supplemented periodically by internally run training courses including those on environmental matters.

All harvesting, engineering and silviculture contractors are subject to quarterly contractor monitoring audits and random drug testing. A full safety systems audit is scheduled and carried out annually. Full crew re-inductions take place every 5 years.

Weekly crew visits and monthly (or fortnightly according to risk) KPI assessments including environmental audits pick up corrective actions and follow-up on those. WorkSafe undertakes audits on an unannounced basis from time to time.

11. Forest Inventory, Mapping and Forest Records

Inventory

Forest growth and development is monitored through forest inventory. Forest inventories providing stand information are required at different times and for different reasons throughout the life of the rotation:

- Pre-assessment: for silviculture rate setting and validating operational timing vs silvicultural targets;
 - Quality control: to check contractor’s performance and update stand records;
 - Mid-crop: to collect measurement inputs for growth modelling;
 - Pre-harvest inventory is scheduled for stands around age 24, to collect measurement data on the crop. This is used for harvest planning, marketing and revenue estimation.
 - New technologies may see some of this information gathered and analysed using remote sensing in the future.
-

Mapping

All mapping of Mangamingi Forest is in digital format and is constantly updated in a Geographic Information System (GIS) that is linked to FIPS. The GIS system spatially records a vast array of forest data, from stand and legal boundaries, to reserves, rivers, roads, infrastructure, topography and soils.

Accurate mapping also assists budgeting, planning, calculation of future revenue/tree crop value, calculation of payments, infrastructure location, and harvest planning.

New plantings are remapped from new aerial photography around age four (when the trees are visible on aerial photography) to accurately determine boundaries and areas and also around two years prior to harvesting to assist with harvest planning.

Forest records

Detailed records of each stand’s silvicultural management history, productivity, inventory and other attribute data are compiled and maintained in a stand records database and Geographic Information System (GIS). These records form the basis for informing silvicultural scheduling, harvesting schedules and other management activity.

Non-commercial Estate Management & Protection

12. Protected Forests, Habitats, Ecosystems and Species

Introduction

Indigenous biodiversity management in or associated with exotic forests is a normal component of everyday forest management. Environmental certification systems place obligations upon the forest manager to be aware of and, where required, enact procedures to assist with the maintenance and protection of important biodiversity where they are able.

Exotic forests can and do provide a level of biodiversity, though this is often enhanced by natural forest ecosystem remnants embedded within the plantation matrix. These are often the most important contributor to the total of the productive landscape's biodiversity. However, rare and threatened species can also be found associated with exotic forests and may require special attention for management.

Protected ecosystems

Mangamingi forest contains a total of 11 protected ecosystem associations in the form of two distinct patches of indigenous forest, three wetlands and various other shrublands, fernlands and manuka areas (Table 13).

Of the protected areas the wetlands and the associated mixed exotics buffer are relatively important to the general area ecologically. WETL-10 and MEXO-06 are part of an erosion management covenant with the Regulatory Authority Waikato Regional Council, while WETL-11 which is of even better quality is not. The wetlands are fenced and are candidates for restoration work and possible inclusion under QEII covenants.

While all the indigenous terrestrial areas are protected, all are variously modified from past logging, land clearance and farm related activities and remain disconnected from the nearest large continuous blocks of indigenous forest in the conservation estate on the Paeroa range.

In their modified and fragmented form, the areas in their own right are of moderate to relatively poor condition and lower ecological ranking. However, with only passive protection the remaining areas still have the capacity to regenerate back to full tall forest status, representing an extension of the Paeroa range forests and contributing to an additional level of forest cover in the otherwise heavily depleted Atiamuri Ecological District.

In addition to the protected ecosystems, Mangamingi has numerous stands of planted forest included under soil conservation covenants with Waikato Regional Council. As the areas are assessed they are classified in FIPS and depending on area/cost the aim is to plant most of them with manuka instead of the weedy species currently in these fenced off zones.

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Furthermore, Landcorp is currently working with the QEII National Trust to establish its first covenanted area within Mangamingi Station. Once the registration is completed 95.1 ha of lowland, modified primary forest, (currently designated as SECF-08, a recognised SNA), will be afforded extra protection and restoration activities under QEII.

The protected ecosystems are shown on the Forest Stands Map.

Table 13: Protected ecosystems and reserve areas

Stand	Area (ha)	Protective Status	Protective Function	Forest Type Description	LENZ Remaining (%)	LENZ Protected (%)	Protection Category
MNGM – WETL - 11	9.2	SNA	Wetland Ecosystem	Leptospermum/coprosma/flax wetland	0	0	Special
MNGM – WETL – 09	7.1	Management Plan			15.3	79.1	
MNGM – WETL – 10	3.9	Erosion Covenant			0	0	
MNGM – WETL – 12	1.9	Management Plan			0	0	
MNGM – SECF – 08	97.3	SNA	Terrestrial Ecosystem	Tawa/Broadleaved Hardwoods	15.3	79.1	Limited
MNGM – MEXO - 06	6.2	Erosion Covenant	Wetland Ecosystem	Exotic Species			
MNGM – FERN – 04	8.6	Passive	Terrestrial Ecosystem	Broadleaved Hardwood shrub & fernland			
MNGM – SECF – 07	7.1			Tawa/Broadleaved Hardwoods			
MNGM – LEPT – 05	16.1			Manuka/Kanuka/Broadleaved Hardwoods			
MNGM – FERN – 03	10.6			Broadleaved Hardwood shrub & fernland			
MNGM – BRDI – 01	1.6			Management Plan			Manuka/Kanuka/Broadleaved Hardwoods
MNGM – BRDI – 02	0.7	94.3	70.9				

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All protected ecosystems are recorded and ranked on the basis of ecological criteria reflecting the stands representativeness, rarity of species, size and connectivity, function and landscape values. Relative value in terms of the ‘ecological landscape’ (Section 4) also informs that process.

Actions are prioritised according to the ‘Protection Category’ status allocated to the areas from the assessments and classifications undertaken (Table 14). The management implications pertinent to each status are summarised in the table below. Prioritisation of work effort will also be based on the principle of ensuring successful and maintainable outcomes at limited scales as a priority over wide scale but marginally beneficial outcomes.

Table 14: Protected Ecosystems Management Categories

Protection Category	Primary Management Objective	Activity Level	Monitoring
Passive	<ul style="list-style-type: none"> Minimise non-essential damage maintain area 	<ul style="list-style-type: none"> Fire protection 	<ul style="list-style-type: none"> Area- with adjacent stand assessments
	<ul style="list-style-type: none"> Observe RPMS obligations 	<ul style="list-style-type: none"> 3rd party arrangements re: pests Apply RPMS 	<ul style="list-style-type: none"> Pests- to meet RPMS General forest health survey
Limited	<ul style="list-style-type: none"> Protect from non-essential damage Maintain area Maintain function (where practical) 	<ul style="list-style-type: none"> Fire protection 	<ul style="list-style-type: none"> Sample forest condition monitoring
	<ul style="list-style-type: none"> Observe RPMS obligations 	<ul style="list-style-type: none"> 3rd party arrangements re: pests, Apply RPMS Associated maintenance pest control 	<ul style="list-style-type: none"> Low level pest monitoring where relevant Sample related fauna if relevant
Full	<ul style="list-style-type: none"> Protect from all controllable damage Maintain area and function 	<ul style="list-style-type: none"> Fire protection 	<ul style="list-style-type: none"> Area monitoring
	<ul style="list-style-type: none"> Improve quality 	<ul style="list-style-type: none"> Specific management 	<ul style="list-style-type: none"> Forest condition monitoring
	<ul style="list-style-type: none"> Observe RPMS obligations 	<ul style="list-style-type: none"> Targeted pest control 3rd party arrangements re: pests. 	<ul style="list-style-type: none"> Pest monitoring where relevant Related fauna monitoring if relevant
Special	<ul style="list-style-type: none"> Restoration if practical 	As above, plus: <ul style="list-style-type: none"> Fencing Covenanting Co-management agreements Funding where practical 	As above, plus <ul style="list-style-type: none"> As defined in any restoration agreement

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Table 15 details the areas in each protection category within Mangamingi Forest, categorised by protective function.

Table 15: Protected ecosystems management categories by function and area

Protective Function	Protective Category		
	Passive	Limited	Special
Erosion Control			
Landscape / Amenity			
Non-specific			
Rare Species			
Riparian Ecosystem			
Terrestrial Ecosystem	44.7	97.3	
Wetland Ecosystem		8.1	20.2
Total Area (ha)	44.7	105.8	20.2

Management and riparian setbacks

A standardised GIS-based stream classification system based on NIWA’s River Environment Classification (REC) has been used to develop a rationale for defining riparian management with a set of rules in the EMS that apply to operations occurring near the riparian corresponding with each stream category. Categorisation of each stream reach is done by the physical characteristics of the particular reach, e.g. underlying geology, streambed slope, climate, and reach order.

It also provides the minimum setbacks upon establishment or reestablishment of forest after harvest where riparian setbacks had not existed before. The morphology of streams can mean that the minimum set back is wider in many instances.

The stream categories within the Mangamingi Forest are summarised in Table 16. The total length of waterways within the forest is 59.3 kilometres.

Table 16: Length of stream by REC class

REC Class	Length (m)	Length (km)
Small, moderate, wet, hard	5,246.1	5.3
Small, low, wet hard	9,439.6	9.4
Medium, moderate, wet hard	9,517.3	9.5
Medium, low, wet, soft	62.9	0.06
Medium, low, wet, hard	24,955.0	25.0
Large, moderate, wet, hard	4,384.5	4.4
Large, low, wet, hard	5,684.7	5.7

Rare and threatened species

Tui, New Zealand Grass Skink and Karearea have been sighted in Mangamingi Forest.

Records of sightings and locations were originally collected and reported in FIPS, but an app call iNaturalist is now used. Over time these databases have enabled the build-up of a spatial distribution picture of species within different geographical locations. Recorded sightings within the plantations and indigenous reserves are summarised in Table 17. These records are made available to conservation authorities.

A listing of key species of interest is held by all contractors and staff, along with the login details for [iNaturalist](#).

Table 17: Rare and threatened species reported in Mangamingi Forest

NZ Threat Classification System Category	Species	No Sightings
Nationally Critical	Long-tailed Bats	2
Recovering	Karearea / NZ Falcon	1
Not Threatened	Common Bully	1
	Tui	1
	New Zealand Grass Skink	1
Total		9

Fish

PF Olsen uses the Freshwater Environments of New Zealand (FWENZ) models to inform the potential for threatened fish species that may be present in streams affected by operations and if necessary, any response to such a presence. The Fish Spawning Indicator published by NIWA to accompany the NES-PF is also used, particularly for works over/in stream beds.

Primary management actions in relation to fish, in addition to those already covered under water quality are:

- Development and maintenance of a register of crossings and an inspection routine to ensure fish passage,
- Sound design and construction of all new stream crossings,
- Timing of in bed crossing construction to avoid peak spawning period,
- Minimising damage to streamside environments and provision of setbacks where they were not originally present,
- Identification of, and avoidance and/or buffering of waterbodies during aerial spraying for replanting and *Dothistroma* control or aerial fertilisation if ever required,
- Protection of any wetlands identified within the plantation matrix.

Avifauna

While the local lists of threatened bird species are much more extensive, most of those species’ habitats are shore, sea, estuarine and riverbed focussed. Of the forest birds, many of the more common species listed can be expected to be regularly within or transient through the plantation forest.

Primary management actions in relation to avifauna are:

- Adherence to industry protocols developed for management of NZ falcon kiwi, bats and shortly, lizards.
- Inclusion of threatened species sightings into the PF Olsen sightings database, and subsequently into the NZ Forest Owners iNaturalist – Biodiversity in Plantations Project⁶.
- Minimising damage to natural forest areas and any small wetlands and scrublands during harvest and reforestation, particularly any gully systems that already form natural corridors through the larger plantation areas,
- Promotion of the development of improved riparian corridors after harvest,
- Co-operation with neighbouring landowners undertaking vertebrate pest control within the wider area.

CITES species

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments.

Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species in the wild, and it accords varying degrees of protection to more than 34,000 species of animals and plants.

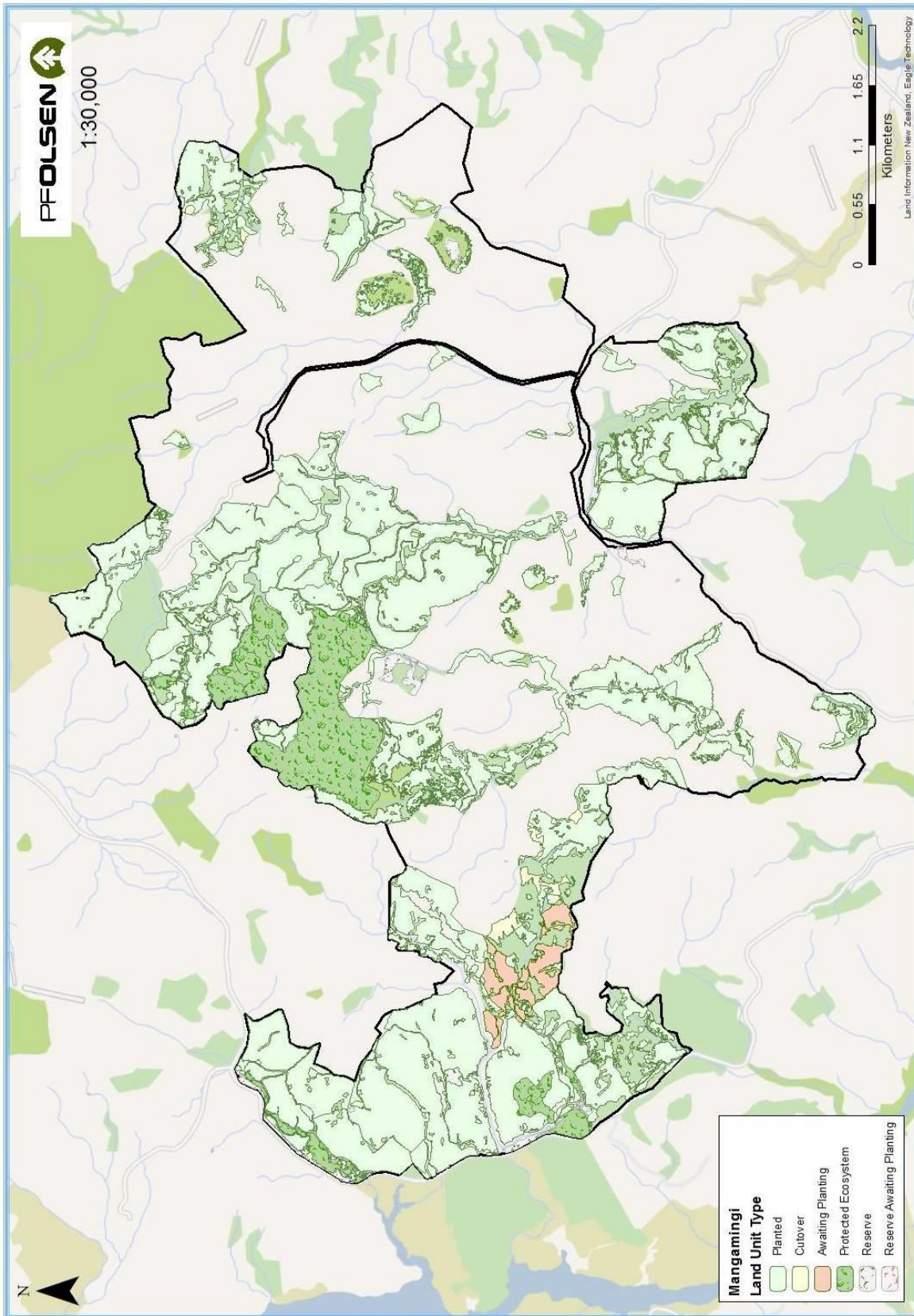
The full list of New Zealand CITES listed species are available on the [Department of Conservation’s website](http://www.doc.govt.nz/cites/).

**High
Conservation
Values Forests**

To date, no High Conservation Value Forests have been identified.

⁶ <https://www.inaturalist.org/projects/biodiversity-in-plantations>

Map 4 - Forest Stands Map



13. Property Management and Protection

Statutory pest obligations

Pest management within Mangamingi Forest is subject to statutory obligations under the Regional Pest Management Strategy administered by the Waikato Regional Council.

The strategy applies to both pest plants and animals and categorises them, in terms of management objectives. The categories, objectives and landowner obligations are summarised the Regional Pest Management Plan. These plans are [maintained online](#) by the relevant Regional Council.

Plant Pests

The overall objective in managing plant and animal pests is to:

- Meet statutory obligations under the Regional Pest Management Strategy,
- Reduce their direct impacts on both plantations and indigenous biodiversity values,
- Ensure that any impacts on neighbouring properties are promptly dealt with,
- Monitor the abundance and distribution of these species within Mangamingi Forest.

The major plant species potentially threatening production values within the forest can be seen in [Appendix 6](#).

Pest control

The main animal pest with potential to cause problems in Mangamingi Forest is the introduced possum. Possums attack the growing tips of both plantation and native trees, causing stem malformation and die back. Possums are also a threat to neighbouring property owners who are farmers as they can carry and spread tuberculosis to domestic stock.

Other pests include rabbits and hares at the time of establishment and wild goats during the first half of the crop rotation when bark is soft and palatable.

Possum control is currently being completed on Mangamingi station by the Animal Health Board. An initial 1080 drop was completed, and ongoing control using Cholecalciferol gel bait is to be maintained. This ground baiting method will be the preferred option in the immediate future as FSC derogations on use of 1080 restrict aerial application methods to the land (by any party) to emergency situations.

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Animal pests in Mangamingi Forest will be controlled using ground control methods as required, which prevent impacts on non-target species. The forest manager will coordinate operations with organisations such as the Regional Council and the Department of Conservation to achieve effective and efficient control within the forest area and on neighbouring land, where required.

Forest plant pests are low on this estate because of the grazing that restricts plant spread and development of such things as pampas. However, there are wilding pines present within the protected ecosystems, and these are being addressed.

Diseases, which can affect the forest trees and adjacent native vegetation, are monitored throughout the year by the forest manager, and once a year by a professional independent forest health assessor. Most diseases cause little damage and do not require control. The exception is *Dothistroma*, a fungus which attacks pine needles. This fungus is controlled using a copper-based fungicide, but only when the infection reaches a critical level.

Dothistroma infection can also be controlled through silviculture by timely thinning and pruning operations, which increases air movement and lowers humidity levels.

Depending on the results of the annual infection inspections there may be a need for *Dothistroma* control to take place in Mangamingi Forest.

Fire prevention and control

With the weather patterns normally experienced in New Zealand during the period late spring/summer, fire can be a real threat to the forest. This can be minimised by:

1. Having an effective fire plan.
 2. Active prevention measures which include restrictions on allowable access, fire prevention signage, publicity when fire danger increases, access to adequate water sources, and selective forest grazing to reduce fuel within stands.
 3. Effective detection systems include good communication systems, mapping, and fire plan alert procedures.
 4. A close link with the relevant fire authorities, and an understanding of equipment and trained manpower requirements.
 5. Good forest management that recognises the influence of terrain, roading network and accessibility, and fuel build-up from silvicultural practice, that will influence fire prevention and control measures.
-

Fire authority responsibilities

The legal responsibility for fighting forest fires lies with the respective territorial land authorities where the forest is situated. In the case of Mangamingi Forest the Rural Fire Authority (RFA) is Pumicelands Rural Fire Authority.

In the event of a fire that starts within the forest, the RFA is responsible for attending and providing the resources to extinguish the fire. Where a fire starts outside the forested area and moves into the forest, the RFA has recourse to the Rural Fire Fighting Fund to compensate for firefighting costs.

There is a close liaison with the RFA in terms of developing the fire plan and the maintenance of good communication relative to potential risks and fire danger ratings.

Public liability insurance

Not Publicly Available

Fire insurance

Not Publicly Available

Other Benefits from the Forest

14. Recreation, Forest Products and Other Special Values

Introduction

Forest plantations may also provide for non-timber forest products that enhance the economic well-being of the owner or legitimate forest users. Non-timber products are an important means of maximising the production capacity of the forest whilst maintaining environmental and social values. The forest management plan provides procedures for developing and managing these resources.

Forests can also provide many other special values, which are also provided for and managed through the forest management plan.

Recreational usage

Mangamingi Forest receives high recreational demand from the wider public. Recreational activities undertaken include:

- Hunting- deer and pigs
- Hunt club (on horses)
- 4x4 club events
- Horse trekking
- Walking groups

The forest will continue to be open for legitimate use subject to entry by notification to farm manager. A sign-in system is utilised to ensure hazards are notified and accepted.

Non-timber forest products

There are no non-timber products for certified, commercial production currently being produced or developed in Mangamingi Forest.

Other special values

The following special values have also been identified in Mangamingi Forest:

- Beekeeping - This has historically occurred on Mangamingi station.
 - Trapping of possums for fur.
-

Public access roads

There are no public tracks and trails near or within the forest as the forest is located on privately owned farmland. All signage of roads and tracks must be followed and those using the routes will still require a permit if there is any intention to access the forest from the road routes.

These public road locations are publicly viewable in the Walking Access Commission website⁷. Any users are expected to abide by the Outdoor access code⁸ published by the Walking Access Commission.

⁷ https://www.wams.org.nz/wams_desktop/index.html

⁸ <http://www.walkingaccess.govt.nz/walkways-and-access/outdoor-access-code>

15. Monitoring

Introduction

To ensure that the management objectives identified in this plan are being achieved, various monitoring exercises outside normal operations management have been developed. Monitoring results are summarised and reported to Landcorp Farming Ltd as and when required and are also, where appropriate, made publicly available through the PF Olsen webpage.

Values monitored

Management inspections are undertaken regularly. The forest monitoring framework that would generally be applied to Mangamingi Forest is shown below. The monitoring may not include all of these elements.

Table 18: Environmental process monitoring framework

Monitored Element	Components	Data Source	Data Medium	Reporting / Website Frequency
Chemical Usage	- A.I Usage - Area Overuse	- Operational Supervisors	- FIPS - <u>Form</u>	- On Demand - Annual
Client Satisfaction	- Post-operation client survey	- Clients	- Survey Form	- Post-operational - Annual
Consultation Activity	- Complaints - Other Interactions	- Operational Supervisors - Planners	- FIPS - <u>Form</u> - <u>Meeting Minutes</u>	- Annual - Annual
Environmental Incidents	- Incident Number - Categories	- Operational Supervisors	- FIPS - <u>Form</u>	- On Demand - Annual
Environmental Goals	- All	- Environmental Management Group	- Meeting Minutes	- Annual
Environmental Training	- Courses - Numbers - Names	- Staff	- FIPS - NZQA	- Annual - Individual
Flora & Fauna	- Species & Status - Frequencies - New Finds	- Operational Supervisors - Public - Crews	- FIPS - <u>Form</u> - <u>Naturewatch</u>	- On Demand - Annual
Forest Estate Structure	- Area: Plantation & Protected Ecosystem - Age-class - Species - Forest Type - Protection Status	- Management Plans - Stand Records	- FIPS Stand Records	- On Demand - Annual

Continued on next page...

...continued

Monitored Element	Components	Data Source	Data Medium	Reporting / Website Frequency
Forest Growth	- PSP Protocols - Periodic Inventory - ISO 9001	- Contractors	- Volume Reconciliations - Estate model	- Periodic-annual - Not on web
Forest Health	- Disease & health	- NFH Surveillance Program ⁹	- Document	- Periodic-Annual - Not on web
FSC Membership	- Block - Location - Name	- Certifying Body	- Certificate	- On Demand - Annual
Health & Safety Statistics	- LTI / MTI / TIFR - Accidents & Incidents - Initiatives	- Operational Supervisors	- Assura	- Monthly - Annual
High Conservation Value Forests	- Condition Trends - Photopoint Monitoring	- Contractors - Supervisors	- Spreadsheet	- Annual
Internal Audit CAR Activity	- Frequency * - Category	- Auditors(ees) - Operational Supervisors	- Assura	- Annual
Log Production	- Total Logs - FSC Certification	- Log docketts at harvest	- Woodtrack	- On Demand - Annual
Operational Monitoring	- Audit Trends - Cause Analysis	- Operational Supervisors	- FIPS - <u>Form</u>	- Monthly - Annual
Pests	- RTC / RTI - Kill Returns - Other	- Contractors - Supervisors - Permitees	- FIPS - Various	- Annual - Where Relevant
Protected Ecosystem Condition	- Condition Trends - Photopoint Monitoring	- Contractors - Supervisors	- Spreadsheet	- Bi-annual if restoration initiated
Recreational & Non-Timber	- Permits Issued	- Branch Offices - Forest Security	- FIPS	- Annual
Resource Consents	- Number - Compliance	- Operational Planners	- FIPS	- Monthly - Annual
Social Survey	- Demographics, - Values - Work Conditions	- Contractors	- Survey form	- 3 yearly
Stream Monitoring	- Clarity +/- other specific - Full NOF	- Supervisors - Contractors - BOPRC	- Various	- Operational - BOPRC S.o.E.

⁹ Forest health inspections are undertaken annually, by an independent specialist forest health assessor, through the NZ Forest Owners Association forest health scheme.

Other monitoring Budget versus expenditure is monitored through the PF Olsen FIPS system and presented to Landcorp Farming Ltd when requested. This information is not made public.

Other operational standards are monitored through a variety of concurrent and post operational assessment procedures that cover all critical aspects of the business of the forest. This information which includes log manufacturing quality performance, safety performance, financial and budget performance as well as stakeholder feedback and client satisfaction surveys and other private or commercially sensitive is not made public.

16. Future Planning

Introduction

This plan pertains to the management of Mangamingi Forest and will be adhered to for the next 5 years. Any deviation from this plan will be justified only on the basis that the changes do not adversely affect the environment. Any changes, which are contrary to the policies contained in this management plan, will require a full review of this plan. The next review date for this plan is June 2024.

Deviations from this plan will be justified on the basis that the changes do not adversely affect the environment and are necessary or beneficial to achieving the management goals and objectives.

The forest management plan is used for both medium and long-term planning.

Operation plans

Short term tactical planning is accomplished through development of annual operations plans in conjunction with detailed budgeting. These plans are prepared in accordance with this Management Plan. Harvesting operations are also planned on a block by block basis because of the level of detail required.

This operation plan and associated budget are subject to approval by Landcorp Farming Ltd at the beginning of each financial year.

Stakeholder consultation

Consultation with key stakeholders has been enabled as part of the development of this plan which will be publicly available on the PF Olsen Certification website. Feedback from stakeholders (and others as they become apparent) is monitored, including actions undertaken to resolve disputes and issues and may inform changes in operational practice or future plan reviews.

17. Register of Plan Change and Review

Introduction

This plan pertains to the management of Mangamingi Forest and will be reviewed on an annual basis. This section documents specific changes made during each review.

Date	Section / Page	Change
Mar 23	HCV and Monitoring	Update information

Appendix 1 – Neighbour Location Map

Appendix 2 – Contact details for Regional and District Councils with jurisdiction over Mangamingi Forest

Entity	Phone	Email	Website
Waikato Regional Council	0800 800 401	Web Form	https://www.waikatoregion.govt.nz/
Rotorua Lakes Council	07 348 4199	info@rotorualc.nz	https://www.rotorualakescouncil.nz

Appendix 3 – Other Relevant Legislation

Commercially Relevant Statutes & Regulations

- Accident Compensation Act 2001 #49
- Animal Welfare Act 1999
- Biosecurity Act 1993
- Climate Change Response Act 2002
- Conservation Act 1987
- Crown Forest Assets Act 1989
- Fencing Act 1978.
- Fire and Emergency New Zealand Act 2017
- Forestry Rights Registrations Act 1983
- Forests Act 1949
- Forest and Rural Fires Act 1977.
- Forests Amendment Act 1993.
- Freshwater Fisheries Regulations 1983
- Hazardous Substances and New Organisms Act 1996
- Health and Safety at Work Act 2015
- Heritage New Zealand Pouhere Taonga Act 2014
- Noxious Plants Act 1978.
- Pesticides Act 1979.
- Protected Objects Act 1975
- Reserves Act 1977
- Resource Management Act 1991 regulations
- Soil Conservation and Rivers Control Act 1941
- The Treaty of Waitangi Act 1975

- Trespass Act 1980
- Wildlife Act 1953

Relevant regulations to the above legislation also apply as well as various industry Accords, Codes of Practice as listed below:

- New Zealand Forest Accord
 - Principles of Commercial Plantation Forest Management
 - New Zealand Environmental Forestry Code of Practice
 - New Zealand Code of Practice for the Management of Agrichemical
 - Climate Change Accord
 - NZ Log Transport Safety Accord
 - Eliminating Illegal Forest Products in New Zealand
 - MoU Federated Farmers and Forest Owners Association and Farm Forestry Association
 - New Zealand Forest Road Engineering Manual
 - Forest Practice Guides
-

Appendix 4 – Current Crop Status

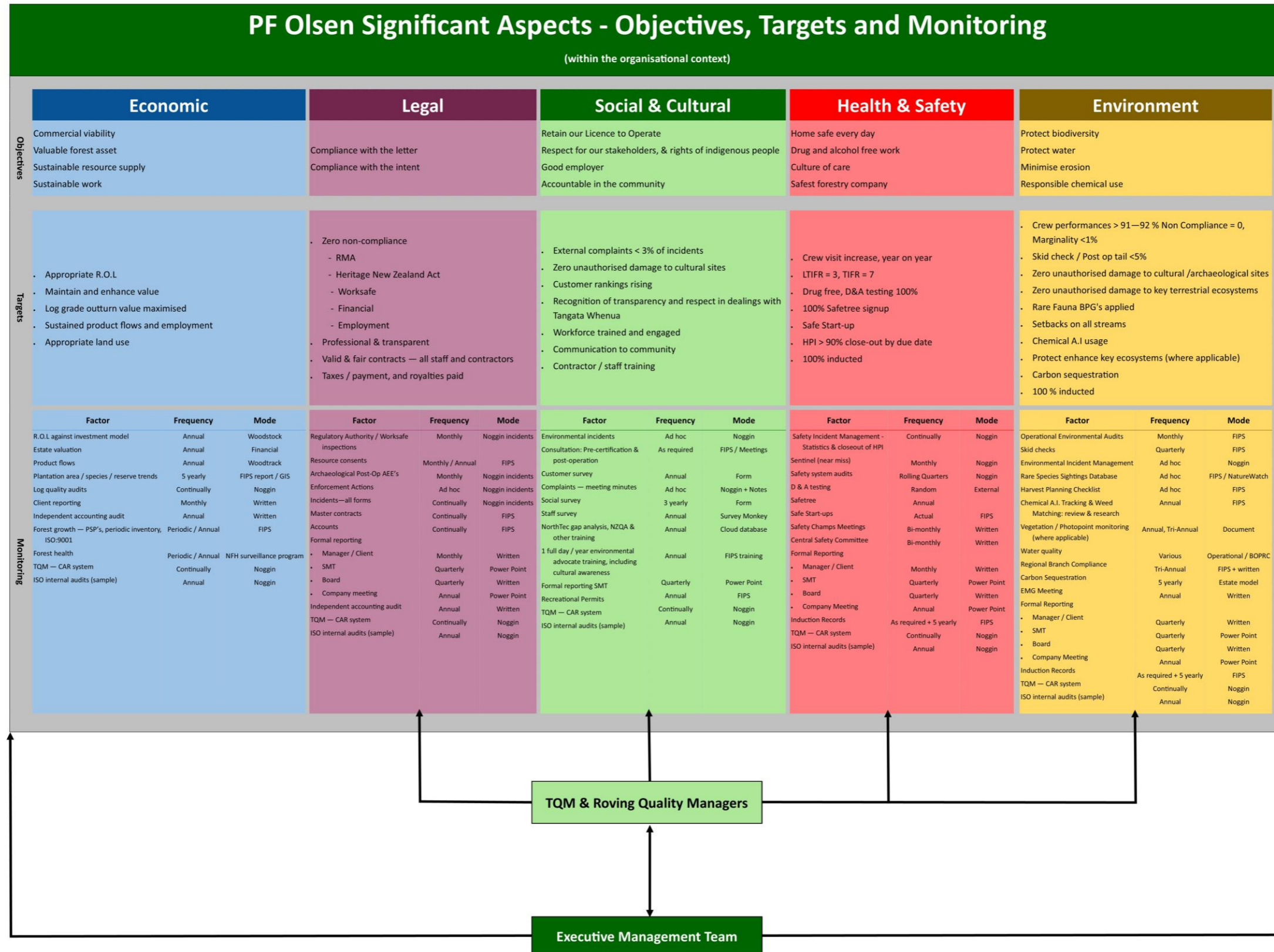
Stand	Year Planted	NSA (ha)	Total Stocking (sph)	BA (m ² /ha)	MTH (m)	Mean DBH (cm)	Pruned Stocking (sph)	Pruned Height (m)
MNGM-0005-01	1995	1.4						
MNGM-0006-02	2012	1.8	825	7.5	8.8	16.3	358	3.7
MNGM-0006-03	2012	3.8	867	8.7	10.5	18.0	344	3.9
MNGM-0006-04	2012	0.5	750	9.1	9.9	17.8	367	3.8
MNGM-0008-02	2014	22.1	804					
MNGM-0014-02	2014	56.6	839					
MNGM-0014-03	2014	3.0						
MNGM-0014-04	2015	0.5	850					
MNGM-0016-02	2011	21.9	841	12.2	13.6	20.7	362	6.2
MNGM-0016-03	2012	43.1	808	8.3	11.2	17.4	352	4.0
MNGM-0018-01	1994	6.0	458	41.9	34.9	32.9		
MNGM-0018-02	1994	32.7	320	38.0	32.2	38.8		
MNGM-0018-03	2020							
MNGM-0019-01	1995	50.8	429	31.9	24.5	30.8		
MNGM-0020-01	1995	37.2	370	34.6	25.6	34.5		
MNGM-0021-01	1996	7.4	267	23.1	26.9	32.7		
MNGM-0022-02	2013	39.6	871					
MNGM-0023-02	2013	47.9	864					
MNGM-0023-03	2013	5.7	856					
MNGM-0023-04	2014	67.9	842					
MNGM-0023-05	2015	1.8	867					
MNGM-0026-02	2010	24.2	824	11.3	12.4	20.3	353	6.1
MNGM-0026-03	2011	1.3	675	6.6	10.2	16.1	325	5.9
MNGM-0026-04	2011	49.7	871	9.5	12.3	19.8	307	6.1
MNGM-0027-03	2011	15.7	819	12.6	13.4	21.7	339	6.1
MNGM-0027-04	2012	1.9	500	27.6	14.8	26.5		

Stand	Year Planted	NSA (ha)	Total Stocking (sph)	BA (m ² /ha)	MTH (m)	Mean DBH (cm)	Pruned Stocking (sph)	Pruned Height (m)
MNGM-0027-05	2014	2.0	750					
MNGM-0028-01	1994	36.5	325	45.8	34.0	42.3		
MNGM-0028-02	2020							
MNGM-0030-01	1990	61.8	514	45.8	33.4	33.7		
MNGM-0030-02	2016	22.5	901					
MNGM-0030-03	2017	9.6	737					
MNGM-0030-04	2019	29.3	862					
MNGM-0030-05	2018	7.7	827					
MNGM-0030-06	2018	0.2						
MNGM-0033-02	2015	19.1	800					
MNGM-0033-03	2017	20.7	828					
MNGM-0033-04	2018	1.6	875					
MNGM-0034-02	2017	36.6	813					
MNGM-0034-03	2018	27.8	870					
MNGM-0034-04	2017	3.0	1,700					
MNGM-0034-05	2018	1.2	833					
MNGM-0035-02	2017	19.2	858					
MNGM-0035-03	2018	0.6	842					
MNGM-0037-02	2010	0.9	500	21.7	13.0	23.5		
MNGM-0047-01	1991	4.3	242	36.5	34.9	43.8		
MNGM-0049-01	2011	2.6	533	17.7	13.7	20.6		
MNGM-0051-01	2012	151.0	534	17.6	12.1	21.3		
MNGM-0052-01	2012	0.7	767	12.7	13.3	21.0	367	3.8
MNGM-0053-01	2016	0.5	858					
MNGM-0054-01	2018	6.6	2,104					
MNGM-0055-01	2018	36.0	850					
MNGM-0056-01	2018	12.6	824					
MNGM-0057-01	2018	11.9	876					
MNGM-0058-01	2018	30.3	842					

Stand	Year Planted	NSA (ha)	Total Stocking (sph)	BA (m ² /ha)	MTH (m)	Mean DBH (cm)	Pruned Stocking (sph)	Pruned Height (m)
MNGM-0059-01	2018	9.8	840					
MNGM-0060-01	2018	41.7	850					
MNGM-0061-01	2018	17.2	860					
MNGM-0062-01	2018	39.5	852					
MNGM-0063-01	2019	3.5	825					
MNGM-0901-01	1984	7.7						
MNGM-0902-01	1984	1.9						
MNGM-0903-01	1984	3.2						
MNGM-0903-02	1984	1.7						
MNGM-0904-01	1980	1.5						
MNGM-0905-01	1980	1.6						
MNGM-0906-01	1980	2.7						
MNGM-0907-01	1984	5.6						
MNGM-0908-01	1984	3.9						
MNGM-0909-01	1984	2						
MNGM-0910-01	1984	13.9	163	28.3	28.4	45.4		
MNGM-0911-01	1984	0.8						
MNGM-0912-01	1984	1.4						
MNGM-0913-01	1980	0.7						
MNGM-0914-01	1984	3.9						
MNGM-0915-01	1984	2.3						
MNGM-0916-01	1984	1.3						
MNGM-0917-01	1984	1.7						
MNGM-0918-01	1984	5.6						
MNGM-0919-01	1984	2.6						
MNGM-0920-01	1984	1.3						
MNGM-0921-01	1984	1.1						
MNGM-0922-01	1984	3.1						
MNGM-0923-01	1984	3.1						

Stand	Year Planted	NSA (ha)	Total Stocking (sph)	BA (m²/ha)	MTH (m)	Mean DBH (cm)	Pruned Stocking (sph)	Pruned Height (m)
MNGM-0924-01	1984	8.2						
MNGM-0925-01	1984	0.4						
MNGM-0926-01	1984	0.9						
MNGM-0927-01	1987	0.3						
MNGM-0928-01	1984	0.5						
MNGM-0929-01	1984	0.9						
MNGM-0930-01	1970	1.5						
MNGM-0931-01	1970	2						
MNGM-0932-01	1970	3.6						
MNGM-0933-01	1970	5.9						
MNGM-0934-01	2017	0.1						
MNGM-0935-01	2017	0.1						
MNGM-0936-01	2017	0.1						
MNGM-0937-01	2017	0.1						
MNGM-0939-01	1984	2.4						
MNGM-0940-01	1984	9.4						
MNGM-0941-01	1984	1.4						
MNGM-0942-01	1984	3.4						
MNGM-0943-01	1984	1.8						
MNGM-0944-01	1984	2.2						
MNGM-0945-01	1984	1.2						

Appendix 5 – PF Olsen Significant Aspects: Objectives, Targets and Monitoring



Appendix 6 – Waikato Regional Pest Management

Plant species to be managed under the Waikato Regional Pest Management Plan

Pest Plant	Production Threat	Environmental Threat	Public Threat	Reference in the Plan
Exclusion Pest Plants				
Bat-wing passionflower		✓		5.7
Broom corn millet	✓			5.10
Freshwater eel grass	✓	✓		5.21
Fringed water lily		✓		5.22
Horsetail	✓	✓		5.26
Hydrilla		✓		5.27
Kudza vine	✓	✓		5.31
Marshwort		✓		5.34
Eradication Pest Plants				
African feather grass	✓	✓		5.2
Cathedral bells		✓		5.12
Chilean flame creeper	✓	✓		5.14
Evergreen buckthorn		✓		5.20
Horse nettle	✓			5.25
Lantana	✓	✓	✓	5.32
Knotweed: Chinese		✓		5.29
Knotweed: Japanese and Giant knotweed	✓	✓		5.30
Manchurian wild rice		✓		5.33
Mile-a-minute		✓		5.38
Nassella tussock, Fine stemmed needle grass, Chilean needle grass	✓	✓		5.41
Noogoora bur	✓			5.42
Purple loosestrife		✓		5.46
Rhododendron ponticum		✓		5.50
Sagittaria		✓		5.52
Sea spurge		✓		5.54
Sengeal tea		✓		5.55
Spartina		✓		5.56
Thistle: Variegated	✓			5.59
Water poppy		✓		5.62
White bryony		✓		5.63
Progressive Containment Pest Plants				
Alligator weed	✓	✓		5.3
Banana passionfruit		✓		5.6
Boneseed		✓		5.8
Chocolate vine		✓		5.15
Climbing asparagus		✓		5.16

Pest Plant	Production Threat	Environmental Threat	Public Threat	Reference in the Plan
Climbing spindleberry	✓	✓		5.17
Contorta pine	✓	✓		5.18
Darwin's barberry	✓	✓		5.19
Giant gunnera		✓		5.23
Mexican devil	✓	✓		5.35
Mignonette vine		✓		5.37
Mistflower		✓		5.39
Moth plant		✓	✓	5.40
Old man's beard		✓		5.43
Pampas	✓	✓		5.44
Tutsan	✓	✓		5.60
Velvet leaf	✓			5.61
Wild ginger (kahili and yellow)		✓		5.64
Woolly nightshade	✓	✓	✓	5.68
Yellow flag iris	✓	✓		5.69
Sustained Control Pest Plants				
Australian sedge	✓			5.5
Broom	✓	✓		5.9
Gorse	✓	✓		5.24
Privet		✓	✓	5.45
Purple nutsedge / nutgrass	✓			5.47
Ragwort	✓			5.48
Thistle: Nodding and Plumeless	✓			5.58
Site-led Pest Plants				
Asparagus: Bushy and Fern		✓		5.4
Californian bulrush		✓		5.11
Cherry: Japanese and Rum		✓		5.13
Japanese walnut		✓		5.28
Mexican water lily		✓		5.36
Reed sweetgrass		✓		5.49
Royal fern		✓		5.51
Saltwater paspalum		✓		5.53
Strawberry dogwood		✓		5.57
Wild kiwifruit	✓	✓		5.65
Wilding conifers	✓	✓		5.66
Willow: Gray and Crack		✓		5.67

Animal species to be managed under the Waikato Regional Pest Management Plan

Animal	Pest (Y / N)	Production Threat	Environmental Threat	Public Threat	Reference in the Plan
Argentine ant	N		✓	✓	6.2.1
Asian paper wasp	Y	✓	✓	✓	6.18.1
Australian paper wasp	Y	✓	✓	✓	6.18.1
Brown bullhead catfish	Y		✓		6.9.1
Canada goose	N	✓	✓		6.4
Common wasp	Y	✓	✓	✓	6.18.2
*Darwin's ant	N		✓	✓	6.2.2
Feral cat	Y		✓		6.6
Feral goat	Y	✓	✓		6.7
Feral pig	Y**	✓	✓		6.8
Gambusia	Y		✓		6.9.3
German wasp	Y	✓	✓	✓	6.18.2
Hedgehog (European)	Y		✓		6.5
Koi carp	Y		✓		6.9.2
Lesser banded hornet	N		✓	✓	6.19.1
*Little fire ant	N	✓	✓	✓	6.3.1
Magpie	Y		✓	✓	6.10
Median wasp	N		✓	✓	6.19.2
Mustelids: ferret, stoat, weasel	Y	✓	✓		6.11
Perch	N		✓		6.9.5
Possum	Y	✓	✓		6.12
Rabbit	Y	✓	✓		6.13
Rainbow lorikeet	Y		✓		6.14
Rats	Y		✓	✓	6.15
Red imported fire ant	N	✓	✓	✓	6.3.2
Rook	Y	✓	✓		6.16
Rudd	N		✓		6.9.7
Tench	N		✓		6.9.6
*Tropical fire ant	N	✓	✓	✓	6.3.3
Wallaby	Y	✓	✓		6.17
Wild deer	Y**	✓	✓		6.20
Wild goldfish	Y		✓		6.9.4
Wild red-eared slider turtle	Y		✓		6.21
*Yellow crazy ant	N	✓	✓	✓	6.3.4
Yellow flower wasp	N		✓	✓	6.19.3

* Although these ant species are not yet in the Waikato region, they are harmful animals that could have considerable negative impacts on the region's biodiversity.

**Only within the Hunua Ranges Pest Management Area.