Fernhill Forest

Owned by
United Forestry Group Ltd

For the period Sept 2018 – Aug 2023

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1. Introduction

Foundation Principle

United Forestry Group 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.

United Forestry Group 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.

The Landscape Context

2. The Forest Land

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 on certificate of titles as follows:

Identifier	Legal Description	Area (ha)
WN12A/1411	Part Deposited Plan A/1606 and Part Section 54 Horokiri Valley District	46.9784
17138	Lot 2 Deposited Plan 304212	50.4630
WN389/200	Edged Green Deposited Plan 8760	140.4983
WNA1/335	Part Lot 5 Deported Plan 8106	143.5850

The tenure is freehold**.**

Forests & location

Fernhill Forest is located off Fernhill Drive / Flightys Road, which in turn are located in the Moonshine Valley, Porirua, Wellington. Internal forest roads provide access to all parts of the forest.

The location of the forest in relation to potential markets, as well as the forest's location within the wider Wellington Region, is listed in Table 1 below, and shown in Map 1.

Table 1. Distance from forest to log markets

Potential Market or Export Port	Distance from Forest (km)	Log Market Type
Wellington Port	30	Export
Featherston	40	Domestic Sawlog
Masterton	75	Domestic Sawlog
Levin	83	Domestic Sawlog
Foxton	93	Domestic Sawlog, Posts & Poles
Dannevirke	180	Pruned Sawlog

Topography

The regional topography incorporates the steep, high, dissected hills and mountains of Tararua and Rimutaka Ranges, rising to 1,571m in the central Tararua Range (Mitre Peak), heavily faulted and broken by major rivers with steep hill slopes dropping to small river flats. Many rivers are gorged near the foothills of the area, with some valleys in central Tararuas possibly being of glacial origin. The southern coastline includes the uplifted beaches of Turakirae Head.

Soils

Fernhill Forest resides in an area where steepland soils (from greywacke geology) form mainly shallow, stony and strongly leached to podzolised soils with low natural fertility. The land is mainly in forest or induced scrub and gorse and there are small areas of shallow stony alpine soils on mountain tops.

At lower altitudes with lower rainfalls the soils become less leached and more fertile. The hill soils of the area range from moderately leached with yellowish brown, well-structured silty subsoils developed under hardwood forest to strongly leached soils with compact, pale coloured impermeable clayey subsoils formed under beech.

Deep silty, well drained soils from Pleistocene drift or loess also form under moderate rainfalls. With increasing altitude and rainfall, soils become more strongly leached, with poorer drainage and peaty topsoils.

Climate[1,2]

The climate and weather of the Wellington region is characterised by strong variations in space and time, and strongly influenced by the presence of the Cook Strait and the rugged local topography. In general, the climate of the region is a reflection of the general disturbed westerly flow, with interspersed anticyclones, modified in specific places by the local topography. The region, as a whole, is generally sunny and windy compared with other parts of New Zealand.

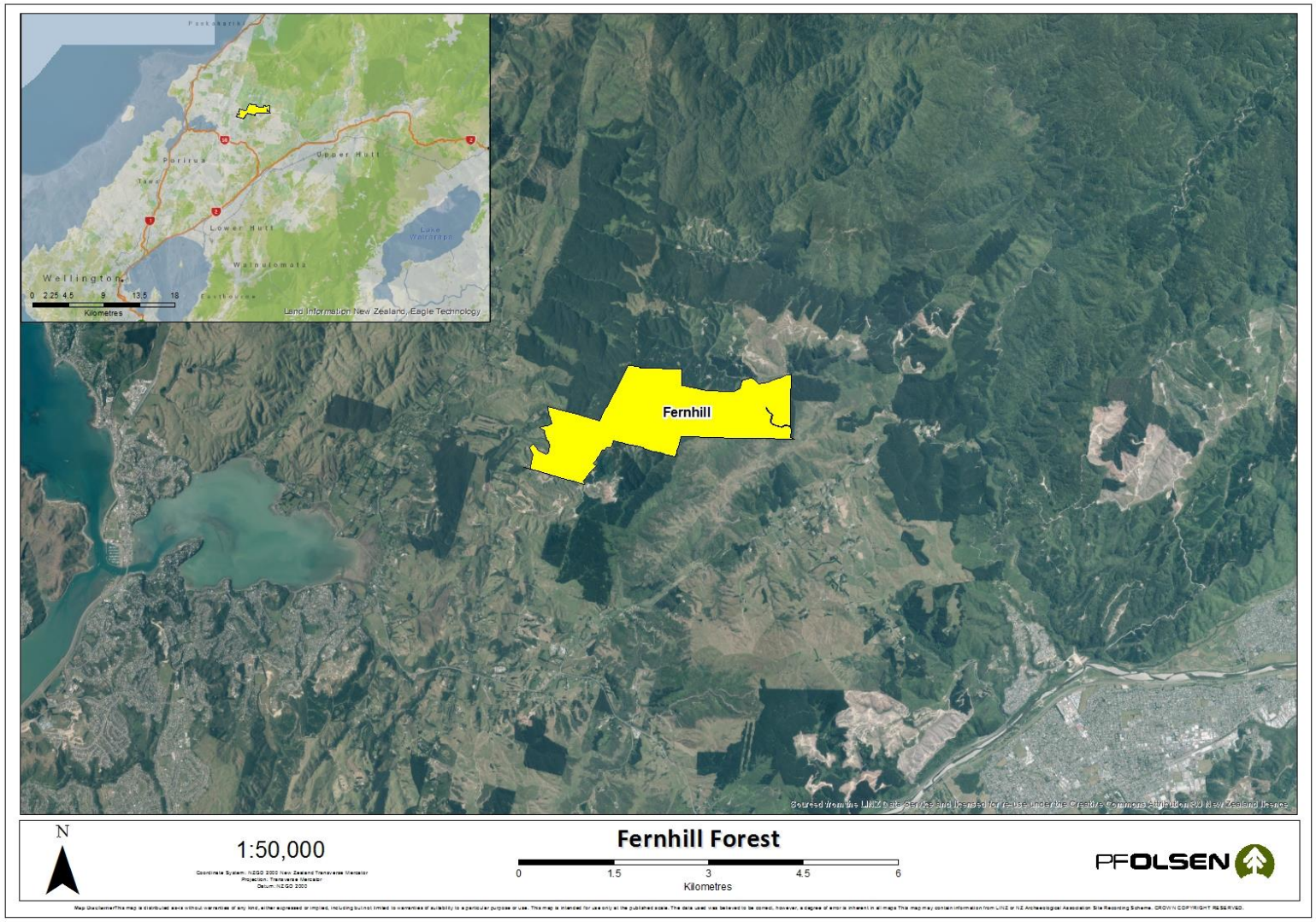
Westerly winds predominate, with gale force winds common. Low cloud covers the ranges for prolonged periods. The area experiances high rainfall, ranging from 1,600 mm p.a. at the lower altitudes where fernhill forest is located, to 8,000 mm and occasionally as high as 10,000mm in the central Tararua Range. Some high intensity rainfalls are recorded.

Temperature: The mean annual temperature is around 11 to 14 °C.

[1] Chappell, P.R. 2014. The climate and weather of Wellington. NIWA Science and Technology Series 65, 44 pp.

[2] Department of Conservation. 1987. Ecological Regions and Districts of New Zealand. Booklet to accompany SHEET 3: descriptions of Districts in central New Zealand, from Eastern Wairarapa to Akaroa; also Chathams, not shown on map.

Map 1 - Forest Location Map



3. The Broader Landscape

Ecological Districts

Fernhill Forest is located within the Tararua Ecological District (Figure 1). Prior to significant human habitation almost the total area was forested, the vegetation types reflecting the passage of time since local volcanic activity, with the soils and geology resulting from such periods. Most of the soils within the Tararua District are unfertile due to the moderate to high leachability of the soils. Silver beech dominated in the montane and subalpine forests, while red beech/kamahi forests and rata/kamahi forest dominated the western Tararua foothills. Rimu, Hall's totara and miro are found throughout the District, and hard beech also occurs. In the Rimutaka Range, there were extensive stands of silver beech, hard beech, black beech and some red beech, while the lowland hardwood forests of Rimutaka Range were a complex mosaic of hardwood species with isolated podocarps. Rata/kamahi forest and scrub dominated at lower altitudes, replaced near the coast by manuka, flax and Cassinia.

Subsequent human, and particularly European settlement, saw large areas of the northern Rimutaka Range become covered in gorse following fires which spread from land clearing. Areas of lowland grassland in the Rimutaka Range are also typically a result of land clearing and wildfires. Pockets of plantation forests can be found throughout the district.

Introduced mammals include red deer, goats, pigs and possums, sheep, rabbits, hares.

The Fernhill Forest is located within this context, surrounded on two sides by other plantation forests. The remaining boundaries consist of farmland, lifestyle blocks and urban subdivisions. In this context, Fernhill Forest, and its associated small indigenous reserves, will only provide modest ecological and biodiversity service. However, Fernhill will provide soil erosion and water quality services to the benefit of the Pauatahanui Inlet and Stream.

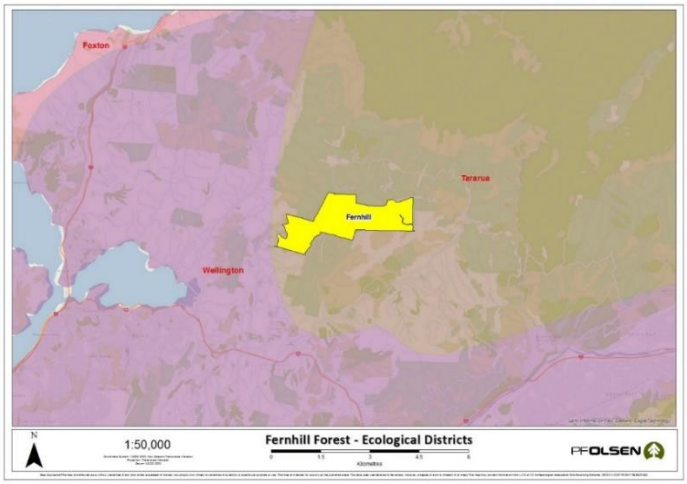


Figure 1. Fernhill Forest Ecological District

Protective Status

Table 2 shows vegetation types as required by the FSC National Standard for Plantation Forest Management in New Zealand revised in 2013.

Table 2. Protective status of the ecological landscape

LENZ Classification	C2.1	F1.4	F7.2
Original (pre-Maori) area of ecosystem type	237,151 ha 100 %	290,292 ha 100 %	558,709 ha 100 %
Natural ecosystem area remaining	10,197.5 ha 4.3%	177,658.7 ha 61.2 %	188,843.6 ha 33.8 %
Proportion of remaining natural ecosystem under protection	1,794.8 ha 17.6 %	56,317.8 ha 31.7 %	104,997.1 ha 55.6 %
Area of ecosystem type under protection by certificate holder	0.6 ha 0.01 %	25.3 ha 0.01 %	35.6 ha 0.03 %
Protected areas as a % of management estate	61.5 ha 17 %		
Protected areas as a % of the aggregated Group Scheme management estate by (Tararua) Ecological District	61.5 ha 100 %		

Historic and Cultural Heritage sites

Records of known archaeological and historical places are maintained in the NZ Archaeological Association (NZAA) Site Recording Scheme website Archsite NZ[3]. PF Olsen subscribes to the system to receive up-to-date data on all sites in its managed estates. Additionally, the Archaeological Site Probability model published by the Department of Conservation[4] 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.

Currently, there are no known archaeological sites within Fernhill Forest.

[3] http://www.archsite.org.nz/

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

Threatened Environments Classification

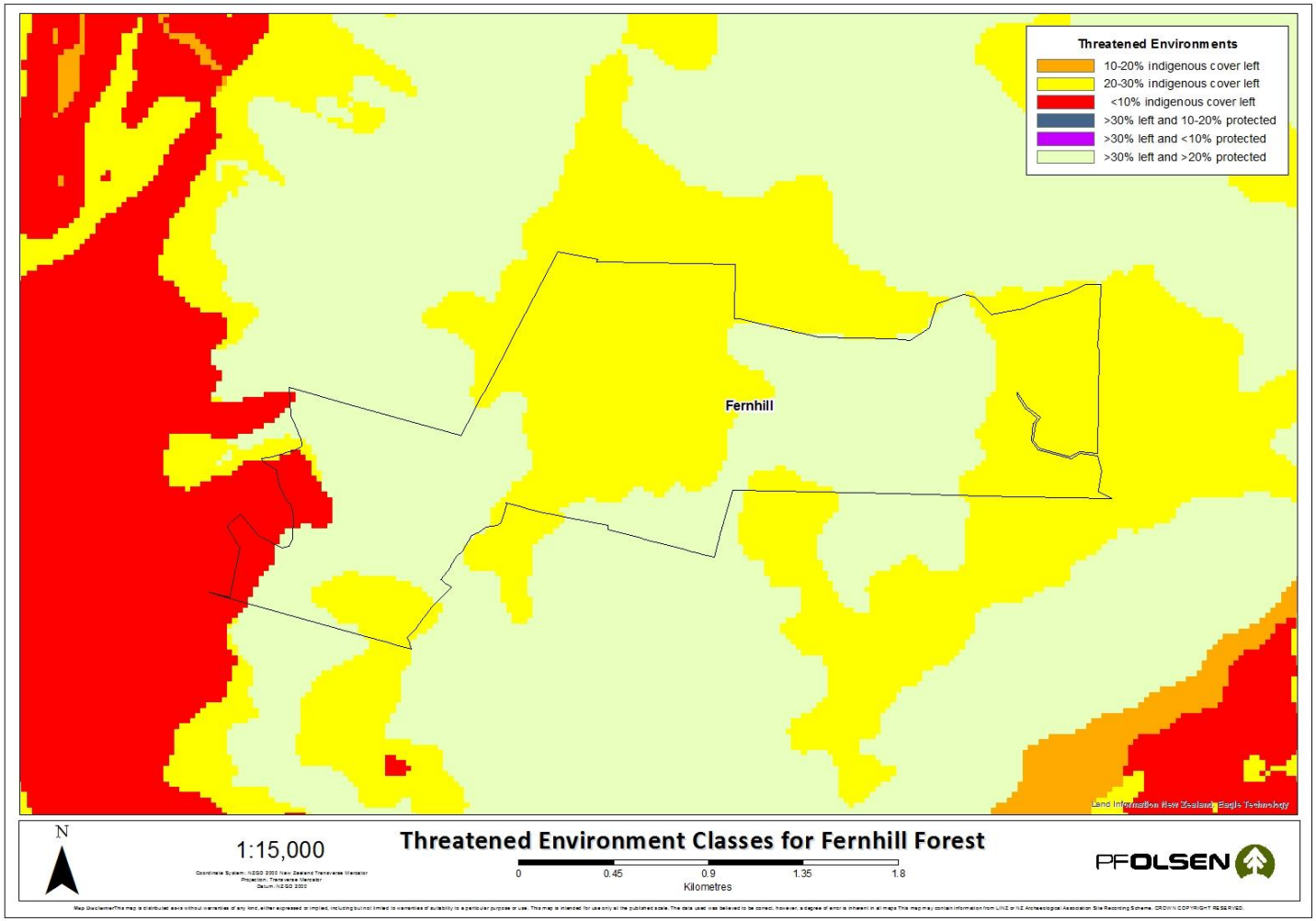
The Landcare Threatened Environments Classification (TEC) is an indication of how much indigenous vegetation remains within particular environments, its legal protection status, and how past vegetation loss and legal protection are distributed across New Zealand's landscape. The TEC is a combination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

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

The TEC models environmental gradients to predict original pre-habitation vegetaton type 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 locations that if occupied by indigenous cover, are likely priorities for formal protection against clearance and/or incompatible land uses, and for ecological restoration to restore lost species, linkages and buffers.

While Fernhill Forest is predominantly made up of two of the lesser threatened environment classes (> 30% left and >20% protected; 20 – 30 % indigenous cover remaining), the western end of the forest displays a highly threatened environment (< 10% indigenous cover remains) that currently is occupied by a very small area of modified indigenous vegetation.

Map 2. Forest Ecological Context



4. Socio-economic profile and adjacent land

Forest history

Fernhill Forest was initially established for the purpose of soil conservation on land that had proven unproductive for farming. The forest has had several owners, and is currently owned by United Forestry Group Ltd.

Current social profile

Fernhill Forest is situated in a highly populated region, that contains 4.5% of New Zealand's total population, and is home to New Zealand's third largest city. Increasingly, urban development is encroaching on rural areas, including the areas forests. This is due to the growth of both the overall population and the growth of Wellington City. With 43.9% of Wellington's population consisting of families with children, 59.1% of the population owning their own homes, and with median weekly rent prices increasing, there is rising pressure to open up land for housing development. In Fernhill Forest's case, there are existing housing developments and new subdivisions along the western boundary of the forest, which will place increased pressure on the forest, its management and it's social licence to operate, due to the increased public scrutiny.

Fernhill was planted with the primary aim of providing financial return to the business owners via export of logs to wellington port. There is dispersed forest products processing and permanent forestry harvesting infrastructure in the Wellington Region.

Table 3. Key statistics as summarised from 2013 Census[5] data

Census Category	Wellington	NZ
Ethnicity: European	76.4%	74.0%
Ethnicity: Māori	7.9%	14.9%
Formal qualifications	91.1%	79.1%
Unemployment	6.5%	7.1%
Dominant occupation	Professional	Professional
Median income	$37,900	$28,500
Family with children	43.9%	41.3%
Internet access	86.6%	76.8%
Home ownership	59.1%	64.8%
Employed in agriculture, fishing & forestry	0.2%	6.5%

Associations with Tangata Whenua

As freehold tenure, the land has no direct association with Tangata Whenua unless archaeological remains were discovered. The iwi to consult in such circumstances are Ngāti Toa Rangatira.

[5] http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-about-a-place.aspx?request_value=14438&parent_id=14322&tabname#14438

Tenure & resource rights

Further information about this land can be found on the Maori Land Online website.

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 4 lists the forest neighbours and their primary activities. Some or all of these parties should be consulted when operations are proposed in forest areas adjacent to their boundaries.

Table 4. Current forest neighbours

Owner/Occupier	Contact Details	Address	Location (See Map 3)	Activities
Greater Wellington Regional Council			Northern Boundary	Forestry
Daniel Scotson, John Scotson and Kylie Richards			Eastern Boundary	Forestry & Farming
Paul and Shirley Harris			South-eastern Boundary	Farming
Heather Phillips			Southern Boundary	Farming
KNK Holdings Ltd (Kapil Maheshwari)			Southern Boundary	Forestry
Jair Valley Developments Ltd C/- Husdson Taylor Charted Accountants Ltd			Western Boundary	Sub-division
G.E.D. Investments Ltd (Gerard and Elizabeth Donnelly)			Western Boundary	Lifestyle

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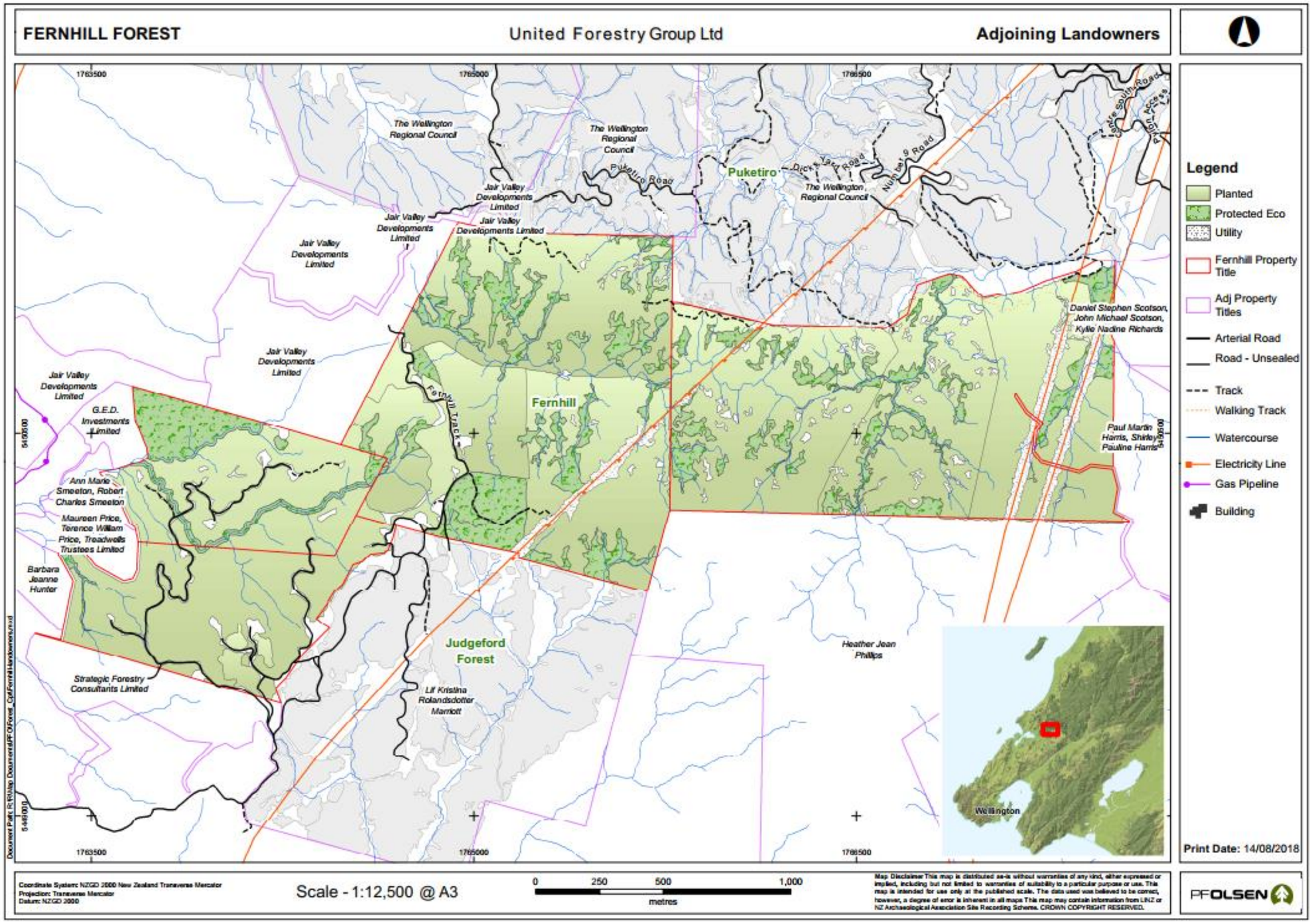
Owner/Occupier	Contact Details	Address	Location (See Map 3)	Activities
Ann Marie and Robert Smeeton			Western Boundary	Lifestyle
Maureen and Terence Price Treadwells Trustees Ltd			Western Boundary	Lifestyle
Barbara Hunter			Western Boundary	Lifestyle
Strategic Forestry Consultants Ltd (Michael Duggan)			Southern Boundary	Forestry

Map 3 – Fernhill Forest Neighbours



Regulatory Environment & Risk Management

5. The Regulatory Environment & Risk

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 forests.

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 type 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 (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. The RMA effectively delegates much of the rule development and enforcement to local government organisations.

Many individual Council rules will now be superseded by a new instrument under the RMA, the 'National Environmental Standard for Plantation Forestry' (NES-PF), which came into effect on 1 May 2018. The NES-PF is designed explicitly to assist streamlining, efficiency and consistency in the application of environmental law to the forest industry (see next section).

The organisations relevant to the Fernhill Forest are listed in Table 5 and contact details for the councils is shown in Appendix 1

Table 5. Regional and District Councils under Fernhill Forest

Regional Council[6]	District Councils [7]
Greater Wellington Regional Council	Porirua City Council

Under the RMA, each Council has its own planning documents and associated rules that have been developed through public process. Some forestry operations not covered by the NES may be required to comply with the rules relevant to the Council area in which the operations are to take place.

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).

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[6] Regional Councils responsible for soil conservation and water and air quality issues
[7] District Councils responsible for land use and biodiversity issues

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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 Fernhill Forest, Table 6 indicates the proportion of the productive 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 6. ESC Classes (Erosion Risk)

	Low	Moderate	High	Very High	Very High (8e)	Undefined
Area (ha)	231.94	149.79	-	-	-	-
Area (%)	60.8%	39.2%	-	-	-	-

Heritage New Zealand Pouhere Taonga Act 2014

The Heritage Pouhere Taonga Act 2014 provides for the management and protection of archaeological sites. Under the HNZPT Act it is an offence to modify or destroy an archaeological site without first obtaining an authority (consent) from Heritage New Zealand Pouhere Taonga.

It is the landowner's responsibility to identify any archaeological sites on their land prior to undertaking any work which may disturb or destroy such sites. If a site is found or suspected on any block, protocols specified in PF Olsen's Environmental Management System, and any others specifically developed in conjunction with Heritage NZ, archaeologists and Iwi or other stakeholders, will be observed and the necessary Archaeological Authorities obtained with Heritage NZ.

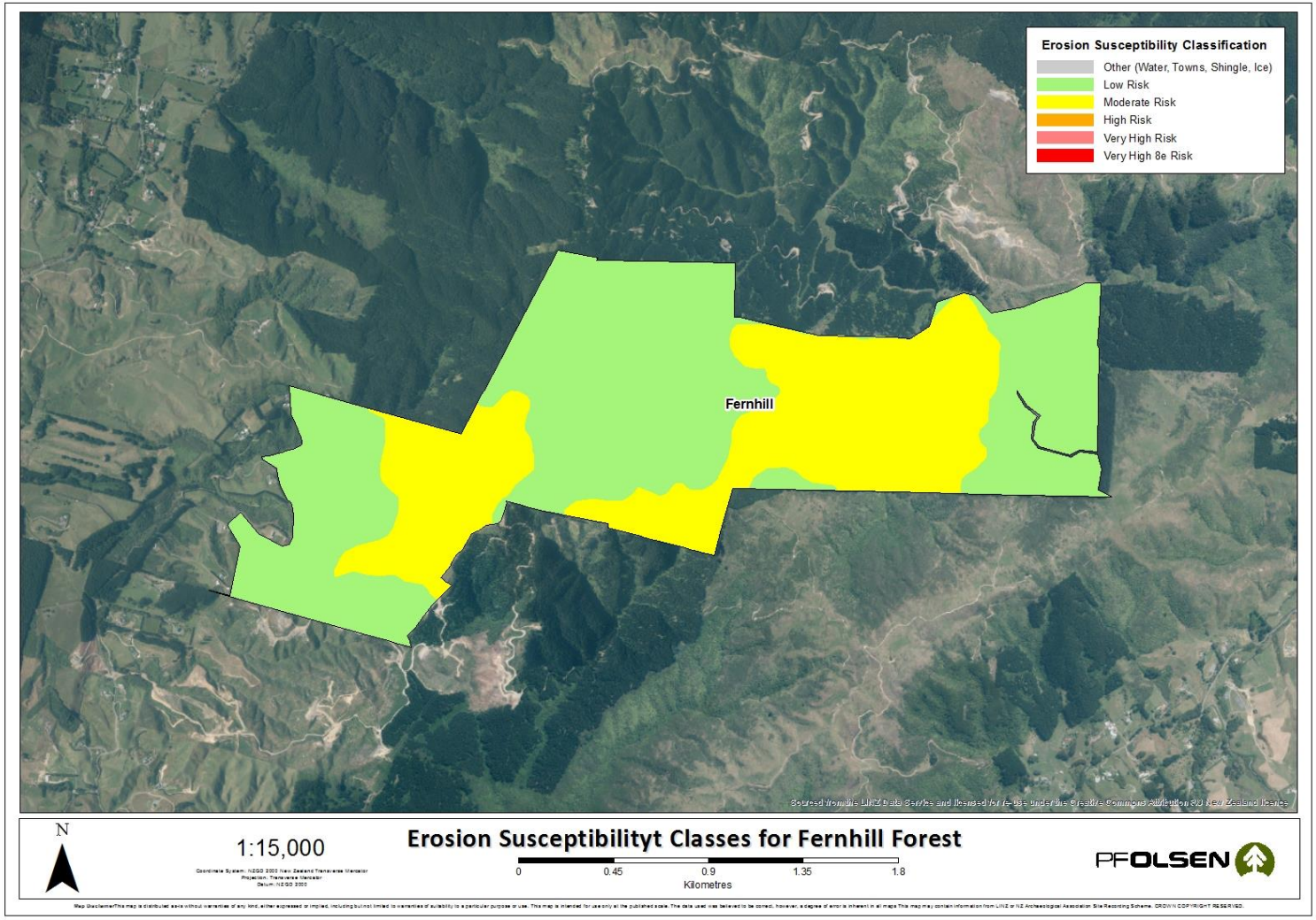
These responses may include, but are not limited to:

- 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, notify Heritage NZ and engage experts if sites are discovered during operations.

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. Updated checks for any sites will be required before any harvesting or related earthworks commences.

Consents & authorities held	There are currently no resource consents or archaeological authorities held that apply to Fernhill Forest.
Emissions Trading Scheme	Forests in New Zealand are governed by rules related to New Zealand's Climate Change Response Act (CCRA) to reduce the nation's carbon footprint and contribution to associated climate change. Fernhill Forest was planted prior to 31st December 1989. As such Fernhill forest is not a 'Kyoto Compliant' forest and is not a participant in the NZ Emissions Trading Scheme. However, at harvest, these stands can be subject to a deforestation liability equivalent to the tonnes of CO_2 projected to be released from decomposition of the forest at a unit financial value determined by the internationally traded emission units. This liability is payable if the forest is not replanted or, if left to regenerate naturally, does not achieve the regulated heights and stocking densities.
Other relevant legislation	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 2.

Map 4 – National Environmental Standard Erosion Susceptibility Classes in Fernhill Forest



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 United Forestry Group Ltd retains credible access to its markets.

United Forestry Group 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 excecution 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

Fernhill Forest has three power lines, plus supporting pylons, that fall within the forest boundary. These are owned, operated, maintained and developed by Transpower (a New Zealand state-owned enterprise). Risks around the powelines and pylons 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.

Fire

Fire is always a risk to the forests, and this risk is managed through:

- Protocols to restrict work hours or to stop work in periods of extreme fire risk.
- Annual auditing and regular monitoring of contractors' fire prevention and first response equipment prior to fire season each year.
- Maintenance of trained personnel and fire suppression equipment.
- Protocols for pooling of resources as a first response to fires under the leadership of the relevant Rural Fire Authority.

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.

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 United Forestry Group 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, cultural & archaeological 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 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** / 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. These are summarised in Appendix 3.

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.

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At a high level, 'risks' are presented as consuming services summarised for a typical plantation life cycle in Appendix 4. As a broad assessment over the total Fernhill Forest, the **potential** for adverse impacts across the range of operations and forest sites is indicated in the Environmental Assessment matrix below (Table 7), which summarises the identified risks across 'key management aspects'. 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 7. Risk assessment for key aspects involved in forest management activities

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

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 Fernhill Forest are:

- Pesticides
  - Herbicides: for commercial and ecological weeds;
  - Fungicides: for forest fungal disease control ; and
  - 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 the Health and Safety Manual, which is maintained under ISO 9001 certification and incorporate legislative controls under EPA and 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 conditions, temperature, chemical formulation & equipment.
- 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.

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 (Table 8). 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 the table below.

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 8. FSC Highly hazardous chemicals used or potentially used within Fernhill 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
Use subject to Animal Health Board emergency provisions only		
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 Fernhill Forest is not compromised. This encompasses multiple aspects that include:

- Pests and weeds and forest health: can reduce productivity;
- Inventory: to feed into growth & yield estimation, a core step in timing silviculture and formulating the cutting strategy;
- Silviculture: to enhance the value of the resource; and
- 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 Ltd (Map 5). Table 9 shows the estimated net stocked areas of each stand, combined, as well as the area of the forest in reserves.

Table 9. Fernhill Forest area (ha)

Gross Area	Net Stocked Area	Reserves	Unproductive
381.5 ha	291.2 ha	61.4 ha	28.9

Unproductive areas include stocking gaps, roads and tracks, and other small unplanted areas.

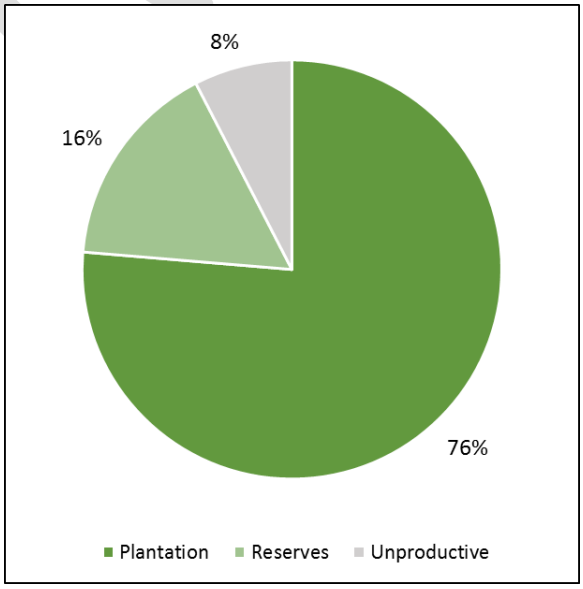

Figure 2. Fernhill Forest area (ha)

Current species

The species grown at Fernhill Forest is *Pinus radiata* (radiata pine). This species has been chosen to best meet the management objectives set out above, and in Section 2, given the characteristics of the forest land as described in Section 3.

There is currently no informaiton available on the treestocks used to establish Fernhill Forest.

Productivity indices

The two most common estimators of the productivity of a site are the Site index and 300 index. Site index is a measure of productivity of a site in terms of height growth of radiata pine at age 20. The 300 index is a measure of productivity of a site based on stem volume growth (mean annual increment) of 300 stems per hectare.

- The average site index for Fernhill Forest ranges between 20 and 22.5. However, the western end of the forest has a slightly higher average site index of approximately 22.5 to 25.
- The average 300 index for Fernhill Forest ranges between 25 and 27.5. While the overall forest has areas of higher and lower 300 index values, these areas are small and scattered across the forest.

Fernhill Forest is about average for site productivity in the general area for forestry sites.

Current crop status

Stands within the forest are of different age classes, ranging from those planted in 1986 (32 years old), to those more recently planted in 2014 (four years old) (Figure 3). There is no measurement data currently available for Fernhill Forest, but Table 10 shows the currentcrop age for each stand within Fernhill Forest.

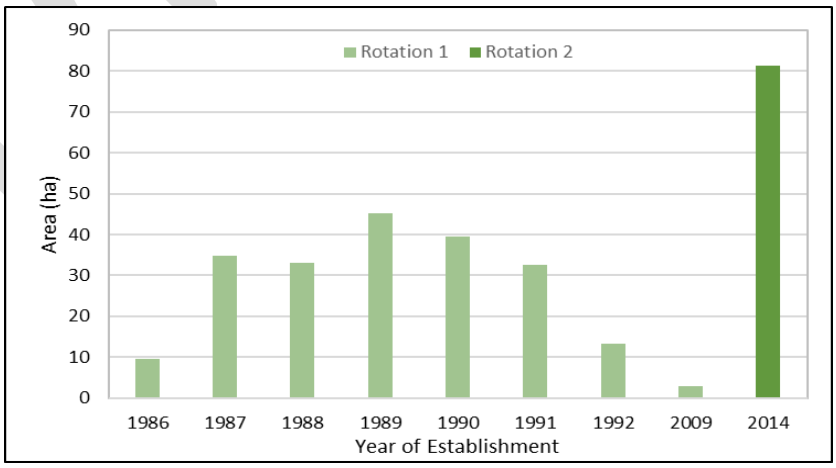

Figure 3. Showing the forest area by year of establishment and by rotation

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Table 10. Current crop age of Fernhill Forest

Stand	Establishment Year	NSA (ha)
1/01	2009	3.0
1/02	2014	81.4
1/04	1986	9.5
1/05	1987	34.8
1/06	1988	33.1
1/07	1989	45.2
1/08	1990	39.6
1/09	1991	32.7
1/10	1992	13.2

9. Commercial Crop Establishment and Silviculture

Introduction

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 asset maintenance.

Forest management goals

The Fernhill Forest 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 archeological and cultural heritage 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.

These goals are further detailed in 'PF Olsen Key Aspects - Objectives, Targets and Monitoring' in Appendix 3.

Crop species

In Fernhill Forest, the main crop species grown is Radiata pine.

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 finger jointing. 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. Radiata pine is also the main focus in terms of research and development. Past research and development has 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

Alternative species may be considered going forward, as current stands are harvested, but any alternatives must meet the objectives of United Forestry Group Ltd, as well as not posing a wilding pine risk.

Unwanted pine spread

All 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.

Restablishment

Re-establishment after the harvest will aim to use high quality treestocks suitable for the site and market. These will be investigated at time of establishment. For radiata, establishment will follow the standard approach of aerial desiccation, planting at 833 sph, aerial releasing, and then thinning the trees down to a final stocking of 550 – 600 stems per hectare over two thinning events at ages seven and 10 (approximately).

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. This may include the extension of an existing wildlife corridor or riparian area by increasing setbacks at the time of crop replanting. A plantation crop is likely to confer beneficial habitat buffering rather than cause adverse effects.

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These considerations are covered by the afforestation checklist and riparian rules contained within the EMS.

Tending

The tending regime executed at Fernhill Forest was a partial pruned regime consisting of two pruning lifts and a waste thinning operation. Going forward, as the existing crop is harvested and replaced, any tending regime for radiata will change to a framing regime (two waste thinning events at ages seven and 10 to achieve a final stocking of 550 – 600 stems per hectare).

Over the duration of this plan there are two planned operations for the current crop:

- Annual Dothistroma checks; and
- Pre-harvest inventory.

Tree nutrition

The soils in Fernhill 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 Fernhill 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. The optimum rotation length (for radiata pine) is expected to be within 25 to 30 years (this may be less for framing or unpruned stands).

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.

The strategy will be reviewed regularly as more or new information arises, such as re-mapping, stand inventory, and research data. This will be used to provide a basis for forward projections on which to plan infrastructure, labour and market access issues as well as environmental and resource consent processes.

Harvesting and related activities are planned over the duration of this plan, with much of the older age class being harvested over the next 5 years.

Planning and preparing for harvest

Forward planning is essential when considering harvesting activities. Harvest planning should ideally commence 2 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

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. Significant road upgrade and new construction will occur over the period of this plan.

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.

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 NorthTech, 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 safety and 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.

Pre-assessment

Pre-assessment is the collection of stand parameters prior to a tending operation. It allows for:

- The calculation of contract rate for tending;
- A final check on the validity of the regime and timing of commencement of operations i.e. DOS targets can be achieved, or crop height is sufficient for pruning lift scheduled.

Sampling intensity is low but pre-assessment does provide good quality information on the work content involved in each tending operation and sets a base price for negotiation.

Quality control

Quality control is carried out during and after a tending operation. The aims of the quality control system PF Olsen have established are to:

- Collect sufficient data to monitor a contractor's performance and correct this if necessary, with minimum delay;
- Collect sufficient quantitative data to provide reliable estimates of the crop state;
- Provide data as input for growth modelling; and
- Provide data for estimating timing of the next tending operation.

PF Olsen's 'Tending Manual' details the procedures to follow for pre-assessment and quality control plotting.

Mapping

All mapping within Fernhill 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.

Forest records

Forest records are essential in monitoring the forest operations by providing a historic perspective to the physical condition of each stand.

Unfortunately, no such records currently exist for Fernhill Forest. Going forwards, detailed records of each stand's silvicultural management history, productivity, inventory and other attribute data will be compiled and maintained in a stand records database and Geographic Information System (GIS). These records will then form the basis for informing silvicultural scheduling, harvesting schedules and other management activities.

Pre-harvest inventory

The principal aim for the pre-harvest inventory is to obtain estimates of recoverable volume by log grade. This information can then be used to develop marketing and harvesting strategies. Pre-harvest inventories will be undertaken when stands reach five years or less from harvesting.

Sampling intensity is targeted to achieve 10% confidence limits on basal area on a stand-by-stand basis. Smaller stands may be aggregated into crop types to achieve this as in mid-crop inventory.

Pre-harvest inventory will be undertaken across the estate over the course of this plan.

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

The 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.

Fernhill Forest predominantly contains degraded scruby areas (consisting of manuka, kanuka, treeferns, bracken and broadleaved hardwoods), and riparian areas. Around a third of the protected ecosystems within Fernhill Forest consist of degraded and/or regenerating secondary forest. All of the protected ecosystems within Fernhill are substantially modified and replications of large, well represented, and well protected forest types present in this and adjacent Ecological Districts.

Ecological management actions are prioritised according to the 'Protection Category' status allocated to the areas from the assessments and classifications undertaken (Table 12). 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.

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Table 10. Protected Ecosystems Management Categories

Protection Category	Primary Management Objective	Activity Level	Monitoring
Passive	Minimise non-essential damage, maintain area	Fire protection	- Area: with adjacent stand assessments
	Observe RPMS obligations	3rd party arrangements regarding pests, apply RPMS	- Pests: to meet RPMS - General forest health survey
Limited	Protect from non-essential damage, maintain area, maintain function (where practical)	Fire protection	- Sample forest condition monitoring
	Observe RPMS obligations	3rd party arrangements regarding pests, apply RPMS. Associated maintenance pest control	- Low level pest monitoring where relevant - Sample related fauna if relevant
Full	Protect from all controllable damage, maintain area & function	Fire protection	- Area monitoring
	Improve quality	Specific management	- Forest condition monitoring
	Observe RPMS obligations	Targeted pest control, 3rd party arrangements regarding pests	- Pest monitoring where relevant - Related fauna monitoring if relevant
Special	Restoration if practical	As above, plus fencing, covenanting, co-management agreements & funding (where practical)	- As above, plus as defined in any restoration agreement

Table 13 details the areas in the special protection category within the Fernhill Forest, categorised by protective function.

Table 11. Protected Ecosystems management categories by function and area

Protective Function	Protective Category			
	Special	Full	Limited	Passive
Riparian Ecosystem				16.4
Terrestrial Ecosystem			11.0	33.8
Total Area (ha)	**-**	**-**	**11.0**	**50.5**

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 set-backs 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 Fernhill Forest are summarised in Table 14. The total length of waterways within the forest estate is 5.21 km.

Table 12. Length of stream by REC class

REC Class	Length (m)	Length (km)
Large_ Mod_ Wet_ Hard	128.19	0.13
Med_Low_Wet_Soft	429.13	0.43
Med_Mod_Wet_Soft	1,887.99	1.89
Med_Mod_Wet_Hard	1,111.26	1.11
Small_Low_Wet_Soft	132.43	0.13
Small_Mod_Wet_Hard	1,518.37	1.52
Total	**5,207.36**	**5.21**

Rare and threatened species

The small indigenous areas within Fernhill are not known, nor expected, to contain permanent habitat for rare or endangered species. It is highly likely that Kereru will and NZ Falcon will make transitory use to the forest habitat, but such usage will form a minor component of use of the larger adjacent forest environment. Long tailed cuckoo may inhabit the area as the plantation forest matures.

Records of sightings and locations will be collected by staff and contractors using the 'iNaturalist app' and linking the sightings into the 'Biodiversity in Plantations project'. This app contains a spatial database of the distribution for every rare species recorded within our plantation forests. A listing of key species of interest is held by all contractors and staff along with species sighting forms and a request to report such information. Over time these sightings will enable the build-up of a spatial distribution picture of species within the forest.

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There is a possibility that native Bats may utilise the central river /riparian valley system and "bat detector" box surveys will be undertaken for these. Advice will also be sought as to whether lizards may be present and surveys required.

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.

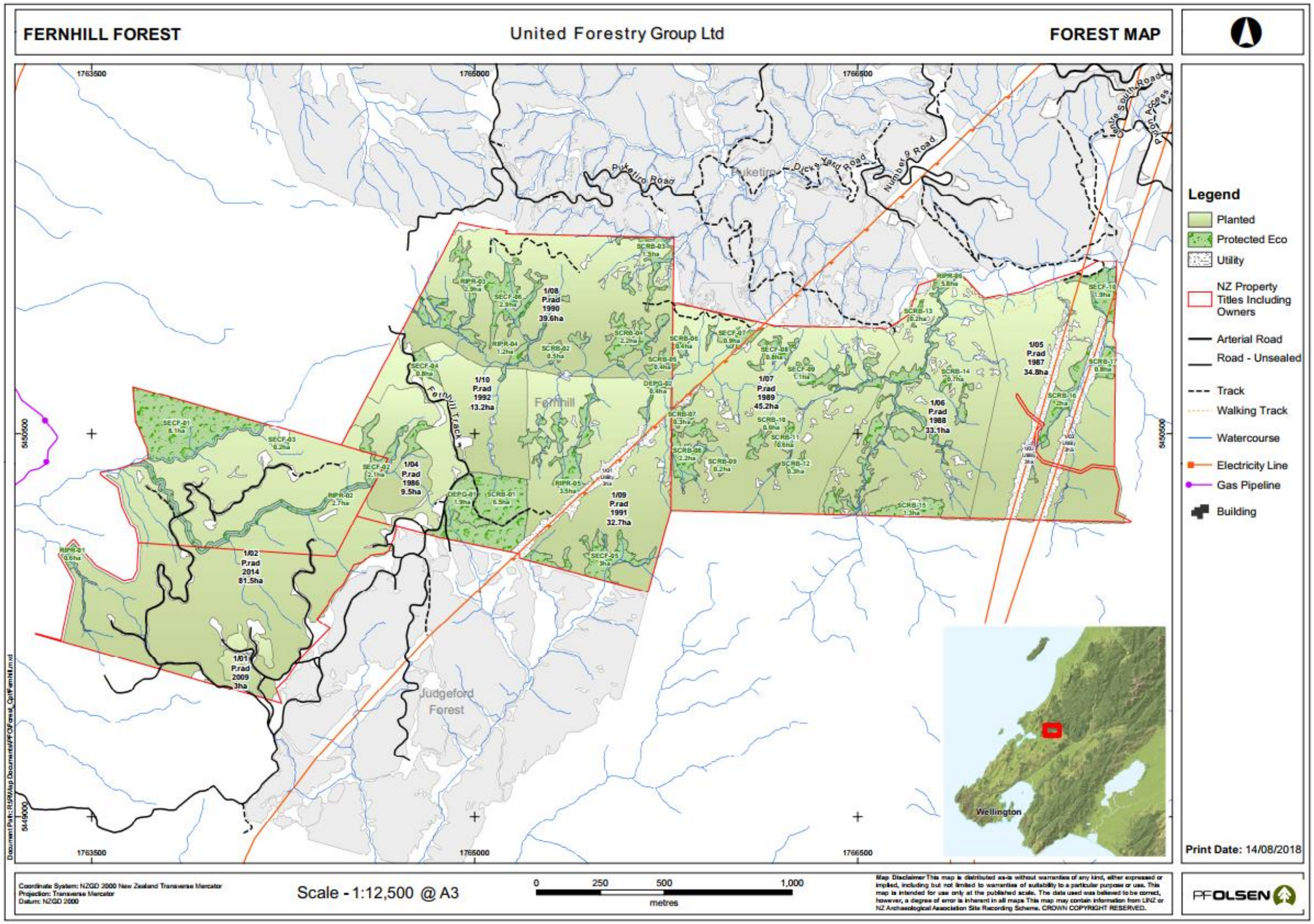
The full list of New Zealand CITES listed species are available in the EMS, or online on the Department of Conservation website.

Anticipated activities

In line with the prioritisation approach described previously, key areas of work related to protected ecosystems within Fernhill Forest over the next 5 years are expected to be:

- Co-operation with neighbours on pest control.
- Maintenance of threatened species records database and integration into industry iNaturalist 'Biodiversity in Plantations' project.
- Weed supression.
- Establishment of wider and rational setbacks from streams that will over time develop into riparian corridors.
- Bat box surveys of the main catchment floor
- A check for lizards if advice deems a presence possible.

Map 5 – Forest Stands Map



13. Property Management and Protection

Statutory pest obligations

Pest management within Fernhill Forest is subject to statutory obligations under the Regional Pest Management Strategy administered by the Greater Wellinton Regional Council.

The strategy applies to both pest plants and animals and categorises them, in terms of management objectives. The categories, objectives and land owner obligations are summarised the Regional Pest Management Strategy Plan in Appendix 5. 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 Fernhill Forest.

The major plant species potentially threatening production values within the forest can be seen in Appendix 5.

Animal pests

The PF Olsen Integrated Pest Management provides guidance on application and execution of the PF Olsen Ltd Environmental Management System (EMS) for pest control and chemical use.

The main animal pest in Fernhill 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, which can impact the trees at the time of establishment.

Animal pests in Fernhill 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 with in the forest area and on neighbouring land, where required.

Insects and fungal disorders

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 though silviculture by timely thinning and pruning operations, which increases air movement and lowers humidity levels.

Pest control

Plant pests

When controlling plant pests, chemicals are applied in keeping with all legislative and safety requirements and with industry best practice. Herbicides are used to desiccate most harvested areas prior to re-establishment or land handback to reduce weed competition. Re-established trees are also released with another chemical application where necessary during the first one to two years after establishment.

Animal pests

Animal pests are controlled using shooting, trapping or toxins, especially prior to establishment and in the first few years of a tree's life. Only licensed operators are used for toxin control and all legal requirements are enforced. Permits are issued to private/recreational hunters on occasion and these permits require that kill returns be completed after hunting to provide information on animal densities, location and health.

The forest manager will co-ordinate operations with organisations such as the local Regional Council and Department of Conservation to achieve effective and efficient control within the forested area and on neighbouring land where required.

Fungal pests

Dothistroma pini is the most commonly occurring fungal disorder within the radiata pine plantation. This fungus is controlled using an aerially applied copper-based fungicide spray, but only when the infection reaches a critical level. *Dothistroma* can also be controlled through silviculture by timely thinning and pruning operations, which increases air movement and lowers humidity levels.

No control is currently required for other fungal disorders nor anticipated in the older radiata age-classes.

Chemical control

All chemical applications are managed in accordance with PF Olsen EMS, the NZ Standard for agrichemical application, HSNO regulations and the obligations conferred by FSC to manage and minimise the use of chemicals including use of alternatives where available and to manage stakeholder expectations.

As part of the FSC commitments:

- All chemical usage is tracked by active ingredient and application area to enable reporting and monitoring of trends and is reported on an annual basis.
- PF Olsen is an active participant in research into chemical reduction, efficacy and safety issues related to the 'restricted use' derogations applied by FSC to various activities pursuing biological control agents.
- No chemicals classified by FSC as 'Highly Hazardous' are used other than under the terms of any derogations applied by FSC.

Fire prevention and control

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

1. Having an effective tactical plan developed in conjunction with the local Fire and Emergency New Zealand (FENZ) team;
2. A close link with the local FENZ personell and an understanding of equipment and trained manpower requirements;
3. Active prevention measures which include restrictions on allowable access, fire prevention signage, publicity when fire danger prevails, access to adequate water sources, and if required constructing and maintaining firebreaks;
4. Effective fire reporting communications systems, mapping, and tactical plan alert procedures;
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

FENZ has been created under the Fire and Emergency NZ Act which has repaced the previous legislation "Forest and Rural Fires Act". This has negated the need for a Forest and Rural Fire cover extension to public liability insurances as this organisation will be first response in the event of a fire.

Public liability insurance

It is recommended that United Forestry Group Ltd maintain public liability insurance cover, to indemnify against unforeseen adverse activity both within the forest area and adjoining land tenure. In the case of fire spreading from Fernhill Forest onto adjoining land, Fernhill would be liable for the firefighting costs and any damage to property.

United Forestry Group Ltd currently hold public liability insurance.

PF Olsen, as the management agency, also carries comprehensive insurance against such issues. All contractors working in the forest must also maintain a level of cover approved by PF Olsen and provide regular verification of currency of policies.

Fire insurance

Regarding the location of the forest and the high public activity around the fringes, there will always be the potential for fire. If a fire originates within the forest, the owners will ultimately be liable for suppression costs. A major fire may cost many thousands of dollars to extinguish, with the main costs being the use of heavy machinery, helicopters, and manpower. If fires are deliberately lit, and perpetrators identified, cost recovery by FENZ will occur.

Insurance for Fernhill Forest is held by United Forestry Group Ltd. The current extent of cover is:

- Firefighting cover (the costs of fire suppression)
- Crop re-establishment cover

United Forestry Group Ltd should liaise closely with the forest manager at the time of fire insurance renewals and if necessary instruct the forest manager to keep premiums paid up.

Other Benefits from the Forest

14. Recreation, Forest Products and Other Special Values

Introduction

Forest plantations can provide non-timber forest products and special values that enhance the economic wellbeing 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.

Environmental and social cost-benefit analysis

Forests can deliver numerous social and environmental products, both positive and negative to varying degrees. These non-timber products can be difficult to quantify, unlike financial costs and benefits.

Table 15 rates the relative positivity and negativity of the more common social and environmental products produced by Fernhill Forest relative to the most likely alternative primary production system, pastoral dry stock farming. A high-level generalised analysis of provisioning and consuming services related to forest management is shown in Appendix 4.

Table 13. Environmental and social cost-benefit analysis of key non-timber products & services

Environmental or social product	Increasingly negative				Neutral			Increasingly positive			
	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Soil stabilisation										✓	
Erosion/soil loss					HP						MR
Water quality				HP							MR
Riparian shading					HP					MR	
Water quantity					MR	HP					
Carbon sequestration			HP								✓
Native wildlife habitat									✓		
Threatened fauna						✓					
Native fish							✓				
Air quality					HP		MR				
Native reserve protection									✓		
Landscape/visual			HP					MR			
Recreation								✓			
Commercial forest use										✓	
Firewood											HP
Local employment				MR					HP		

NOTE: where the ratings differ throughout a rotation, 'MR' is used to indicate the mid rotation (growing) stage of the forest, and 'HP' refers to during or post-harvest.

Recreational usage

All access to Fernhill Forest is controlled through a permit system; though this control is sometimes delegated to some (usually hunting) clubs with Iwi affiliations and customary right usage of their lands or otherwise strong controls over membership.

Primary requirements in management of such forest usage are:

- Access subject to non-conflict with current operations and any other safety requirements;
- Acceptable fire danger status;
- Access provided to defined areas other than those freely open to the public;
- Appropriate liability and fire insurance to be carried by permittees; and
- Forest usage rules to be adhered to.

Non-timber forest products

The primary commercial non- timber (timber and pulp) uses arising from the forests are:

- Sites for apiarists.
- Commercial firewood dealers who may be licensed to pick up low grade residues for resale to domestic households.
- Permitted collections of pine cones for community fundraising events.

None of these products hold any forest certification status. Currently Fernhill Forest is not producing or developing non-timber products, but this may change as the existing crop is harvested and a new crop is established.

Other special values

In the regional landscape context, Fernhill Forest's plantations and indigenous ecosystems in combination provide well-defined 'environmental services'. These include:

- Enhanced water quality, and buffering of regionally significant water bodies (including the Te Awarua-o-Porirua Harbour) from agricultural, urban generated nitrification and sedimentaion;
- Soil stabilisation and conservation;
- Providing a buffer against flooding during storms;
- Temperature moderation in waterways for maintenance of aquatic life including native species such as longfin eel and the quality of water in the Hutt sports fishery;

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- Enhance wildlife and plant habitat leading to increased biodiversity;
- Expanded habitat opportunities for some declining and or threatened fauna; and
- Carbon sequestration and buffering of the effects from a nationally adverse carbon generation footprint.

In recent times some of these environmental services have acquired quantifiable and significant financial value (nitrogen and carbon in particular).

Over the term of this plan, the regulatory environment will continue to be actively monitored and where possible efforts made to secure the introduction of properly structured market mechanisms to ensure forestry is not dis-incentivised, relative to other land uses.

Other environmental services will continue to be supplied or enhanced based on good corporate citizenship and responsible environmental management.

Public access roads

There is one section of unformed public road that originates in the Hutt valley and traverses across farmland to the SE corner of Fernhill forest before following a circuitous route into the forest to a dead end a little beyond major powerline corridors. Though not a practical route, by law the public can walk this route and closure, if required for safety reasons, must be organised through the local territorial authority.

The Walking Access Commission website[8] can be used to view the location of this route. Any users are expected to abide by the "Outdoor Access Code" published by the Walkign Access Commission[9].

There are also several public roads that are adjacent to Fernhill, including Fernhill Drive and Flightys Road. Any members of the public seeking access to Fernhill forest via these routes must follow all road, track and forest signage, and will require a permit.

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[8] https://www.wams.org.nz/wams_desktop/index.html
[9] http://www.walkingaccess.govt.nz/walkways-and-access/outdoor-access-code

Looking Ahead

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 as and when required and are also, where appropriate, made publicly available through the PF Olsen webpage.

Values monitored

Management inspections are undertaken regularly. Table 16 shows the direct forest monitoring framework implemented and applicable to Fernhill Forest.

Table 14. Environmental process monitoring framework

Monitored Element	Components	Data Source	Data medium	Reporting / Website Frequency
Chemical Usage	- A.I Usage - Area Overuse	- Operational Supervisors	- FIPS - Form	- On Demand - Annual
Client Satisfaction	- Post-operation client survey	- Clients	- Survey Form	- Post-operational - Annual
Consultation Activity	- Complaints - Other Interactions	- Operational Supervisors - Planners	- FIPS - Form - Meeting Minutes	- Annual - Annual
Environmental Incidents	- Incident Number - Categories	- Operational Supervisors	- FIPS - Form	- 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 - Form - INaturalist	- 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
Forest Growth	- PSP Protocols - Periodic Inventory - ISO 9001	- Contractors	- Volume Reconciliations - Estate model	- Periodic-annual - Not on web

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Monitored Element	Components	Data Source	Data medium	Reporting / Website Frequency
Forest Health	- Disease & health	- NFH Surveillance Program[10]	- 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	- Noggin	- Monthly - Annual
High Conservation Value Forests	- Condition Trends - Photopoint Monitoring	- Contractors - Supervisors	- Spreadsheet	- Annual
Internal Audit CAR Activity	- Frequency * Category	- Auditors(ees) - Operational Supervisors	- Noggin	- Annual
Log Production	- Total Logs - FSC Certification	- Log dockets at harvest	- Woodtrack	- On Demand - Annual
Operational Monitoring	- Audit Trends - Cause Analysis	- Operational Supervisors	- FIPS - Form	- 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 - GWRC	- Various	- Operational - GWRC S.o.E.

Other monitoring

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. However, the framework around this monitoring is shown in Appendix 3.

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

16. Industry Participation and Research

NZFOA and FGLT

United Forestry Group Ltd's primary means of participating as part of the forest owner community, and to gain industry intelligence and access to research findings is via:

- Membership of New Zealand Forest Owners' Association Inc. (NZFOA) http://www.nzfoa.org.nz/ and representation through its Property Manager on the Executive Board and working committees of NZFOA.
- Payment of a commodity levy (currently 27 cents/tonne or JAS) to the Forest Growers' Levy Trust (FGLT). http://fglt.org.nz/ .The FGLT uses these funds to finance pan-industry good programmes and contracts NZFOA to carry out this work.

Research

A little over 50% of the funds raised by FGLT are allocated to forestry research projects. These funds are supplemented by NZ Government research for industry funds that are bid for on a contestable basis every few years.

Application of the research is via knowledge gained in workshops, uptake by contractors, commercial providers and better genetics. PF Olsen's direct involvement with other research bodies such as FFR contributes to and benefits United Forestry Group Ltd through early application of good ideas and research findings.

FISC

The Forest Industry Safety Council (FISC) was set up in early 2016 following an independent review of safety in the forest industry. FISC is a forum for exchange of safety improvement initiatives, and to develop resources for forest managers and contractors. These resources are primarily delivered via the Safetree website http://safetree.nz/. FISC is financed jointly from FGLT and government, primarily Accident Compensation Corporation (ACC).

PF Olsen's continued support of FISC in the form of senior staff involvement in the OAG and TAG committees ensure United Forestry Group Ltd's interests are considered and that outcomes are understood and applied in practice.

17. Future Planning

Introduction

This plan pertains to the management of Fernhill 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 require a full review of this plan. The next review date for this plan is July 2023.

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.

Associated management plans

Associated with this plan are forest agreement specific plans covering the descriptive and management detail pertinent to each forest. These plans contain primary descriptive data for the specific forest and details of planned silvicultural objectives. These plans are maintained by the investment manager for United Forestry Group Ltd.

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.

Such operational plans and associated budgets are subject to approval by the forest owners 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.

18. Register of Plan Change and Review

Introduction

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

Change	Date	Section/Page

Appendix 1
Contact details for Regional and District Councils with jurisdiction over Fernhill Forest

Council	Phone	Fax	Email	Website
Greater Wellington Regional Council	0800 496 734	04 385 6960	info@gw.govt.nz	www.gw.gotvt.nz
Porirua City Council	04 237 5089	04 237 6384	enquiries@poriruacity.govt.nz	https://poriruacity.govt.nz/

Appendix 2
Other Relevant Legislation

Commercially Relevant Statutes and 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
- 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
- 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

Industry Accords and Codes

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

Appendix 3

PF Olsen Significant Aspects – Objectives, targets and monitoring

PF Olsen Significant Aspects - Objectives, Targets and Monitoring

(within the organisational context)

Economic

Objectives

- Commercial viability
- Valuable forest asset
- Sustainable resource supply
- Sustainable work

Targets

- Appropriate R.O.L
- Maintain and enhance value
- Log grade outturn value maximised
- Sustained product flows and employment
- Appropriate land use

Monitoring

Factor	Frequency	Mode
R.O.L against investment model	Annual	Woodstock
Estate valuation	Annual	Financial
Product flows	Annual	Woodtrack
Plantation area / species / reserve trends	5 yearly	FIPS report / GIS
Log quality audits	Continually	Noggin
Client reporting	Monthly	Written
Independent accounting audit	Annual	Written
Forest growth — PSP's, periodic inventory, ISO:9001	Periodic / Annual	FIPS
Forest health	Periodic / Annual	NFH surveillance program
TQM — CAR system	Continually	Noggin
ISO internal audits (sample)	Annual	Noggin

Legal

Objectives

- Compliance with the letter
- Compliance with the intent

Targets

- Zero non-compliance
  - RMA
  - Heritage New Zealand Act
  - Worksafe
  - Financial
  - Employment
- Professional & transparent
- Valid & fair contracts — all staff and contractors
- Taxes / payment, and royalties paid

Monitoring

Factor	Frequency	Mode
Regulatory Authority / Worksafe inspections	Monthly	Noggin incidents
Resource consents	Monthly / Annual	FIPS
Archaeological Post-Op AEE's	Monthly	Noggin incidents
Enforcement Actions	Ad hoc	Noggin incidents
Incidents—all forms	Continually	Noggin incidents
Master contracts	Continually	FIPS
Accounts	Continually	FIPS
Formal reporting		
• Manager / Client	Monthly	Written
• SMT	Quarterly	Power Point
• Board	Quarterly	Written
• Company meeting	Annual	Power Point
Independent accounting audit	Annual	Written
TQM — CAR system	Continually	Noggin
ISO internal audits (sample)	Annual	Noggin

Social & Cultural

Objectives

- Retain our Licence to Operate
- Respect for our stakeholders, & rights of indigenous people
- Good employer
- Accountable in the community

Targets

- External complaints < 3% of incidents
- Zero unauthorised damage to cultural sites
- Customer rankings rising
- Recognition of transparency and respect in dealings with Tangata Whenua
- Workforce trained and engaged
- Communication to community
- Contractor / staff training

Monitoring

Factor	Frequency	Mode
Environmental incidents	Ad hoc	Noggin
Consultation: Pre-certification & post-operation	As required	FIPS / Meetings
Customer survey	Annual	Form
Complaints — meeting minutes	Ad hoc	Noggin + Notes
Social survey	3 yearly	Form
Staff survey	Annual	Survey Monkey
NorthTec gap analysis, NZQA & other training	Annual	Cloud database
1 full day / year environmental advocate training, including cultural awareness	Annual	FIPS training
Formal reporting SMT	Quarterly	Power Point
Recreational Permits	Annual	FIPS
TQM — CAR system	Continually	Noggin
ISO internal audits (sample)	Annual	Noggin

Health & Safety

Objectives

- Home safe every day
- Drug and alcohol free work
- Culture of care
- Safest forestry company

Targets

- Crew visit increase, year on year
- LTIFR = 3, TIFR = 7
- Drug free, D&A testing 100%
- 100% Safetree signup
- Safe Start-up
- HPI > 90% close-out by due date
- 100% inducted

Monitoring

Factor	Frequency	Mode
Safety Incident Management - Statistics & closeout of HPI	Continually	Noggin
Sentinel (near miss)	Monthly	Noggin
Safety system audits	Rolling Quarters	Noggin
D & A testing	Random	External
Safetree	Annual	
Safe Start-ups	Actual	FIPS
Safety Champs Meetings	Bi-monthly	Written
Central Safety Committee	Bi-monthly	Written
Formal Reporting		
• Manager / Client	Monthly	Written
• SMT	Quarterly	Power Point
• Board	Quarterly	Written
• Company Meeting	Annual	Power Point
Induction Records	As required + 5 yearly	FIPS
TQM — CAR system	Continually	Noggin
ISO internal audits (sample)	Annual	Noggin

Environment

Objectives

- Protect biodiversity
- Protect water
- Minimise erosion
- Responsible chemical use

Targets

- Crew performances > 91—92 % Non Compliance = 0, Marginality <1%
- Skid check / Post op tail <5%
- Zero unauthorised damage to cultural /archaeological sites
- Zero unauthorised damage to key terrestrial ecosystems
- Rare Fauna BPG's applied
- Setbacks on all streams
- Chemical A.I usage
- Protect enhance key ecosystems (where applicable)
- Carbon sequestration
- 100 % inducted

Monitoring

Factor	Frequency	Mode
Operational Environmental Audits	Monthly	FIPS
Skid checks	Quarterly	FIPS
Environmental Incident Management	Ad hoc	Noggin
Rare Species Sightings Database	Ad hoc	FIPS / NatureWatch
Harvest Planning Checklist	Ad hoc	FIPS
Chemical A.I. Tracking & Weed Matching: review & research	Annual	FIPS
Vegetation / Photopoint monitoring (where applicable)	Annual, Tri-Annual	Document
Water quality	Various	Operational / BOPRC
Regional Branch Compliance	Tri-Annual	FIPS + written
Carbon Sequestration	5 yearly	Estate model
EMG Meeting	Annual	Written
Formal Reporting		
• Manager / Client	Quarterly	Written
• SMT	Quarterly	Power Point
• Board	Quarterly	Written
• Company Meeting	Annual	Power Point
Induction Records	As required + 5 yearly	FIPS
TQM — CAR system	Continually	Noggin
ISO internal audits (sample)	Annual	Noggin

TQM & Roving Quality Managers

Executive Management Team

Appendix 4
Significant Aspects of a Plantation Forest Life Cycle

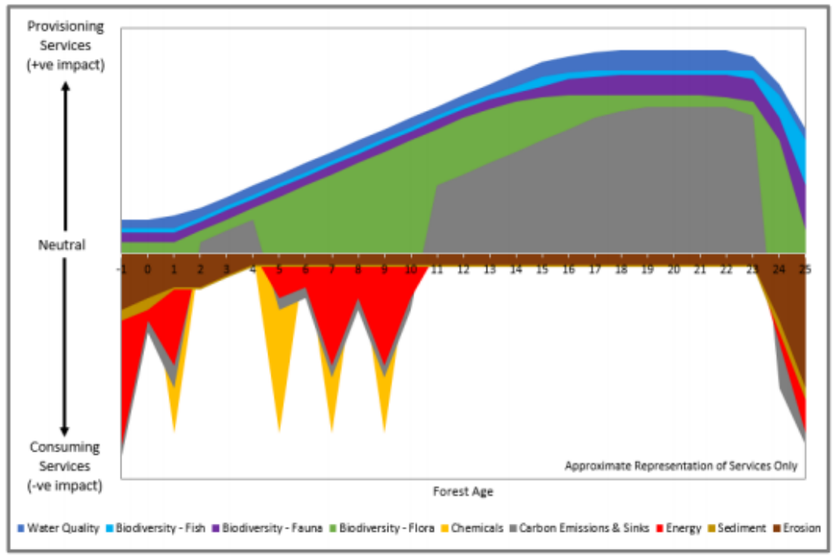
PFOLSEN

SIGNIFICANT ASPECTS OF A PLANTATION FOREST LIFE CYCLE

Provisioning and Consuming Services

Provisioning Services (+ves)

1. **Biodiversity — Fauna:** plantation forests are home to a wide range of native and endemic species, including kiwi, New Zealand falcon, fernbird, weka, kokako, geckos, skinks, frogs, and short- and long-tailed bats.
2. **Biodiversity — Fish:** streams provide habitat for a range of native fish species, including Giant and Banded Kokopu, Long-finned Eel, Koura and whitebait species.
3. **Biodiversity — Flora:** plantation forests host a variety of native plants. Pioneering plants (ferns, coprosmas, manuka etc.) eventually form the sub-canopy layer under the production species. In addition riparian zones, wetlands, native reserves and other natural areas add a native flora component to the overall forest matrix. These are often protected under Regional/District Council plans, the NZ Forest Accord, management agreements, or as part of forest certification schemes.
4. **Carbon sinks:** trees absorb carbon dioxide from the atmosphere and convert it into oxygen. Trees store the absorbed carbon, even after they are harvested.
5. **Water quality:** once canopy closure is achieved the in-stream temperature stabilises. Riparian zones and the plantation trees stabilise the land, reducing and removing excess nutrient loads. This in turn provides a better quality of habitat for fish and freshwater insects.
6. **Clean air**
7. **Employment,** especially at the time of harvest , both within the forest and ancillary services such as transport and processing
8. **Recreation** opportunities such as hunting, walking, mountain biking, hunting, orienteering, horse riding, motor sport events,



Aspect	Provisioning / Consuming Services	Frequency	Impact Level	Control Level	Time of Impact	Control Methods
Biodiversity	Fauna	Low	Variable	Medium	Land prep, roadworks & harvesting	Protection, BEP's, buffer zones, timing of operations, monitoring, species management plans
	Fish	Low	Variable	Partial	Land prep, roadworks & harvesting	Protection, BEP's, buffer zones, timing of operations, monitoring, species management plans, fish passage
	Flora	Low	Variable	Partial	Harvesting	Protection, BEP's, buffer zones, timing of operations, monitoring, species management plans, weed control, remedial/enhancement planting
Ecosystem Health	Pests & Weeds	High	Variable	Medium	Ongoing	Control based on identification of weed/pest and associated threat. Chemical (aerial or ground-based), mechanical, biocontrol, trapping, species/management selection. Research into non-chemical alternatives
	Carbon Emissions & Sinks	Oscillating	Medium	Low	Land prep, silviculture, spraying, roading & harvesting	Use of bio oils and lubricants, try to minimise machine movements, replanting new crop after harvest
	Chemicals	Infrequent	High	High	Land prep & ages 5-10 years	Research into amounts used and chemical types, limit spray drift
	Energy	Medium	Low	Low	Any operation involving machinery	Invest in / research energy efficient machinery and technology
Soil & Water	Erosion	Intermittent	High	High	Until canopy closure (-1 to 5 years), extreme weather events, harvesting	Hydroseeding, mulching, BEP's, appropriate earthwork engineering, check sites after weather events, replanting new crop after harvest
	Sediment	Continuous but Low	Medium	High	Until canopy closure (-1 to 5 years), extreme weather events, harvesting	Use of sediment control traps, appropriate earthwork engineering, check sites after weather events, replanting of new crop after harvest
	Water Quality	Low	Variable	High	Extreme weather events, harvesting	Use of sediment control traps, appropriate earthwork engineering, buffer/riparian zones, protection of wetlands, remedial planting, replanting new crop after harvest
Social	Recreation	Medium	Variable	Medium	Variable, dependent on forest and location	Access provided through forest permit system to ensure user and operational safety. Permits allow monitoring of forest usage and hunting kill returns
	Employment	High	Variable	High	Ongoing, peak at harvest/replant	Seek to provide continuity of employment for high performing contractors, provide training opportunities to engage and retain a professional and capable workforce

Consuming Services (-ves)

1. **Carbon Emissions:** heavy machinery and chainsaws during land prep, thinning and harvesting operations (fuel/oil use)
2. **Chemicals:** *Dothistroma* control and weed control
3. **Energy:** energy is released during any forestry operation involving machinery
4. **Erosion:** caused by harvesting, roading and land prep operations, plus extreme adverse weather events
5. **Sediment:** caused by harvesting, roading and land prep operations, plus extreme adverse weather events

Appendix 5
Greater Wellington - Regional Pest Management Strategy 2002 - 2022

Pest animals (kararehe nanakia) included in the RPMS and their management

Common Name	Scientific Name	Regional Surveillance	Total Control	Containment	Suppression			Site-Led Management				
			Service Delivery	Service Delivery	Service Delivery	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Argentine ant	*Linepithema humile*	✓									✓	
Australian subterranean termite	*Coptotermes acinacoformis*	✓									✓	
Brown bullhead catfish	*Ameiurensis nebulosus*	✓									✓	
Darwin's ant	*Doleromyrma darwinia*										✓	
European hedgehog	*Erinacues europaeus occidentalis*										✓	
Feral cat	*Felis catus*									✓	✓	
Feral deer	*Cervus elaphus, C. nippon, Dama dama*									✓	✓	
Feral goat	*Capra hircus*									✓	✓	
Feral pig	*Sus scrofa*									✓	✓	
Feral rabbit	*Oryctolagus cuniculus*				✓	✓	✓				✓	✓
Ferret	*Mustela furo*										✓	
Gambusia	*Gambusia affinis*									✓	✓	

Common Name	Scientific Name	Regional Surveillance	Total Control	Containment	Suppression			Site-Led Management				
			Service Delivery	Service Delivery	Service Delivery	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Goldfish	Carassius auratus										✓	
Hare	Lepus europaeus occidentalis										✓	
House mouse	Mus musculus										✓	
Koi carp	Cyprinus carpio									✓	✓	
Magpie	Gymnorhina tibicen tibicen, Gymnorhina tibicen hypoleuca								✓		✓	
Norway rat	Rattus norvegicus										✓	
Possum	Trichosurus vulpecula									✓	✓	
Rainbow lorikeet	Trichoglossus haematodus	✓									✓	
Rainbow skink	Lampropholis delicata	✓									✓	
Red-eared slider turtle	Trachemys scripta elegans	✓									✓	
Rook	Corvus frugilegus		✓								✓	
Rudd	Scardinius erythropthalmus										✓	
Ship rat	Rattus rattus										✓	
Stoat	Mustela erminea										✓	
Sulphur crested cockatoo	Cacatua galerita										✓	
Tench	Tinca tinca										✓	
Wasp	Vulpecula germanica; V. vulgaris								✓		✓	
Weasel	Mustela nivalis										✓	

Pest plants (taru) included in the RPMS and their management

Common Name	Scientific Name	Regional Surveillance	Total Control	Containment				Suppression		Site-Led Management				
			Service Delivery	Service Delivery	Biological Control	Boundary Control	Occupier Responsibility	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Alligator weed	*Alternanthera philoxeroides*	✓											✓	
African club moss	*Selaginella kraussiana*												✓	
African feather grass	*Pennisetum macrourum*		✓										✓	
African fountain grass	*Pennisetum setaceum*	✓											✓	
Apple of Sodom	*Solanum linneanum*	✓											✓	
Artemisia	*Artemisia spp.*												✓	
Artillery plant	*Galeobdolon luteum*												✓	
Arum lily	*Zantedeschia aethiopica*												✓	
Asiatic knotweed	*Reynoutria japonica*	✓											✓	
Australian sedge	*Carex longebraciata*	✓											✓	
Banana passionfruit	*Passiflora mixta;* *P. mollisima, P. tripartita*									✓			✓	
Barberry	*Berberis glaucocarpa*												✓	
Bathurst bur	*Xanthium spinosum*		✓										✓	
Blackberry	*Rubus spp. barbed cultivars*									✓	✓		✓	
Blue morning glory	*Ipomoea indica*												✓	
Blue passion flower	*Passiflora caerulea*		✓										✓	

Common Name	Scientific Name	Regional Surveillance	Total Control	Containment				Suppression		Site-Led Management				
			Service Delivery	Service Delivery	Biological Control	Boundary Control	Occupier Responsibility	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Boneseed	*Chrysanthemoides monilifera*			✓	✓		✓						✓	
Bomarea	*Bomarea caldasii, B. multiflora*	✓											✓	
Boxthorn	*Lycium ferocissimum*												✓	
Broom	*Cytisus scoparius*												✓	✓
Brush wattle	*Paraserianthes lophantha*												✓	
Buddleia	*Buddleja davidii*												✓	
Californian arrowhead	*Sagittaria montevidensis*	✓											✓	
Californian bulrush	*Schoenoploectus californicus*	✓											✓	
Cape honey flower	*Melianthus major*												✓	
Cape ivy	*Senecio angulatus*												✓	
Cape tulip	*Moraea flaccida (syn. Homeria collina)*	✓											✓	
Cathedral bells	*Cobaea scandens*									✓			✓	
Chilean flame creeper	*Tropaeolum speciosum*	✓											✓	
Chilean needle grass	*Nassella neesiana*	✓											✓	
Chinese pennisetum	*Pennisetum alopecuroides*	✓											✓	
Chocolate vine	*Chocolate vine*	✓											✓	
Climbing dock	*Rumex sagittatus*												✓	

Common Name	Scientific Name	Regional Surveillance	Total Control	Containment				Suppression		Site-Led Management				
			Service Delivery	Service Delivery	Biological Control	Boundary Control	Occupier Responsibility	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Climbing asparagus	*Asparagus scandens*												✓	
Climbing spindleberry	*Celastrus orbiculatus*		✓										✓	
Cotoneaster	*Cotoneaster franchetti; C. horizontalis*												✓	
Crack and pussy willow	*Salix fragili, S. cinerea*												✓	
Darwin's barberry	*Berberis darwinii*												✓	
Delta arrowhead	*Sagittaria platyphylla*	✓											✓	
Didymo	*Didymosphenia geminata*	✓											✓	
Eelgrass	*Vallisneria spiralis, V. gigantea*		✓										✓	
Elaeagnus	*Elaeagnus x reflexa*												✓	
Evergreen buckthorn	*Rhamnus alaternus*			✓			✓						✓	
German ivy	*Senecio mikanioides*												✓	
Giant knotweed	*Reynoutria sachalinensis and hybrids*	✓											✓	
Gorse	*Ulex europaeus*									✓	✓		✓	✓
Great bindweed	*Calystegia silvatica*												✓	
Gunnera	*Gunnera tinctoria*												✓	
Hawaiian arrowhead	*Sagittaria sagittifolia*	✓											✓	
Hawthorn	*Crataegus monogyna*												✓	

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			Service Delivery	Service Delivery	Biological Control	Boundary Control	Occupier Responsibility	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Hemlock	*Conium maculatum*									✓	✓		✓	
Himalayan honeysuckle	*Leycesteria formosa*												✓	
Hornwort	*Ceratophyllum demersum*	✓		✓			✓						✓	
Houttuynia	*Houttuynia cordata*	✓											✓	
Hydrilla	*Hydrilla verticillata*	✓											✓	
Japanese honeysuckle	*Lonicera japonica*												✓	
Japanese spindletree	*Euonymus japonicus*												✓	
Johnson grass	*Sorghum halepense*	✓											✓	
Lagarosiphon	*Lagarosiphon major*												✓	
Madeira vine	*Anredera cordifolia*		✓										✓	
Manchurian wild rice	*Zizania latifolia*	✓	✓										✓	
Marram grass	*Ammophila arenaria*												✓	
Mexican daisy	*Erigeron karvinskianus*												✓	
Mile-a-minute	*Dipogon lignosus*												✓	
Mist flower	*Ageratina riparia*							✓					✓	
Monkey apple	*Acmena smithii*												✓	
Montbretia	*Crocosmia x crocosmifolia*												✓	

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Moth plant	*Araujia sericifera*		✓										✓	
Nassella tussock	*Nassella trichotoma*	✓											✓	
Nasturtium	*Nasturtium officinalis*												✓	
Nodding thistle	*Carduus nutans*									✓			✓	✓
Noogoora bur	*Xanthium occidentale*	✓											✓	
Old man's beard	*Clematis vitalba*									✓			✓	
Pampas grass	*Cortaderia jubata; C. selloana*												✓	
Parrot's feather	*Myriophyllum aquaticum*												✓	
Perennial nettle	*Urtica dioica (sub spp)*		✓										✓	
Periwinkle	*Vinca major*												✓	
Phragmites	*Phragmites australis*	✓											✓	
Plectranthus	*Plectranthus ciliatus*												✓	
Polypodium (Common polypody)	*Polypodium vulgare*	✓											✓	
Purple loosestrife	*Lythrum salicaria*	✓											✓	
Purple ragwort	*Senecio glastifolius*												✓	
Pyp grass	*Ehrharta villosa*	✓											✓	
Ragwort	*Senecio jacobaea*									✓			✓	✓

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Saffron thistle	*Carthamus lanatus*		✓										✓	
Salvinia	*Salvinia molesta*	✓											✓	
Senegal tea	*Gymnocoronis spilanthoides*	✓											✓	
Silver poplar	*Populus alba*												✓	
Smilax	*Asparagus asparagoides*												✓	✓
Spanish heath	*Erica lusitanica*												✓	
Spartina	*Spartina spp*	✓											✓	
Stinking iris	*Iris foetidissima*												✓	
Sweet pea shrub	*Polygala myrtifolia*			✓			✓						✓	
Sycamore	*Acer pseudoplatanus*												✓	
Tradescantia	*Tradescantia fluminensis*												✓	
Tuber ladder fern	*Nephrolepis cordifolia*												✓	
Variegated thistle	*Silybum marianum*							✓		✓			✓	
Velvet groundsel	*Senecio petasitis*												✓	
Water Hyacinth	*Eichhornia crassipes*	✓											✓	
Wild ginger	*Hedychium gardnerianum; H. flavescens*									✓			✓	
Wild onion	*Allium vineale*												✓	

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Wilding pines	*Pinus spp*												✓	
White bryony	*Bryonia cretica subsp dioica*	✓											✓	
White edged nightshade	*Solanum marginatum*	✓											✓	
Woolly nightshade	Solanum mauritianum		✓										✓	