Forest Enterprise Scotland
Managing the National Forest Estate

Forestry Commission Scotland
Coimisean na Coilltearachd Alba

Dean & Carnock

Land Management Plan

Scottish Lowlands Forest District

Approval date: ***

Plan Reference No: ****

Plan Approval Date: *****

Plan Expiry Date: ******

We manage Scotland's National Forest Estate to the United Kingdom Woodland Assurance Standard – the standard endorsed in the UK by the international Forest Stewardship Council® and the Programme for the Endorsement of Forest Certification. We are independently audited.

Our land management plans bring together key information, enable us to evaluate options and plan responsibly for the future. We welcome comments on these plans at any time.

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CSM 6 Appendix 1b

FOREST ENTERPRISE - Application for Land Management Plan Approvals in Scotland

Forest Enterprise - Property

Forest District:	Scottish Lowlands
Woodland or property name:	Dean & Carnock
Nearest town, village or locality:	Saline
OS Grid reference:	Dean (NT05448798), Carnock (NT04449066)
Local Authority district/unitary Authority:	Fife

Areas for approval

	Conifer	Broadleaf
Clear felling	3.49 ha	
Selective felling	31.8 ha	
Restocking	2.97 ha	
New planting (complete appendix 4)		

1. I apply for Land Management Plan approval*/~~amendment approval*~~ for the property described above and in the enclosed Land Management Plan.

~~2. * I apply for an opinion under the terms of the Environmental Impact Assessment (Forestry) (Scotland) Regulations 1999 for afforestation* /deforestation*/ roads*/ quarries* as detailed in my application.~~

3. I confirm that the initial scoping of the plan was carried out with FC staff on 02/10/2015

4. I confirm that the proposals contained in this plan comply with the UK Forestry Standard.

5. I confirm that the scoping, carried out and documented in the Consultation Record attached, incorporated those stakeholders which the FC agreed must be included.

6. I confirm that consultation and scoping has been carried out with all relevant stakeholders over the content of the design plan. Consideration of all issues raised by stakeholders has been included in the process of plan preparation and the outcome recorded on the attached consultation record. I confirm that we have informed all stakeholders about the extent to which we have been able to address their concerns and, where it has not been possible to fully address their concerns we have reminded them of the opportunity to make further comment during the public consultation process.

7. I undertake to obtain any permission(s) necessary for the implementation of the approved Plan.

Signed …….. Signed……..
Forest District Manager Conservator

District …Scottish Lowlands…….. Conservancy……Central……..

Date …….. **Date of Approval**……

*delete as appropriate **Date approval ends**……

Contents

Version History

Version	Date	Comments
1.0	26/09/2016	Initial draft by C. Little
1.1	04/06/2018	Updated draft by H. Mackintosh
1.2	20/06/2018	Formatting update

Summary of proposals

This land management plan details the various management interventions required to achieve the site objectives for Dean and Carnock.

The plan proposes both sites are managed under Low Impact Silvicultural Systems (LISS). The long-term aim of this approach to management is to provide multiple benefits. As well as producing timber, the development of a varied stand structure will result in a high number of potential niches; thus enhancing biodiversity. Furthermore, a multi-species, structurally diverse forest, combined with a lack of clear-felling, should enhance the aesthetic of both management areas for the public.

A common feature of both management areas is that conifer areas will progressively move from light demanding species such as Larch and Scots Pine, both of which are currently at risk from pathogens, to more shade tolerant species better suited to LISS. This will be achieved primarily through uniform shelterwood and group selection systems used in combination with under-planting.

Key Proposals

Planned Operations	**2017-2027**
Mini-coupe felling; Dean only (ha)	3.49 ha
Thinning (ha)	31.8 ha
Restock (ha)	2.35 ha
Woodland Creation (ha)	NA
Habitat Restoration (ha)	NA
Road Construction (m)	NA

1.0 Introduction

1.1 Setting & Context

Carnock & Dean Plantation are two management areas situated in south-west Fife; lying north and south respectively of the villages of Carnock and Gowkhall on the A907, Dunfermline to Alloa, road.

Carnock is skirted by the B913 to the west and covers an area of 48.9ha. The eastern half is mainly Scots pine whilst the west is predominately birch. The management area is entirely surrounded by farmland other than a thin strip of private woodland adjoining its eastern edge. Other than the few houses in Cowstrandburn and the surrounding farmland, visibility is limited to the B913 and an uncategorised road to the south.

Dean has unclassified roads to the east (Lundin road) and west (Pitdinnie road). The management area covers 79.5ha and is very mixed in terms of species and age-classes. The area is bisected by a north-south running valley through which the Crossford burn passes and is also bisected by a major gas pipeline. The surrounding landscape is farmland other than a small area of woodland to the north-east. Dean is moderately visible in the surrounding landscape, being viewable from the surrounding roads and Carnock village itself.

See **Map 1.1 Location** & **Map 2.1 Context**

The current land matrix is as follows:

Table 1 – Current land usage

Land type	Dean Plantation	Carnock
Existing woodland (Conifer)	38.5	31.1
Existing woodland (Broadleaf)	32.2	11.6
Open ground	8.8	6.2
Total (ha)	79.5	48.9

1.2 Site Histories

Dean

The earliest references to the Dean Plantation come from data compiled prior to the first Ordinance Survey (OS). This data was collected in a report produced by CFA archaeology (2007) which suggests the earliest planting took place around 1711 after a failed exploration for coal. There is further evidence to suggest that these initial plantings were of oak. However, later, conifer species were also grown as the plantation expanded.

The OS survey from 1854 shows the entire area as forested. In addition to this, the Fife and Kinross-shire OS Name Books, 1853-1855 (127, Pg. 36) describes the area as:

"A large Plantation consisting of Fir & Forest timber, on the South side of the Stirling & Dunfermline Railway. A stream forming the Boundary between the Parishes of Carnock and Dunfermline runs thro' it, which bears no name"

It is therefore likely that productive conifers were grown on site from at least the early 1800s and that the entire area has been forested for over 200 years.

The Forestry Commission bought the Dean Plantation in two separate purchases. Firstly, the easterly 65 hectares in 1962, followed by the remaining 15ha in the West in 1970. Both purchases were from the Dunfermline co-op.

Carnock

The OS from 1854 shows approximately 10ha as forested, along the southern edge, though scattered conifers are shown to be growing across much of what was Carnock moor.

The Fife and Kinross-shire OS Name Books, 1853-1855 (126, Pg. 51) describes the site as follows:

"A considerable portion of moor, chiefly heathy, with scattered fir trees on different parts of it"

Later editions of the OS maps show that by 1894 the entire area had been planted other than a portion that runs through the centre of the management area, north to south.

The Forestry Commission bought the block in 1948 from DB Laird.

2.0 Analysis of previous plans

The aims and progress of the previous plan are outlined in the following table:

Table 2 – Progress on previous LMP objectives

Objective	Proposed management actions	Progress to date 1 - Little / No progress 2 – Some progress 3 – Progress as per LMP
Carnock & Dean: To meet the UK Forestry Standard. The Strategic Plan for Scottish Lowlands Forest District sets out the framework for this to be achieved, detailing the policies for achieving maximum public and environmental benefit from the forests. This LMP fits into that framework and shows how it will be implemented in this part of the forest.	Various – see plan for details.	3 – Progress as per LMP
Carnock: To enhance the value of the area to wildlife by increasing age and species diversity and integrating broadleaf components throughout the forest.	Use of Alternatives To Clearfell (ATC). Felling and restocking will be small-scale and timed to ensure a variety of age classes are dispersed throughout the area. When restocking species will be mapped to soils.	3 – Some progress Thinning has taken place in 2008 and 2013, along with various small restocks of suitable species.
Dean: to increase age diversity and develop broadleaf/open space watercourse corridors and link with other key habitats, such as the possible Ancient Woodland Site (AWS). The expansion of the associated flora and fauna from the AWS into more of the forest will be facilitated.	Use of ATC. Felling and restocking will be small-scale and timed to ensure a variety of age classes are dispersed throughout the area. When restocking species will be mapped to soils.	2 – some progress Thinning has taken place in 2008 and 2013, along with various small restocks of suitable species. However, some areas not thinned due to access.
Carnock & Dean: Improve the recreation value of the forest and preserve features of archaeological interest.	**Carnock:** The old water tank site will be protected by keeping planting back from that area. **Carnock:** Harvesting access road to be built at western end of Block. **Dean** – Open up dense conifer areas that act as barriers to recreation.	3 - Progress as per LMP Carnock - Water tank site kept clear of planting. Access road built providing improved access to the public. 2 – some progress Dean –Thinning has taken place in 2008 and 2013
Carnock & Dean: Improve the external and internal views of the forest.	**Dean:** Small clear-fells to improve “height difference”. Felling along edges to increase	2 – some progress Some small clearfells have taken

	"softening" by addition of broadleaf species. **Carnock:** Windblown areas to be felled and restocked with mixed conifer-broadleaf species in order to increase diversity. Blending of solid/dark conifer edges into woodland/farmland matrix to be achieved through small-scale felling and restock with conifer-broadleaf species	place, including windblow clearance in 2008 and 2013. However, restocking with broadleaves on edges has not occurred. 3 – Progress as per LMP Windblow areas cleared and restocked with appropriate species. 3 – Progress as per LMP Three small areas on boundary replanted with mixed broadleaves
Carnock & Dean: Protect water quality and the physical integrity of streams.	**Dean:** Opening up of dense conifer canopy along the valley area	2 – some progress Canopy has been opened and broadleaf species have been favoured. However, there is still western hemlock (WH) regenerating in riparian area.

3.0 Background information

3.1 Physical site factors

3.1.1 Soils & landform

The British Geological Survey (BGS) shows Dean and Carnock share the same underlying geology. These are split into the bedrock layer which is made up of the rocks forming the majority of the earth and the Superficial layer which is made up of the youngest geological layer formed in the Quaternary period.

The sedimentary bedrock layer formed approximately 328 to 329 million years ago in the Carboniferous period. Subsequently, the superficial layer, made up of Devensian-Diamicton till, formed up to two million years ago.

The Soil Moisture Regime (SMR) provides an indication of the moisture and oxygen availability within the soil, both of which are essential for root growth. The Soil Nutrient Regime (SNR) is a measure of both availability of soil nutrients for plant growth, and the acidity of the soil (which impacts on solubility and hence availability of nutrients). For Dean and Carnock, the SMR is 3 (moist) and the SNR is 3 (medium).

In Carnock the soils are largely acidic peaty gleys, with more fertile pockets in small areas. In Dean, the majority of the site comprises of surface-water gleys and typical brown earths, often with a gleyed phase.

The elevation at Dean ranges from 64 - 113m, so is relatively sheltered whereas Carnock ranges from 116 to 172m.

See **Map 3.1.1 – Dean & Carnock Soils**

3.1.2 Current climate & exposure

Dean and Carnock are in the warm, moist climatic zone with a SMR of 3 (moist) and an accumulated temperature (day-degrees above 5oC) lying in the range 1337-1381 degree days. This puts both management areas in the warm category (1200-2400 day-degrees).

See **Map 3.1.2 – Climatic Zones**

Detailed Aspect Method Scoring (DAMS) describes the exposure and windiness of a site. DAMS produces scores from 3-36, with the lower the score the more sheltered the site:

<13 = DAMS Class 1 (Sheltered)
>=13 and <16 = DAMS Class 2 (Moderately exposed)
>=16 and <18 = DAMS Class 3 (Highly exposed)
>=18 and <22 = DAMS Class 4 (Severely exposed)
>=22 = special class 5 'too exposed for forestry'

Dean has scores ranging from 9 - 14.2, whilst Carnock is slightly more exposed, with scores of 10.9 - 15.2.

3.1.3 Future climate

Climate data projections for 2050 and 2080 have been used to predict the anticipated future climate, which is expected to have warmer and drier summers, but with an increase in the frequency and severity of winter storms. Although this suggests that the range of suitable species may expand to accommodate more demanding species, and that the growing season may extend, it may also indicate an increased risk of drought which may limit the site suitability of e.g. Sitka spruce during the next rotation.

3.1.4 Hydrology

Dean has a steep-sided valley running north to south. Pitfirrane Dean Burn runs through this and feeds into the Crossford Burn, which in turn flows into the Lyne Burn which exits directly into the Firth of Forth.

Cowstrandburn runs along the north edge of Carnock, meandering in and out of public ownership. It passes into various watercourses, eventually feeding into the Firth of Forth via Bluther Burn.

See **Map 3.1.4 Hydrology**

3.2 The existing forest

3.2.1 Age structure Species & yield class

See **Map 3.2.1 - Existing Woodland**

Figure 1 – Carnock Current Species Composition

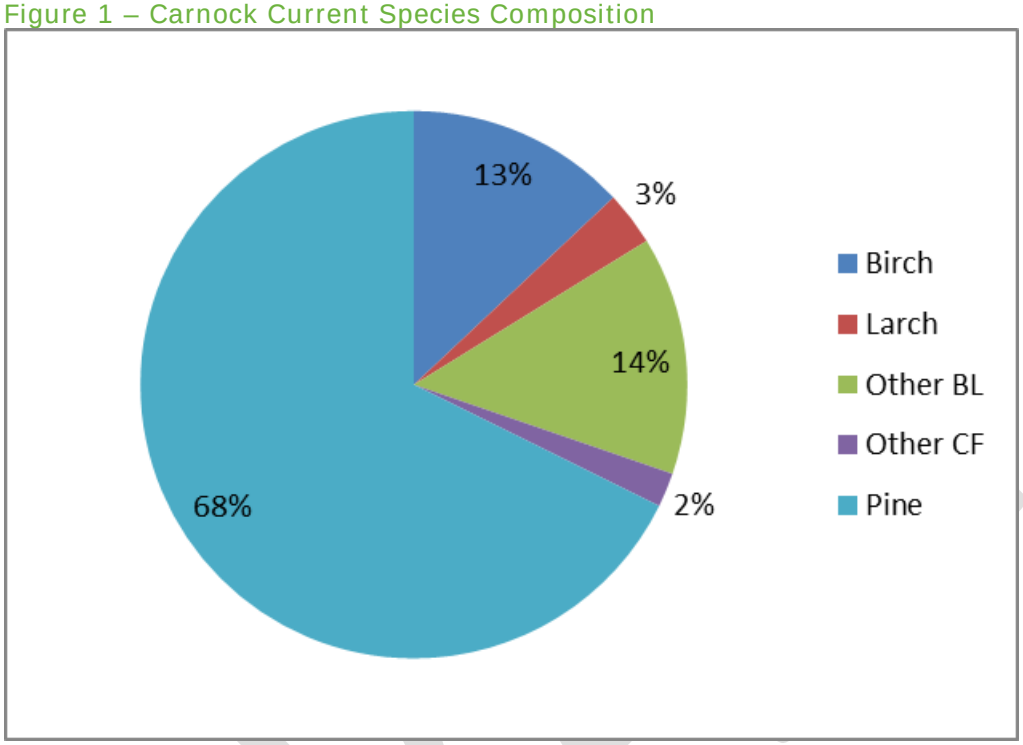


Figure 2 – Dean Current Species Composition

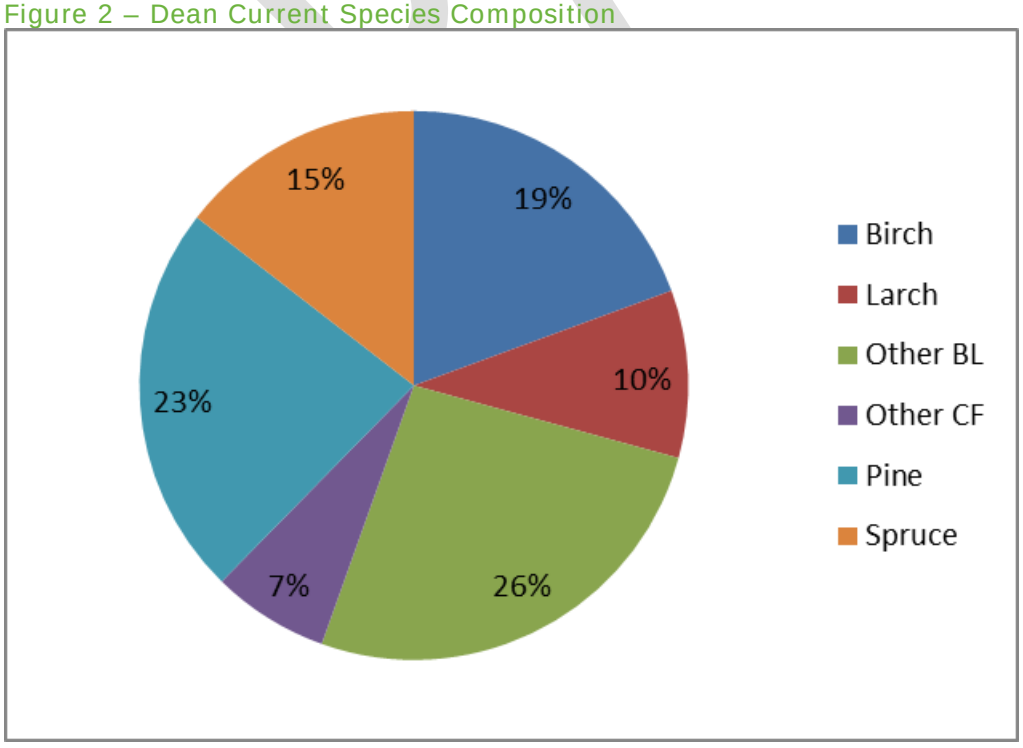


Table 3 –Species by Area for Dean and Carnock

	Area (ha)	
Species	**Dean**	**Carnock**
Ash	3.8	
Alder	0.2	0.2
Beech		0.6
Birch	13.7	5.6
Douglas-fir	2.6	
Elm		0.5
European larch	0.2	0.9
Hawthorn	0.5	
Hybrid larch	4.7	0.1
Japanese larch	2.1	0.5
Lawson cypress		0.2
Lodgepole pine	2.7	
Mixed broadleaf	3.6	4.5
Mixed conifer		0.6
Norway spruce	6.7	
Oak	0.4	
Ponderosa pine		0.1
Scots pine	13.7	28.8
Serbian spruce	1.2	
Sitka spruce	2.4	
Sycamore	6.7	
Western hemlock	2.3	
Willow	3.2	0.2
Total (ha)	**70.7**	**42.7**

Figure 3 – Carnock Current Age–class distribution

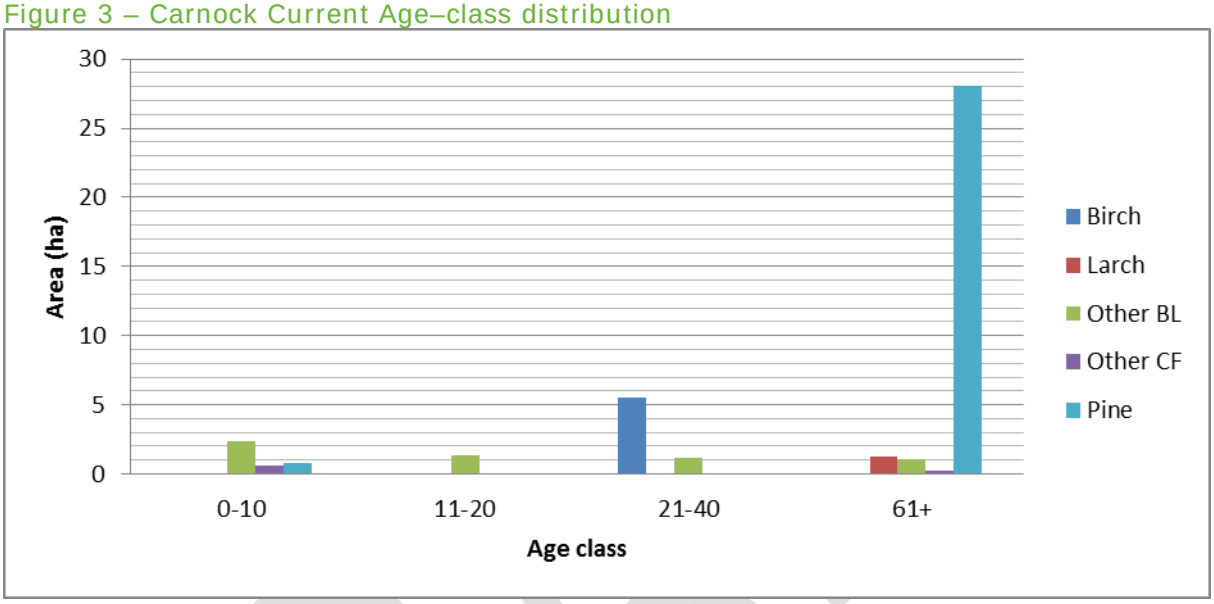


Figure 4 – Dean Current Age–class distribution

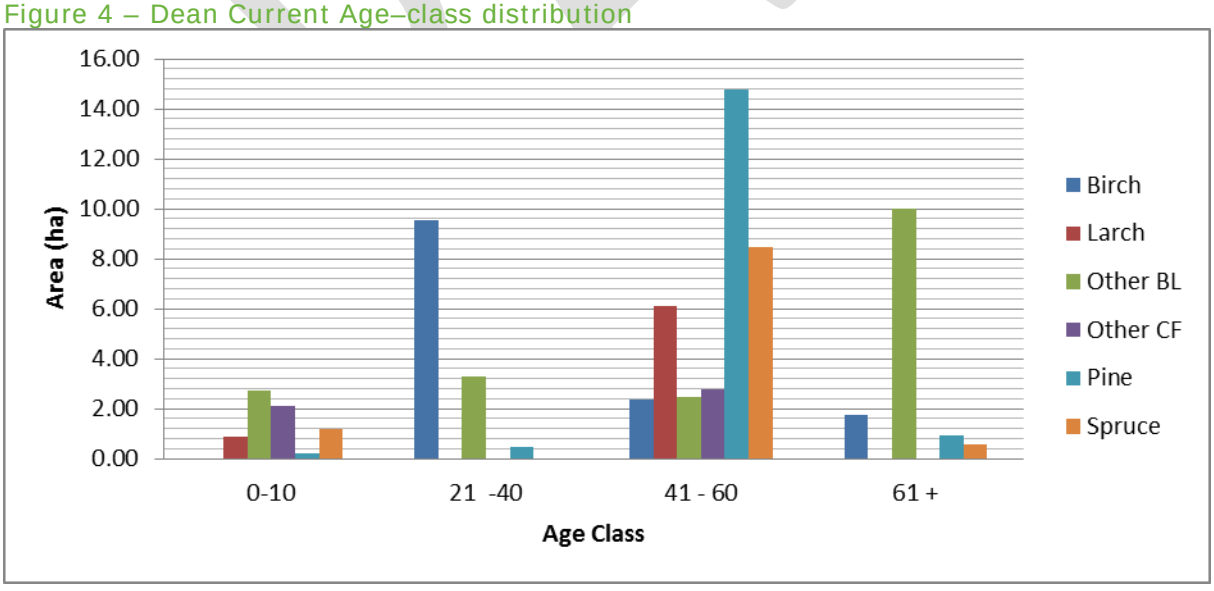


Figure 5 – Carnock Yield class by species group

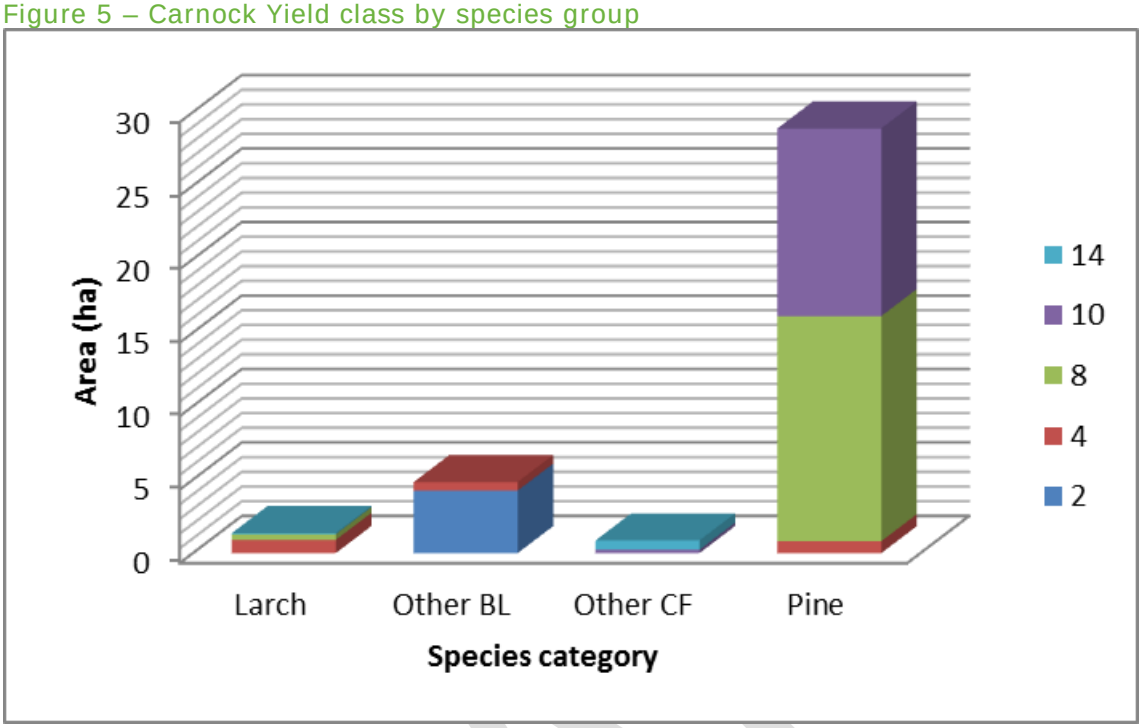
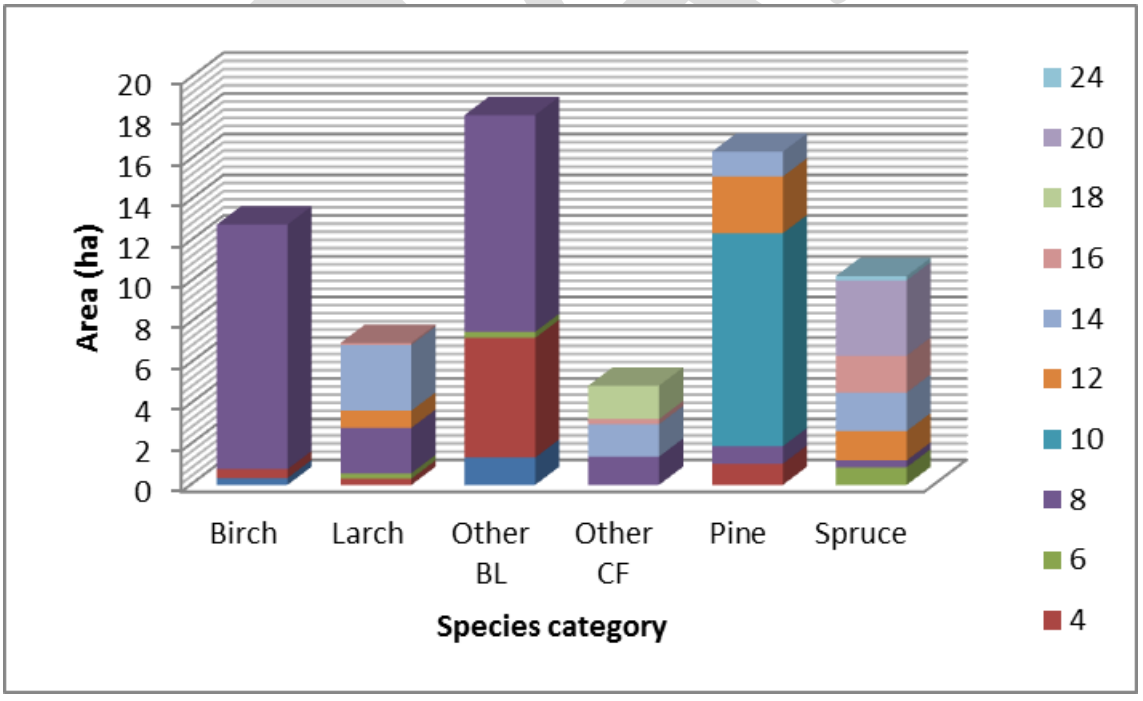


Figure 6 – Dean Yield class by species group



3.2.2 Operational access

See **Map 3.2.2 Access for Dean & Carnock**

Dean

A forest road (category A and B) gives access to the eastern half of the area. However, there is currently no roading from the west side making access an issue for operations. Machine crossing points have been laid across the gas pipeline at the time of construction to prevent damage during operations. At the south of the management area there are also areas that are more than 500m from the road, making operations potentially uneconomical.

There is potential to investigate a road accessing Dean from Pitdinnie road in the west.

Carnock

Access is generally good; the forest road accesses the management area from the west and runs approximately half way along the north edge. This road then carries on as an unclassified road to the south. Throughout the conifer areas there are several existing forwarder routes created during previous thinning operations.

3.2.3 Low Impact Silviculture Systems (LISS) potential

Both sites have good potential for LISS due to good soils, relatively good access and low DAMS scores. The main limiting factors for both sites are deer browsing and weed competition.

See appendices VI (Carnock) and VII (Dean) for an in-depth analysis of the potential for each management area.

3.2.4 Pathogens

3.2.4.1 Dothistroma Needle Blight (DNB)

DNB causes premature needle defoliation, resulting in loss of yield and, in severe cases, tree death. Recent surveys have shown outbreaks of DNB across Scottish Lowlands Forest District, and all of the pine stands, including Dean and Carnock, have been infected.

However, the Scots pine in both these management areas has been well thinned, which results in a less favourable micro-climate for the pathogen. From experience

at Devilla, where needle retention was measured over several consecutive years, thinning can result in a stop, and even reversal, of needle loss.

3.2.4.2 *Phytophthora ramorum* (*P. ramorum*)

P. ramorum is a fungus-like pathogen of plants that causes extensive damage and mortality to trees and other plants in parts of the United Kingdom. Larch in particular is extremely vulnerable, and high infection and mortality levels are currently causing significant issues in Galloway Forest District. There have been eight SPHNs issued to SLFD, three of which have been within the lowest risk zone in the FCS Action Plan for Larch in Scotland (Devilla, Callendar wood and East Grange). The impact of a potential infection is very low at Carnock which has 0.5ha (1.2%) of Larch. At Dean the impact would be slightly higher where Larch makes up 6.34ha (9.5%) of the total area.

3.2.4.3 Chalara fraxinea (Ash dieback)

Ash dieback is a serious disease of ash trees caused by a fungus, resulting in leaf loss, crown dieback and, potentially, tree death. There is no ash present within Carnock but in Dean it forms a minor component. At present symptoms seem minimal though this will be monitored.

3.3 Landscape & Land use

3.3.1 Landscape character

Dean is all classified as Lowland Hills & Valleys.

Carnock is mostly Upland foothills, except the access at its western extremity which is Lowland Hills & Valleys.

Table 4 – Landscape character assessment

	Fife	
Landscape Type	Upland Foothills	Lowland Hills and Valleys
Key characteristics and features	• Highly conspicuous, the Foothills (often with the Upland Slopes), define the edge of other landscape types and the extent of views across the lowlands. • Distinctive backdrops to other landscape types. • Woodlands, steadings and other buildings well related to landform. • Some extensive views across other landscape types.	• The variety and subtlety of landform. • The open, regular farmland patterns of medium-scale fields of arable and grasslands. • The variable pattern of post and wire fences and mostly tall hedges with hedgerow trees. • The extensive areas of plantations, shelter planting, roadside planting and policies linked to large estates. • Other dominant linear and point features of plantations and tree groups, individual trees or local buildings.
Relevant landscape guidelines	• Planting should generally be encouraged but the more distinctive, recognisable and prominent hill tops, peaks and skylines should be left free of new woodland plantations to maintain their distinctive character. However, there is scope for natural woodland regeneration up to the natural tree line. • Planting on the upper slopes should be encouraged but will require particularly sensitive location and design and should be predominantly broadleaved species.	• There is considerable scope for new planting schemes in this landscape character type. • Through the WGS it is possible to initiate the planting of the landscape framework that would accommodate the development requirements of the 21st century whilst, at the same time, achieving the shorter term objective of environmental improvement. This could be vital to the image of the area as perceived from the motorway and the A94 and other through routes.

	• The middle, lower, less steep areas of the hills have the capacity for absorbing much more woodland planting but in order to ensure it contributes positively to the landscape character it should comply with all of the Forestry Authority design guidance. • Important historical and other landscape features and local landmarks should be protected from woodland planting that would obstruct views of the features. • Planting should not obstruct the views to and from the large houses and steadings on the Foothills. • For existing plantations, ensure that the current Forestry Authority and Forest Enterprise approach to restructuring is followed. Replanting should conform to Forestry Authority design guidance and should result in a varied age and species structure, a greater proportion of open space and woodland forms which more closely reflect the underlying landform and the local landscape character. • Encourage the uptake of the WGS to create new woodland planting to help achieve other aims, for example, to absorb better existing development into the open countryside and to	• Extensive areas of woodland and other planting would enable some larger residential type development to be accommodated with little harm to the landscape, but it would again need to sustain the strong existing relationships between the built settlements and landscape in this part of Fife. • Encourage the uptake of the WGS to create new woodland planting to help achieve other aims, for example, to absorb better existing development into the open countryside and to screen quarries and other visually intrusive or uncharacteristic features. • New woodland could be in a variety of forms ranging from small groups of trees to small broadleaved woodlands, mixed species plantations, linear belts along burns and roads and larger mixed plantations where these would relate to and not obscure the subtle topography. • All new planting should be in accordance with all of the Forestry Authority design guidance • Encourage the planting of broadleaved trees along the rivers and burns to link existing woodlands and other habitats and to reinforce the semi-natural patterns of drainage and riparian vegetation and habitats. • Encourage new planting to enhance the interlinking of new woodlands to existing plantations and semi-natural woodlands on the hills and in the lowlands.

	screen quarries and other visually intrusive or uncharacteristic features. • Encourage the interlinking of new woodlands to existing plantations and semi-natural woodlands on the hills and in the surrounding lowlands. • New planting should respect historic features, and have regard to the importance of the long distance views from the hills.	• New planting should have regard to the importance of the long distance views from the hills. • The restocking and management of over-mature, neglected or declining woodlands and shelterbelts should be encouraged.

3.3.2 Visibility

Carnock – Few views from households at medium scale, mostly fleeting from roadside

Dean – Viewable at small-medium scale from the north by housing on Carnock road. Scattered housing in surrounding fields.

3.3.3 Neighbouring land use

Surrounding area is almost entirely farmland (both arable and pastoral) and some scrub/woodland. There is a golf course to the south-west of Dean.

3.4 Biodiversity & Environment

3.4.1 Priority Habitat Types

PHT's are protected under the UK Biodiversity Action Plan, and FES policy is to protect, enhance and expand these habitats where suitable. Both Dean and Carnock have two of these habitats present: Upland birchwood and Lowland mixed deciduous woodland.

3.4.2 Ancient Woodland

Both sites contain areas of Long-Established Woodlands of Plantation Origin (LEPO), with Dean surveyed in 2011. LEPO is defined as being forested in maps from 1750 or 1860 and continuously wooded since. Many of these sites have developed semi-natural characteristics, especially the oldest ones, which may be as rich as Ancient Woodland. There are significant areas of LEPO in both Carnock (9.35 ha) and Dean (71.47 ha).

In addition, there are a number of veteran trees throughout Dean. These are of varied species (Oak, Ash, Beech and Sycamore) and present potentially important roosts for bats.

Carnock similarly has several specimen Scots pine, veteran Beech and Rowan on the south-east edge of the management area.

3.4.3 Important Species

There are several important species present at both Dean and Carnock.

At Carnock, pine marten are known to be present. The pond provides valuable habitat for common toad, palmate newt and large red damselfly.

At Dean, pine marten have also been observed. Broad-leaved helleborine is also present and two species listed as priority in the LBAP (2013-2018): bluebell and red-squirrel.

Where possible, opportunities will be taken to enhance habitat for pine marten e.g. retention of veteran trees that provide suitable dens. If possible, the effect of pine marten populations on red and grey squirrels will also be explored.

3.4.4 Wildlife (Deer Management)

Dean & Carnock, part of Deer Management Unit No 3, are covered by a contract ranger. The cull target for 2017/18 was set at 30 deer from Dean and 8 from Carnock.

3.4.5 Non Native Invasive Species

At Carnock, the main focus has been on rhododendron removal, with mulching taking place in 2012/2013. Following this, top-up spraying was carried out in 2013/2014, 2015/2016 and 2017. In 2017, cutting and burning of rhododendron also took place.

3.5 Heritage

FES maintains extensive archaeological records for the NFE within its heritage database. Important historic environment features are surveyed, recorded, mapped and monitored by SLFD to ensure and demonstrate Forestry Commission Scotland compliance with the UK Forestry Standard. This ensures that undiscovered historic environment features are mapped and recorded prior to forestry management operations and ensures the continued comprehensive protection of the known archaeological resource. There are a high number of features within the plan area most of which are unscheduled.

3.5.1 Non-scheduled Archaeology

Although there are no scheduled monuments in Carnock or Dean, an archaeological survey of Dean by CFA archaeology in 2007 found:

"Twenty sites are considered to be of Local Importance. These comprise the field boundaries, quarries, rig and furrow, marker stone, enclosure, cairns, a trackway and mine and spoil heaps.

Three sites are considered to be of Lesser Importance. These are a disused well which could not be located and modern structures.

No sites are considered to be of National or Regional Importance."

At Carnock there are two unscheduled features of interest; a boundary dyke and a carved stone which is most likely a boundary marker stone

3.6 Community & Recreation

Dean

The majority of Dean is designated as Woodland in & Around Towns (WIAT). The woodland is well used by local dog walkers, walkers and cyclists from the surrounding villages and Dunfermline. No formal routes are installed, though Core Path 679/680 runs along the southern boundary. Additionally, the forest road and a number of informal desire lines allow access throughout the management area (See access maps 3.2.2 and entrance map 3.6). Part of the appeal of the site is its informal nature, with the southern boundary and the glen being the most popular amenity areas.

Limited community engagement has been carried out on the site, though it is used by local nursery groups.

Carnock

Carnock has limited visitor numbers, mainly local dog walkers who park at the barrier on the public road and walk in to the site. Desire lines follow the western boundary and link up with harvester track and road network in the southern end of the management area. There is a designated Core path 599 running along the northern boundary; however this has become inaccessible due to severe windblow (See access maps 3.2.2 and entrance map 3.6).

Part of the site was identified as being suitable for the Scottish Government backed, pilot "Hutting" programme as part of the Thousand Huts Campaign. The majority of community engagement has centred around the Hutting project and whilst Reforesting Scotland are leading on this, FES have been involved. Site management is likely to be routine maintenance in response to any issues that arise as a consequence of the hutting development. Reforesting Scotland currently have planning approval from Fife Council to build 12 huts. If constructed the hutting site would be managed under a lease from FES to a hutting association.

There have also been historic drainage issues on the west side of the forest with the neighbouring farmer.

4.0 Analysis & Concept

Through survey work and research, a broad range of factors have been identified which are potentially relevant to the future makeup and management of the land. These have been analysed in order to better understand the way these interact, and to draw out the most important features and trends.

See **Map 4a Opportunities & Constraints**

This analysis was used to develop an initial design concept highlighting general themes and outlining key considerations and activities which are likely to be most relevant during the plan period, and which formed the basis for the initial consultation with both the general public and key stakeholders.

See **Map 4b Design Concept Proposals**

5.0 Management Proposals

5.1 Forest Stand Management

All proposals have been designed in accordance with sound silvicultural and environmental principles, falling within the framework outlined by the UK Forestry Standard, the UK Woodland Assurance Scheme, FC Bulletin 112 Creating New Native Woodlands, FC Bulletin 115 Alternative Silvicultural Systems, FC Bulletin 124 Ecological Site Classification for Forestry and the current FC edition of Forest & Water Guidelines.

The management of both areas will follow a similar approach with LISS being employed. The majority of both management areas will be managed using a uniform shelterwood with underplanting using medium-shade-tolerant conifer species. In certain areas, other silvicultural systems may be employed, with the most likely being a group selection system.

See **Map 5.1 Management**

5.1.1 Clear felling

Clearfelling will be kept to a minimum and will mainly occur reactively when windblow occurs.

In Dean, several small mini-coupes are being felled during phase one. These are areas of western hemlock and an area of Norway spruce which is badly windblown.

There is no clearfelling expected to take place in Carnock for the duration of the LMP.

See **Map 5.1 Management**

5.1.2 Thinning

FCS policy generally assumes that all productive crops will be thinned, unless:

- Thinning is likely to significantly increase the risk of windblow
- Operations are likely to require an unacceptably large investment in relation to the potential benefits due to access or market considerations
- Thinning is unlikely to improve poorly stocked or poor quality crops

All thinning decisions will be guided by Operational Guidance Booklet 9 - Managing Thinning, and the current SLFD Thinning Plan.

All proposed thinning operations are covered within the LISS management plans for each site (See appendices VI & VII). In addition to standard silvicultural

prescriptions and timber production, consideration should be given to biodiversity and aesthetics. Specifically, ground flora and below-canopy light environment should be taken into consideration in the north-west and southern areas of Dean.

See **Map 5.1 Management**

5.1.3 Low Impact Silvicultural Systems (LISS)

The generally favourable conditions in Fife (in terms of both climate and soil suitability) lend themselves to management through LISS regimes, which potentially can be beneficial in terms of timber quality, biodiversity, recreation and aesthetics.

The main silvicultural systems being employed will be uniform shelterwood and group selection systems. See individual LISS plans for details (Appendix 1 & 2).

5.1.4 Minimum Intervention and Natural Reserves

For various areas of the forests, biodiversity will be the primary objective and we are prepared to commit such areas of land to minimum intervention management or leave as natural reserves. This minimum intervention classification need not apply in perpetuity and should future economics allow, these areas may be reviewed and revaluated for alternative management in future plans.

The steep-sided valley that bisects Dean will be designated as a riparian zone, with the current broadleaf species being maintained. This area will be designated as minimum intervention, with the only operations taking place being the removal of undesirable natural regeneration (mostly Western hemlock). There is also an area of wet woodland to the north with a soil classification of Juncus bog which will be treated similarly.

There are several small patches of minimum intervention at Carnock. These stands are of low economic value but of high amenity and biodiversity value so will be left to follow the natural processes of succession. There are also small areas of quarry/rocky knolls, and a small riparian area to the north of the area.

5.1.5 Operational Access

No additional roading is anticipated during the span of the LMP.

5.2 Future species and habitats

Taking into account all the survey information and objectives set out in the brief, a mix of productive conifer, productive broadleaf and native woodlands are proposed, along with areas of open ground.

The woodlands will be matched to the soils and ground vegetation, using the guidelines set out in the Forestry Commission's Ecological Site Classification (ESC) Bulletin 124, which uses climatic zone, exposure, soil moisture, and soil nutrient levels to inform the type of woodland most suited to particular areas within the site.

5.2.1 Proposed Restock Species

Carnock and Dean are both currently composed of a mix of conifer and broadleaf species. Each site has a wide array of potential species classed as "suitable" or "very suitable", with many of these being shade or medium-shade tolerant.

Conifer species: Most of the conifer areas will be underplanted. The potential species include Lawson/Leyland cypress, western red cedar, European silver fir, Pacific silver fir, grand fir, noble fir, coast redwood, Norway spruce, Sitka spruce, Douglas-fir or western hemlock (Carnock). The main issue with many of these species is their palatability to deer. Additionally, some fir species are initially slow-growing meaning deer control and mitigation of weed competition need to be considered. At both sites the initial plantings will focus on Norway spruce, Douglas-fir, European silver fir and Pacific silver fir.

Broadleaf species: Both sites have areas of wet woodland and Riparian areas (W7) which will primarily be composed of common alder, downy birch and willow.

At Dean, there is an area to the south (>500m from the forest road) which will be left as minimum intervention, with conifer species selectively removed to leave native broadleaves such as oak sp., birch, rowan and hazel (W11). The remaining broadleaf at Dean will be productive and likely oak sp.

At Carnock, the remaining broadleaf areas are primarily birch of low quality, which is envisaged to provide a firewood crop. This is likely to continue as the birch is regenerating beneath the existing canopy.

See **Map 5.2– Future Species & restocking** for spatial distribution of species.

5.3 Prescriptions

In both management areas the general trend will be transitioning from light demanding conifer species such as Scots pine and larch to shade tolerant conifers.

This will be a long term process involving thinning of the overstorey and a phased underplanting of both stands. In Carnock, this underplanting will be delayed with the current, naturally regenerating birch being left to produce a fire-wood crop and suppress ground vegetation before being removed. In areas where the incorrect light environment or intense weed competition is anticipated, other restock options may be employed.

As underplanting is being used, a couple of differences with standard restock practice will occur:

- Permanent extraction racks should be mapped out and not planted.

- Planting positions should be dictated by the position of over storey trees and their roots. As a result, planting may not be in an even, grid-like pattern.

In both areas group selection systems will be the main silvicultural system used for broadleaf areas. However, the approach taken towards restocking will differ:

- At Carnock the groups will be left to naturally regenerate. Groups should be chosen reactively based on evidence of existing regeneration beneath the canopy. It is likely this regeneration will be birch and of low potential quality.

- At Dean there is the potential to grow oak. This can either be achieved through high-density restocking or through the use of oak “nests” (See appendix 1).

Within riparian areas along existing watercourses, planting will generally be a variant on W7 woodland, and will include a significant (30% or more) element of open space. In accordance with current Forest & Water Guidelines, a 5-10m buffer zone will be left open, dependent on localised width. In the long-term retention areas, the conifer elements will gradually be thinned out, with the aim of moving towards W11 woodland. Planting in these areas will be an intimate mix at 1,600 trees/ha.

5.4 Biodiversity & Environment

Neither management area has any designations.

5.4.1 Habitat Management

At Dean, the riparian corridor following the Pitfirrane Dean burn will be monitored and where possible, non-native, naturally regenerating conifer species will be removed.

At Carnock, follow-up spraying of rhododendron will take place in 2019/2020.

5.4.2 Protected Species

The plan aims to improve habitats for protected species, and their presence has been accounted for in the location, choice and silviculture of tree species.

Careful design, particularly with regard to species choice, has been used in order to maximise the potential benefit to red squirrel within the future woodland habitat. The use of Norway spruce, Macedonian pine, Douglas-fir and small seeded broadleaves such as birch should all increase the potential of the woodland to provide a beneficial habitat, providing an opportunity for the red squirrel population in the wider environment to expand its range. The use of mixed-species LISS should ensure that there is a sufficient food supply throughout the year.

All operations will adhere to SNH approved FCS Guidance notes and appropriate operational buffer zones will be established prior to the commencement of any works. If required, licenses to carry out operations will be applied for.

5.4.3 Deadwood

The aim is to use natural processes by retaining dead, windblown or snapped stems or those created during previous operations. Deadwood can be trees or limbs in the early stage of decomposition, e.g. veterans or dying individual trees. These should be retained wherever possible to create an even mix of standing, fallen or stacked deadwood.

Deadwood will be concentrated in areas where it will provide the highest ecological benefit, such as;

- Riparian and wet woodland areas
- Natural reserves and long-term retentions
- Ancient semi-natural woodland
- Areas of significant existing deadwood

The UKWAS target is for an average of 20 m^3/ha, although it is expected that actual concentrations will vary widely across the site.

A District wide analysis categorised all management areas into areas of high, medium and low Deadwood Ecological Potential (DEP). The volume per hectare figures were taken from deadwood surveys of various areas. In the case of Dean

and Carnock, the figures are 15 m3 ha-1 (Low DEP), 30 m3 ha-1 (medium DEP) and 100 m3 ha-1 (high DEP) for low/med/high areas.

Table 6 – Assessed Deadwood Ecological Potential (DEP)

CARNOCK

Assessed DEP	Area (ha)	Future Volume Estimate (m^3/ha)	Total Future Volume (m^3)
High	2.17	100	217
Medium	44.52	30	1335.6
Low	1.78	15	26.7

Total future potential is therefore estimated at **32.58** m^3/ha.

DEAN

Assessed DEP	Area (ha)	Future Volume Estimate (m^3/ha)	Total Future Volume (m^3)
High	6.57	100	657
Medium	72.15	30	2164.5
Low	0.29	15	4.35

Total future potential is therefore estimated at **35.77** m^3/ha.

Given that a relatively high total volume of deadwood is expected to come from High & Medium DEP areas, in line with FES Deadwood Policy the following approach should be adopted in the remaining Low DEP areas:

- Take any obvious opportunities to retain deadwood in a coupe e.g. large veterans, deadwood in wet areas or inaccessible areas.
- Consider harvesting wind blow only when it is economic or required to make site safe.

5.4.4 Wildlife Management

Deer control is vital to successful crop establishment, and the proposed introduction of 'soft' conifer and productive broadleaves species means that there will be potentially vulnerable crops in a number of areas across the site. As a result, deer numbers will need to be controlled to minimise damage. Although deer fencing will

only be considered as a secondary option, the use of potentially vulnerable tree species may require small enclosures to be erected in order to minimise damage during establishment. Careful planning will be required as to the size and location of such enclosures so that deer welfare is not compromised. The use of Black Netlon will be trialled as described in "Successful Underplanting" – this may be preferable to traditional fencing as it is reusable and easily moved using overstorey trees as strainers, using cable ties. Where fencing is not a viable option, tree tubes could be employed.

Full details of proposed deer management can be found within Scottish Lowlands Forest District Deer Management Strategy (in conjunction with the Deer Overview Map), but the relevant objectives within the Fife Deer Management Unit are:

- To enable restocking to take place without the need for deer fencing and to achieve a stocking density of 2500 stems per hectare at year five in accordance with OGB 4.
- The District aim for damage allowance is to keep leader damage levels below 10% on all commercial plantations.
- Ensure all biological resources on the National Forest Estate remain in favourable condition (as per SNH guidelines).
- To maintain a sustainable deer population.
- Stop the spread of Sika westwards from Devilla forest.

5.4.5 Heritage

Appropriate buffers have been applied by our Environment & Heritage Forester to all features across the sites which are recorded within the heritage database. This is done in accordance with guidance provided in the Forests and Historic Environment guidelines (2011), the FCS policy document: Scotland's Woodlands and the Historic Environment (2008) and the supporting FES Historic Environment Planning Guidelines. Features generally have buffers ranging from 5-10 metres depending on their nature but these can be wider or even have no buffer. Such constraints are identified and surveyed by Forest District staff prior to any work being undertaken in order to ensure that upstanding historic environment features can be marked and avoided. For operations, work prescriptions protect relevant historic environment features, apportioning appropriate buffers from ground disturbing operations and planting. Opportunities to enhance the setting of important sites are considered on a case-by-case basis.

5.5 Water Quality

All operations will follow best practice as detailed in the current Forest and Water Guidelines. Timber extraction will normally avoid crossing burns or main drains, but, where necessary, each crossing point will be piped or bridged. Branches will be kept out of watercourses and trees will generally be felled away from the

watercourses. Restocking of areas around watercourses will take into account suitably sized buffer areas as per Forest and Water Guidelines.

5.6 Community & Recreation

Scottish Lowlands Forest District staff will actively engage the local community to encourage use of the forest, and FD Ranger staff will look for opportunities to build links with local community groups and schools.

At Dean, the current use by nursery groups is envisaged to continue through to primary school as part of their curriculum delivery. Also, management of the roadside vegetation (gorse) will be carried out to enhance the visitor experience on site and maintain the integrity of the current road structure.

At Carnock, the hutting scheme occupies much of the future anticipated work. Reforesting Scotland are taking this forward and have now obtained planning permission for 13 huts (one for local community use) in the south-west corner of the site, along with a car parking area for hutters in the north-west. Reforesting Scotland is now in the process of selecting a group of people to form a constituted group who will agree and sign up to a land management agreement (lease). This group will then be responsible for constructing and managing the hutting community though FES will need to be involved to a greater extent as the site develops. FES is likely to have a major role in liaising between the new hutting community and the local community around Carnock.

5.7 Critical Success Factors

The success of this plan will be based on whether the objectives set out in the Management Plan Brief (see Appendix III) are achieved. The table which forms Appendix IV details how each objective will be appraised, where and when each objective will be monitored; by who and where it will be recorded. This will enable an evaluation of success as part of the mid and end of plan reviews.