

APPENDIX 16.1: LONG TERM FOREST PLAN

Tangy Wind Farm Long Term Forest Plan

2020 - 2045



A. Description of Woodlands

A.1 Property Details

Property Name:	Tangy Wind Farm		
Grid Reference: (e.g. NH 234 567)	NR860 294	Nearest town or locality:	Kilkenzie by Campbeltown
Local Authority:	Argyll and Bute		
LTFP Plan area (hectares):	270.75ha		
Owner's Details - Tangy Wind Farm is leased by SSE			
Address:	Inveralmond House, 200 Dunkeld Road, Perth		
Postcode:	PH1 3AQ	Country:	UK
Agent's Details – Author of Forest Plan			
Title:	Mr	Forename:	Neil
Surname:	McKay		
Organisation:	Neil McKay Forestry Consultant Limited	Position:	Director
Primary Contact Number:	+44(0)7748995 234	Alternative Contact Number:	+44(0)1576 710296
Email:	mckayforestry@outlook.com		
Address:	Grange Farm, Tundergarth, Lockerbie		
Postcode:	DG11 2QG	Country:	UK

A.2 Location and Background

Provide details on the wider context of the LTFP area. Append a 1:25,000 or 1:50,000 map with contours and the grid reference of the main forest entrance. The map should show the estate boundary based on the Business Reference Number (BRN) and the woodland boundary, if different.

The site is located approximately 9km north-west of Campbeltown, Kintyre's largest settlement. The closest villages are Bellochantuy, 2km north-west of the site, and Kilchenzie, 3km south of the site.

Current wind farm consent (August 2018)

The consented repowering (Tangy III) would involve the removal of the existing 22 turbines (some of which have been generating since 2003) and then replacing them with 15 new larger modern turbines over an extended area. Replacing the existing turbines would allow the site to continue to benefit from the excellent coastal wind resource combined with the significant advances in modern turbine technology and efficiency. The total installed capacity would also significantly increase the installed generating capacity of the wind farm and maximise the energy yield from the site. To ensure maximum turbine efficiency, the repower includes extending the existing site boundary into the conifer plantations to the north.

Proposed Development (Tangy IV)

The Tangy IV Wind Farm Forest Plan is for a 16 turbine layout.

Similarly, as is normal with this type of development, a degree of design change and micro-siting will possibly take place. The Forest Plan will be amended in accordance with the Tolerance Table C.4.

The application site boundary includes different ownerships and planting years from 1974 through to replanting in 2014. Only one ownership area has so far entered into felling and replanting while the other ownerships are ready to be restructured. The development is partially within a well forested area with upland commercial plantations being established by both the private and state forestry sectors. Tree growth in these areas benefit from a mild wet climate but are restricted by wind and poor soil strength.

For the purposes of this Forest Plan compartments and sub compartments outside the Plan area are considered as neighbouring land and are dealt with separately by each of the owners/managers.

A.3 Existing Schemes & Permissions

Provide details on any existing forestry permissions, grants, EIA approvals, previous plans, or cases in progress.

Type (e.g. Felling Licence)	Ref. No.	Details
Tangy Forest Long Term Forest Plan	Case No: 4886194	BRN: 164310 MLC: 155/0039 Area: 151.48Ha August 2013
Lussa Forest Land Management Plan	2018 - 2027	Area: 7999Ha Approved February 2018

A.4 Stakeholder Engagement

Include a summary of the main points from Scoping and where they are addressed in the plan. Append pre- and post- scoping maps, and the full Scoping Report.

Scoping – Main Points	LTFP Reference (section/page):
Forestry Commission Scotland ES scoping:	
The criteria for determining the acceptability of woodland removal and further information on the implementation of the policy is explained in the Control of Woodland Removal Policy	C.2.5 Replanting proposals
If timber is to be disposed of on site, details of the methodology for this should be submitted. Areas of retained forestry or tree groups should be clearly indicated and methods for their protection during construction clearly described.	C.2.1 Felling
If areas of woodland are to be temporarily removed but then replanted shortly afterwards (typically within 1-5 years) this should be indicated in the ES, and details of the replanting plan provided.	C.2.5 Replanting proposals
Where there is a change in land use (e.g. to non-woodland habitats) the woodland should be described in sufficient detail (e.g. including details of the age of the trees; the species type and mix; the soil types; etc	C.2.5 Replanting proposals
Design approaches which reduce the scale of felling required to facilitate the development	C.2.1 Felling

should be considered and integration of the development with the existing woodland structure is a key part of the consenting process	
Trees cleared for turbine bases, access roads and any other wind farm related infrastructure must be replaced by replanted on-site or on an alternative site (compensatory planting). The restocking plan should show which areas are to be replanted and when during the life of the windfarm.	C.2.5 Replanting proposals C.2.14 New (Compensatory) Planting
The plan should clearly identify and describe the restocking operations including changes to the species composition, age class structure, timber production and traffic movements.	C.2.1 Felling C.2.5 Replanting proposals
It should be made clear that both felling operations and compensatory planting (if relevant) must be carried out in accordance to good forestry practice as defined in the UK Forestry Standard 4 (UKFS)	C.2.1 Felling C.2.5 Replanting proposals C.2.14 New (Compensatory) Planting
A key component of this is to ensure that even-age woodlands are progressively restructured in a sustainable manner: felling coupes should be phased to meet adjacency requirements and their size should be of a scale which is appropriate in the context of the surrounding woodland environment.	C.2.1 Felling
In particular we note that the revised application increases the tip height of the proposed turbines, in light of this: - there should be more scope to phase, or reduce the scale of felling on the site. - it should be possible to increase the maximum top height of the restock above 10m.	C.2.1 Felling C.2.5 Replanting proposals

A.5 Long Term Vision and Management Objectives

Tell us how you intend to manage the forest in the long term and your goals for its development.

Vision

Describe your long term vision for the LTFP area.

The long term vision for the area covered by Tangy Wind Farm Forest Plan is to create a woodland environment which is compatible with the current wind energy generation technology. An acceptable balance between tree cover and wind energy generation has been achieved.

The woodland within this area will be managed to develop into a productive conifer crop which can be harvested when it reaches a *mean height* of 10 metres. The attainment of this height is predicted as being approximately 21 years after replanting. The wind energy land use and forest cover requirements will be both presented for review at this time.

As the wind farm plan area is integral with the forest owners' other forest holdings, the review will be considered in the context of the individual forest owners' objectives.

Management Objectives

Give your objectives of management and also how you will manage the forest area sustainably. Your objectives should be specific and you should also be able to measure their outcomes.

No.	Objectives (including environmental, economic and social considerations)	Indicator of objective being met
1	Manage the woodland in the context of the construction and operation of the wind energy development.	Tangy IV wind farm constructed and generating renewable energy within the context of a felled and replanted woodland.
2	Through design, the woodland habitat will be compatible with the operation of the wind farm	Wind energy is not reduced beyond feasible generation parameters.
3	To maintain a critical mass of productive conifer crop which will provide a harvestable product.	A marketable forest product will be available for harvesting as a short rotation forest crop.
4	To protect and enhance local ecologically important features within the site such as riparian zones.	Improved biodiversity within the riparian zones which are redesigned to UK Forestry Standards guidelines.
5	To respect and cooperate with the different landowners' and	The three forest owners are able to include this area within their

No.	Objectives (including environmental, economic and social considerations)	Indicator of objective being met
	leaseholder's, broader land management objectives. This includes not compromising forest owners' UK Forestry Standards compliance.	broader forest holdings in terms of sustainable forest management.

A.6 General Site Description

Provide details under each of the headings below. Append maps if appropriate for each subsection.

A.6.1 Topography

There is a general southerly aspect to the Forest Plan area across an elevation range approximately between approximately 140 – 225m AOD (Above Ordnance Datum).

The site reaches maximum elevations of 260m AOD in the north-east. The terrain is gently to moderately sloping, with slopes generally less than 8°. Localised slopes are present to the Allt nan Creamh and Cnocan Gean.

See also Tangy IV Wind Farm EIA Report Figure 11.2

A.6.2 Geology and Soils

Forest soils classification is summarised by:

Code	Group	Type
6	Peaty Surface-water Gley	Typical peaty surface-water gley
9e	Flushed Blanket Bog	Trichophorum-Calluna-Eriophorum-Molinia bog
11b	Unflushed Blanket Bog	Calluna-Eriophorum blanket bog

See also Tangy IV Wind Farm EIA Report Chapter 11: Geology, soils and hydrology.

EIA Report Figure 11.3: Superficial Geology Map identifies Till, Devensian-Diamicton, an area of Peat and smaller areas of Alluvium.

The bedrock geology is understood to be comprised of the Stonefield Schist Formation on the western area of the site. According to the British Geological Society this is a metamorphic bedrock formed approximately 542 to 1000 million years ago. This formation was originally sedimentary in origin and has been later altered by low-grade metamorphism to its current facies.

The Eastern area of the site consists of the Glen Sluan Schist Formation.

The central region of the site has two bedrock formations running as linear sub-crops orientated in a north-west to south-east direction. The eastern band is the Loch Tay Limestone Formation. The western band is the Neoproterozoic Basic Minor Intrusion Suite, Amphibolite & Horneblende Schist.

The peat encountered across the site is typically brown pseudo-fibrous peat with a thin surface of peaty topsoil. With a moderate amount of decomposition and large content of root structure; typical Von Post Classification values range between [H4] to [H7]. Beneath the peat, although spatially variable in its extent, a variety of glacial deposits are understood to be present. These materials are remnants from the last glacial retreat. All are erosional, transported sediments of glacial diamicton, sands and gravels, cobbles and boulders in a matrix of clay and silt.

Peat has been found to form a deep deposit across the north-eastern part of the study area. Deposits elsewhere have been found to be relatively shallow. The calculated mean peat depth across the recorded deposits is 0.55m, with a maximum recorded peat depth of approximately 3.6m in a deep pocket of peat recorded on the north-eastern boundary of the study area.

A.6.3 Climate

In terms of forest potential Tangy Wind Farm Forest Plan area can be summarised as having a mild but windy climate with little winter frost or significant snow. The strength of the wind is a limiting factor to tree stability when combined with wet soils.

The climate of Western Scotland is relatively mild due to the strong maritime influence. The warm Gulf Stream also has a strong influence on Western Scotland. With winds mainly blowing from the sea the annual mean temperatures are in the range 9.5 to 9.9 °C in coastal areas.

Kintyre is among the sunniest parts of Western Scotland where the average annual sunshine totals approach 1450 hours.

Kintyre is one of the more exposed areas of the UK, being close to the Atlantic. The strongest winds are associated with the passage of deep

depressions close to or across the UK. The frequency and strength of depressions is greatest in the winter half of the year and this is when mean speeds and gusts are strongest.

The direction of the wind is defined as the direction from which the wind is blowing. The wind rose for the development site shows the clear prevailing winds are westerly and south-westerly. The range of directions between south and north-west accounts for the majority of occasions and the strongest winds nearly always blow from this range of directions. Spring time also tends to have a maximum of winds from the north east, due to the build-up of high pressure over Scandinavia at this time of year.

A.6.4 Hydrology

The Forest Plan area involves the catchments of the Allt nan Creamh, Allt na Ceardaich, Allt a' Ghoirtein and Tangy Burn.

See also Tangy IV Wind Farm EIA Report Chapter 12: Surface Water Figure 12.1: Hydrological Features

River Basin Management Plans (RBMP)

No watercourses within the Forest Plan boundary have been classified under SEPA's RBMP. Glenlussa Water in proximity to the Forest Plan area has been classified under the RBMP.

Drinking Water Protected Areas (DWPA)

Peninver Water Treatment Works (WTW) is approximately 6.9km from the site boundary; felling and replanting will be carried out within the catchment of the Allt Harvie, which drains into the Glenlussa Water, south of Lussa Water approximately 1.1km from the application boundary (NGR 1707 6285).

Private Water Supplies

Although a number of private water supplies have been identified in and around the Tangy IV Wind Farm, within the Forest Plan area only one source is located inside the planted area shown in EIA Report Figure 12.1

A.6.5 Windthrow

Windthrow has been evident within the forest area for a number of years. All three forest ownerships exhibit some degree of windthrow in a variety of age classes.

Tangy Forest Plan reports damage having occurred, within P1989 compartments, during the storms of 2012.

Aerial imagery used in developing the 2014 Environmental Statement clearly show the extension of significant blown areas within P.1975 compartments within Lagalgarve Forest. (Appendix Plate 6) It is also noticed that the P1988 compartments, outside the Tangy Wind Farm Forest Plan area has areas of wind throw.

There are pockets of wind throw within the FES P.1975 compartments.

A.6.6 Adjacent Land Use

A.6.7 Access

Lagalgarve Forest has unimproved access through Lagalgarve Farm, there is no connection to the forest area covered by this plan.

Tangy Forest has Servitude Rights of Access over shared road for all forestry purposes through Tangy Farm via the minor public road and access the A83 north of Kilkenzie.

The forest access is yet to be developed.

Lussa Forest has established an internal forest road system to the north which joins the A83 north of Bellochantuy.

The wind farm development has access through the existing Tangy Wind Farm, Tangy Farm and the minor public road to the A83.

There is little or no public access taken within the forest area to date.

Argyll and Bute Council confirmed there are no known rights of way within the study area of the wind farm (November 2013).

A.6.8 Historic environment

See also Tangy IV Wind Farm EIA Report Chapter Figure 13.1

Site No.	HER No.	Site Name	Site Type	Designation	Importance
3	2968	Alt nan Creamh	Hut Circle	None	Regional
10	2977	Alt nan Creamh	Sheiling Huts	None	Local
	304772*	<i>Avro Anson I: North Channel</i>	<i>Ditched Aircraft</i>	<i>None</i>	<i>n/a Arbitrary</i>

					<i>grid reference</i>
13	2985	Tangymoil	Cup Marked Stone	None	National

* This asset does not have an HER reference, therefore the Canmore ID is provided for information.

Allt Nan Creamh Hut Circle (Asset 3) is associated with Allt Nan Creamh Burnt Mound (Asset 2). Both assets are situated on a gentle north facing slope overlooking Allt Nan Creamh. The hut circle has an internal diameter of 9.5m and although the wall dimensions are vague a boulder slab construction is evident. The hut circle has been badly damaged by forest ploughing and planting. Such assets in upland marginal areas are well known in the archaeological record and many date to the late Bronze Age. They are believed to have been abandoned during the climatic downturn in this period when they became unsustainable as settlement sites. Although damaged during forestry operations, taking into account its importance as evidence of prehistoric domestic activity and its potential to increase our knowledge of prehistoric domestic activity through material remains this asset has been assessed as being of Regional importance.

Cup marked stones (Appendix Plate 8) are a form of prehistoric art and comprise hollows pecked out of rock with a stone hammer. Some are surrounded by one or more concentric rings and other examples are joined by linear grooves. Such rock art is difficult to date although some examples have been discovered incorporated into graves, the likely period of their use spans the Neolithic and Bronze Age. In consideration of their importance as evidence of prehistoric art, and their group value, these assets have been assessed to be of National importance.

A.6.9 Biodiversity

There are no statutory ecological designations present within the area of Tangy Wind Farm Forest Plan. However, using the Land Information Search (LIS) it is noted outside the site:

- Native Woodland – Integrated Habitat Network
- SSSI – Tangy Loch
- SSSI - Bellochanty and Tangy Gorges
- SPA – Kintyre Goose Roosts
- Wetlands of International Importance - Ramsar

No habitats of greater than local value have been identified on site.

Four species of bat have been recorded on or near the proposed development over the course of the bat surveys:

- soprano pipistrelle;
- common pipistrelle;
- Leisler's bat; and
- Daubenton's bat.

No otter resting places in the form of holts or couches were recorded at the site during the surveys. Three otter spraints were recorded along the Allt na Creamh river that runs adjacent to the north-western edge of the proposed development and through the northern part of the site, confirming otter presence on-site, as shown on EIA Report Figure 10.8. The site is therefore considered to have local value for otter.

No evidence of water vole was recorded during the survey work. The site is not considered to have any value for this species.

No red squirrel signs or sightings were observed during the survey work. The site is not considered to have any value for this species.

One badger sett with three holes was recorded on-site.

See also Tangy IV Wind Farm EIA Report Chapter 10: Ecology and Nature Conservation

A.6.10 Invasive Species

There is no evidence of *rhododendron ponticum* which may be expected in the woodland areas of Argyll.

A.7 Woodland Description

Provide a brief description of woodland types and any relevant past management. Also complete the Tables below, with reference to Appendix 2 of the Long Term Forest Plan – Applicant’s Guidance.

This Long Term Forest Plan is concerned with a defined area within the planning site boundary which, through a process of assessment and consultation, requires forest felling and replanting to ensure the satisfactory construction and operating of the new wind farm turbine layout.

The forests within the plan area are parts of three separate ownerships and management arrangements, as shown on the accompanying Felling Plan.

Two forest units are privately owned by different parties. The third central section is National Forest Estate managed by Forest Enterprise Scotland (FES).

All are established productive conifer forests typical of traditional upland plantations in the west of Scotland. The overriding influence on the performance and character forests is its coastal location affected by a mild, wet but windy, climate on generally waterlogged soils. Forest rotation length is largely determined by terminal height (at which windthrow is predicted to reach levels requiring clearfelling).

The three forest ownership entities are Lagalgarve forest, West Lussa and Tangy Forest;

1. The family owned Lagalgarve forest is the most westerly unit and extends to the lower slopes of the development site. This presents some earlier established plantations which are now over-mature and have significant sections of windblow. No felling or replanting has taken place in this area to date. The overall management objective is as investment for family succession.
2. Forest Enterprise Scotland manages the section of woodland which forms part of the West Lussa Forest. Within this forest there has been felling and restocking under two consecutive forest design/land management plans. Part of the area outside the site boundary has been felled and replanted with a further area planned for felling imminently. These areas are outwith this plan remit.
3. Tangy Forest is managed by a forest investment company and is entering into the timber production phase. Some windthrow is already present. Tangy Forest has a current approved Forest Plan.

Forest condition varies with elevation and soil type from good timber achieved (Appendix Plate 5) to windblown (Appendix Plate 6) with growth rates and quality ranging through to checked on waterlogged soils.

Data is provided by the land owners or their managers where available. Additional information is drawn from LiDAR and aerial imagery and site observations.

Table 1 - Area by species

This shows the current and future species composition within the entire Long Term Forest Plan area.

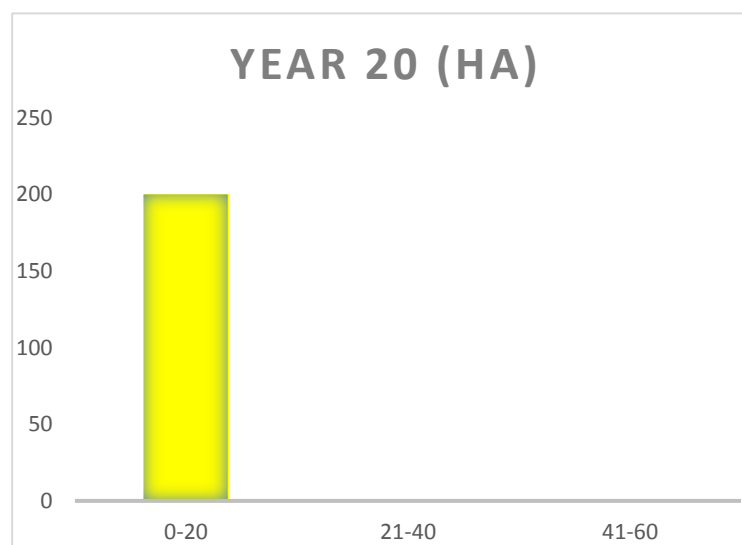
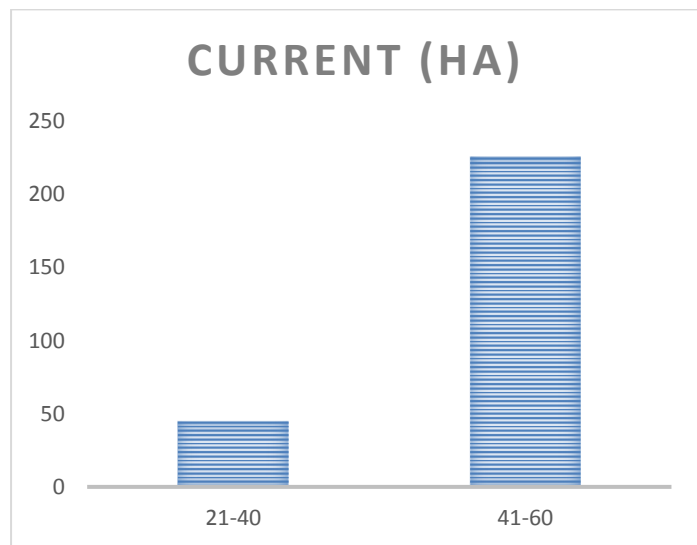
Area by species						
Species	Current*		Year 10*		Year 20*	
(Add relevant species groups, or OG/OL)	Area (ha)	%	Area (ha)	%	Area (ha)	%
Sitka spruce (some LP)	270.75	100	196.32	68%	196.32	68%
NBL			3.50	1%	3.50	1%
Designed Open Ground			30.43	10%	30.43	10%
Peatland restoration			27.72	10%	27.72	10%
Wind Farm Infrastructure (including bat buffer clearance areas)			31.73	11%	31.73	11%
Total		100		100		100

* Of whole Forest Plan area (including open ground (OG)). Any mixtures such as Mixed Conifer (MC) should be broken down and included as an individual species component where a species occupies more than 10%.

Table 2 – Area by age

This shows the woodland area broken down by age class and will show how well the woodland is distributed across the age classes. This information can be provided as a chart below. Double click on the chart below and paste your area figures into the spreadsheet that appears.

Age class (years)	Current	Year 20
	Area (ha)	Area (ha)
0-20		199.85
21-40	44.92	
41-60	225.83	
61-80		
81-100		
100+		
Total	270.75	199.85



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A.8 Plant Health

Provide details on any known plant health issues within the LTFP area and their effect on the forest plan.

There is no evidence of tree health issues within this Forest Plan area. Current observations have reported no presence of *Dothistroma* or *Phytophthora ramorum*.

B. Analysis of Information

B.1 Constraints and Opportunities

Identify constraints and opportunities. Append maps as appropriate and provide map reference.

Factor	Constraint	Opportunity
Wind farm infrastructure	Design of roads, turbine and other infrastructure dictate the overall sub-compartment structure.	Separate management units with good road access.
Wind energy production	A tree height limitation of 10m is presently agreed, after which felling of the replanted site will take place.	10m tree height should provide marketable timber resource.
Watercourses	Loss of planting ground.	Biodiversity enhancement through enlarging the riparian zones.
Deep peat/ poor tree growth	Loss of planting ground due to poor tree growth.	Revisiting the forest edge design. Appropriate peatland restoration.
Fragile public road access	harvesting plans must take into consideration likely restrictions when assessing the viability of any haulage operation.	A Timber Traffic Management Plan will be required to mitigate the risk of accelerated damage due to intensive haulage operations

Outline how you intend to incorporate the constraints and opportunities into the management objectives.

The wind farm design layout provides an outline for new compartment boundaries which will allow future management options. The replanting design considers how this layout will encompass the environmental “constraints” such as buffer zones for bats and riparian enhancement zones.

The felling and replanting processes provides the opportunity to review the land use where tree growth on deep peat is poor. The decision for an area of peat restoration follows the management options given within the Forestry Commission Practice Guide *Deciding future management options for afforested*

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deep peatland.

In a similar manner the replanting design will include open space and access to the historic sites identified.

The unfavourable effect of tree growth on wind energy performance is treated by compromising turbine performance with a limitation of tree height. The compromise *mean tree height* of 10m is sufficient to provide a timber product without recourse to managing forestry waste regulations.

Recognition of the fragility of the minor public road for timber haulage is mitigated by land owner agreements to move some timber from site through the internal forest road system on the National Forest Estate.

C. Management Proposals

C.1 Silvicultural Practice

Outline silvicultural practice and management prescriptions. Include any past management practice that is relevant and the strategies to address the issues identified during the analysis phase.

The decision process requiring the felling of the selected area for the wind farm construction and operation was detailed in the Tangy III Wind Farm Environmental Statement Appendix 16.2 Forestry. The preferred option for wind energy production is to clear the area and maintain free of trees, however, through consultation a compromise position is to fell the selected area and to replant to a keyhole design.

According to the Argyll and Bute Council Woodland and Forestry Strategy Tangy Wind Farm Forest Plan area falls into two categories;

- Land with limited flexibility for the growth and management of tree crops and
- land with moderate flexibility for growth and management of tree crops.

The current practice for this site type, as demonstrated by neighbouring forest areas, is a clearfell and replant rotational system.

The proposals for Tangy Wind Farm Forest Plan area will follow this procedure with a limitation to *mean tree height* of 10m. This may be described as a "short rotation" silvicultural system. At this point the felling and replanting options will be reviewed in the context of wind turbine performance, further repowering options and future forest management.

C.2 Prescriptions

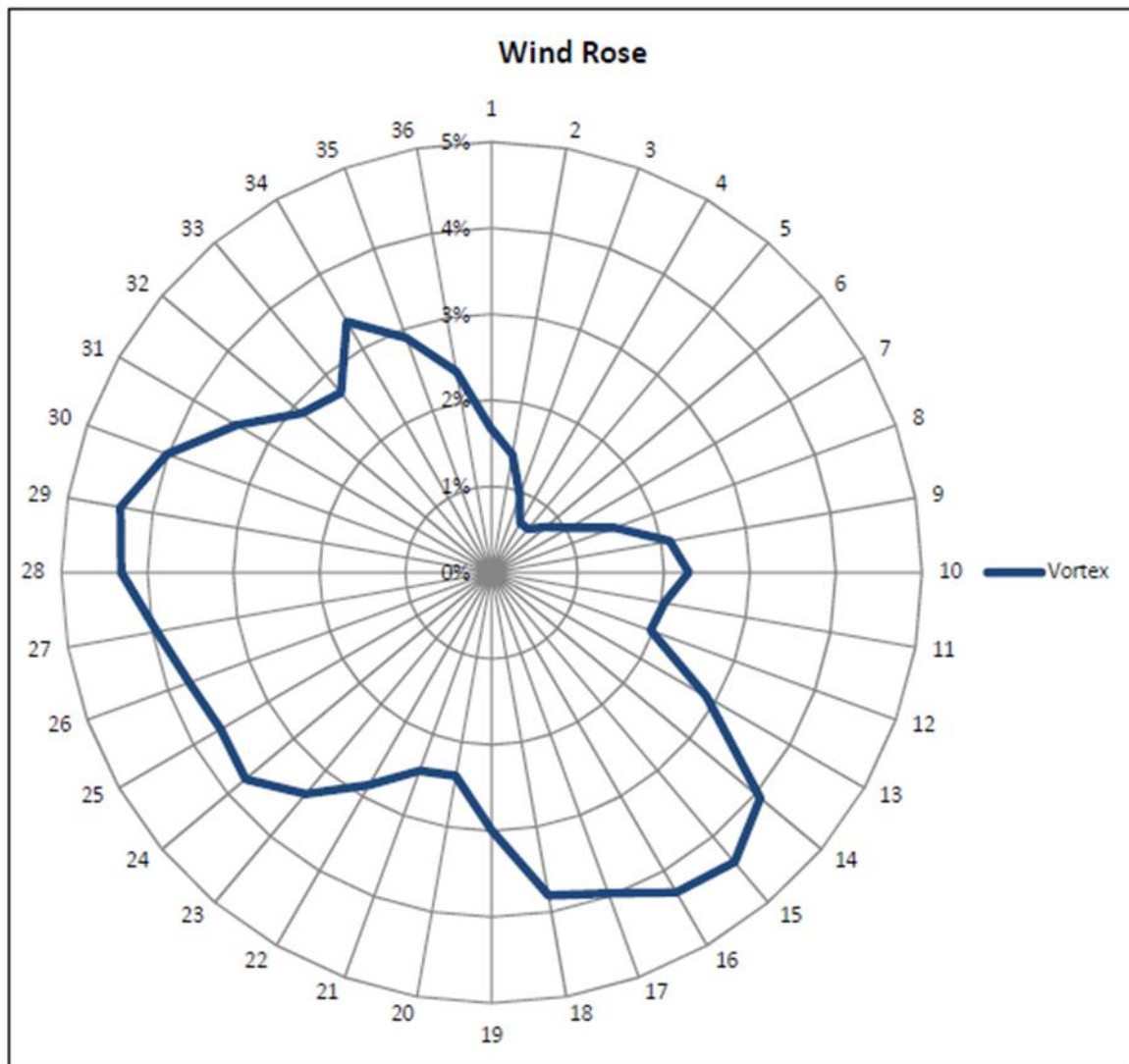
Please provide maps as set out in Appendix 2 of the Forest Plan Applicant's Guidance and complete the associated Tables. Provide any further details required along with the map references.

C.2.1 Felling

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The felling requirements have been identified as part of the overall site design whilst taking account of other constraints. Wind resource analysis modelling has been carried out using Computational Fluid Dynamics (CFD) and has reduced the area considered suitable for wind resource, within the planning boundary.

The felling design is governed by the wind energy requirements of the wind farm. The wind rose below illustrates the significance of the wind direction and the requirements to clear fell and replant. Also where the wind direction is less influential and felling requirements are reduced.



The north-west forest area within Lagalgarve Forest comprises the complete P. 1988 compartments and is not required for felling for the development. However, forest design is integral with the overall land management. The optimal felling date for this crop is circa 2025, although there is already evidence of some windblow within this area which may indicate this as optimistic. This section of forest will be restructured to continue as a productive unit. Opportunities will be taken to extend the riparian native broadleaf planting into the open ground below the development boundary.

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An appropriate felling line (Felling Plan) has been developed in conjunction with Forest Enterprise Scotland which gives enough clearance for the wind farm development while minimising the felling area. The current restocked areas P.2010 and P.2014 do not impact the proposed development due to their location and/or topography. Outside this area (i.e. beyond the agreed felling line) is under the management of the FES West Argyll Forest District with no further requirements or implications for the proposed development.

The landscape photomontage, VP Ranachan Hill, illustrates a straight edge on the eastern boundary, this will be less evident with FES continued felling and restocking in the wider area.

Tangy Forest, the south east forest area within the proposed development is one part of two units in the locality under the same ownership. The CFD results similarly suggested that a significant part of this development would not require felling for the benefit of the turbines. This woodland was all planted in 1986 and sits within a relatively more sheltered area. The restructuring of this unit will likely to be circa 2025 and will develop biodiversity through open space and native broadleaves associated with the Allt Trasda watercourse.

Tree felling and timber extraction:

It is noted through site investigations that tree sizes and crop condition vary from wind thrown large tree size to stunted poor growth however the overall tree size and site conditions are favourable to current standard harvester felling with extraction of shortwood products by standard forwarders.

The principles of felling produce to the side and creating a brash mat will be adopted as good practice. The techniques set out in Forestry Commission Technical Note Protecting the Environment during Mechanised Harvesting Operations will be followed. Furthermore, the felling and extraction operations will follow UK Forestry Standards Forest and Water Guidelines pertinent at the time of harvesting. To avoid potential diffuse pollution, and other adverse events, good site pre-planning and on-going site management and monitoring will minimise any adverse effects on watercourses.

Following the current Forestry and Water Scotland pocketbook guidelines around watercourses, including connected ditches and drains operations will;

- Prepare and follow the site plan, paying particular attention to the main extraction route locations
- Minimise the risk of diffuse pollution by assessing the drainage system and identifying watercourses and drains
- Ensure that roadside drains are disconnected before work commences
- Plan for bad weather and work sensitive areas in drier conditions
- Only use band tracks where necessary
- Always try to fell away from watercourses and lift any brash and tops out of the buffer zone
- Minimise water crossings; Use pipes and log bridges when crossing is unavoidable (and remove these when site work is completed)

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- Stack from in-wood where site conditions allow
- Use brash or cut-offs to deflect water from extraction routes onto the forest floor
- Maintain brash mats, patching holes before they become waterlogged
- Utilise alternative working options for sites that lack brash.

The operations will not;

- Operate machines in watercourses
- Track machines for long distances on forest roads
- Repeatedly track harvesting machinery within sensitive areas (eg buffer areas, wetlands, designated areas)
- Continue to work sensitive areas during prolonged and heavy rain
- Stack timber in roadside drains or buffer areas
- Run extraction routes where run-off is likely to enter a watercourse

Follow the 'Keep Your Distance' guide for harvesting;

Minimum working distances from watercourses, including connected ditches and drains

Width up to 1m	Fuels and Oils
5m	No refuelling within 10m* of any watercourse, No storage or handling of fuels and oils within buffer areas
No harvesting, brash tracking	

*Construction Environmental Management Plan details may specify a greater distance.

Accordingly, timber harvesting operations will require sufficient infrastructure to enable the transfer and despatch the timber volumes through forest/windfarm roads to public highway.

Road haulage direction;

Timber volumes released during the harvesting will be transported to the public highway and onward by conventional timber lorries. The direction of haulage will be split between timber from Forest Enterprise Scotland being hauled north west to link with the internal forest road system to link with the A83 north of Bellochantuy.

Timber from the two privately owned woodlands will be hauled through the existing Tangy Wind Farm via the minor public road and access the A83 north of Kilkenzie.

Timber haulage will be governed by statutory Department of Transport regulations and operators will follow the FISA Forest Haulage Safety Manual 2018 or later updates.

Typically, round timber from the Kintyre peninsular is transported onward through the timber handing facilities at Ardishaig and Campbeltown.

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Timber products and markets;

Mean tree volumes range from 0.45m³ to 0.03m³ giving a range of products from sawlogs through to small round wood.

Markets outwith the area;

- BSW Ltd; Fort William and Carlisle
- Adam Wilson & Sons Ltd. Troon
- Balcas; Sawmill in Enniskillen, Northern Ireland and Combined Heat and Power plants in Enniskillen and Invergordon.
- Drenagh Sawmills; Limavady, Northern Ireland
- Iggesund Paperboard
- UPM Caledonian

Depending on market conditions and exchange rates at the time European mainland and Scandinavian outlets may be available.

C.2.2 Thinning

Tree removal, which results in a temporary reduction in basal area, made after canopy closure to promote growth and greater value in the remaining trees.

Thinning options for the second rotation crop will be limited for a number of reasons;

- Wind hazard Class exposed slopes and wet ground conditions are not conducive to crop stability during or after the thinning operations.
- The maximum 10m tree height for felling would be the earliest tree height for thinning.

C.2.3 LISS

Lower Impact Silvicultural systems are defined as forest management decisions including group selection, shelterwood or under-planting, small coupe felling, coppice or coppice with standards, minimum intervention and single tree selection systems which are suitable for windfirm conifer woodlands and most broadleaved woodlands.

With the short rotation period planned for the area of the wind farm Lower Impact Silvicultural Systems are not considered viable.

Soil type and exposure together limit the options for LISS even in subsequent rotations.

TANGY WIND FARM FOREST MANAGEMENT PLAN

C.2.4 Long Term Retentions (LTR) / Natural Reserves

Long-term retention is defined as trees retained for environmental benefit significantly beyond the age or size generally adopted by the woodland enterprise. Natural reserves are predominantly wooded, are permanently identified and are in locations which are of particularly high wildlife interest or potential. They are managed by minimum intervention unless alternative management has higher conservation or biodiversity value.

The concept of LTR and wooded natural reserves are not conducive to wind resource or other habitat constraints within the area of Tangy Wind Farm Forest Plan.

There are more suitable opportunities for LTR and natural reserves within the broader forest holdings under the same ownerships.

Peatland restoration has been identified for an area of deep peat where the tree growth is poor (<YC 8) following FCS Practice Guide "*deciding future management options for afforested deep peatland.*"

C.2.5 Restocking Proposals / Natural Regeneration

ESC analysis

Ecological Site Classification (ESC) is the aid to select tree species, and to make related decisions based on the appreciation of the ecological potential of sites.

The ESC analysis for Tangy Wind Farm Forest Plan area is summarised below:

Species (provenance)	Suitability
Lodgepole pine	Suitable
Macedonian pine	Suitable
Scots pine	Marginal
Sitka spruce (QCI)	Marginal
Downy birch	Suitable
Grey alder	Suitable
NVC Woodland analysis Woodland Type	Suitability
W4 Birch with purple moor grass	Very Suitable

ESC analysis

Forest owners' objectives, the success or otherwise of the current crop and the compromise by the wind farm developers lead to a general replanting with Sitka spruce.

TANGY WIND FARM FOREST MANAGEMENT PLAN

The replanting design incorporates the permanent wind farm layout in terms of access roads, infrastructure and specified buffer zones around each turbine. Replanting also provides for the opportunity to adopt current environmental standards, including UKFS Requirements, regarding watercourses and peatland restoration.

Replanting around the in-forest water supply for Lagalgarve/Tangytavil will increase the buffer to 50m commensurate with current good practice as stated in UK Forest Standards.

Bat buffer zones;

The basis for leaving the buffers unplanted is that bat species tend to follow linear features such as tree lines or hedgerows when commuting/foraging and are less likely to cross open spaces. Guidance in the UK (the Natural England TIN051) specifies a minimum buffer distance of 50m from the edge of the feature and the blade tip of the turbine to reduce the risk of bat species flying close to turbines. However, this 50m cannot be used to measure the distance from the turbine base at ground level so the following equation is used to calculate the distance between the edge of the feature and the centre of the turbine tower at ground level:

$$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$$

bl=blade length (m)

hh=hub height (m)

fh=feature height (m)

As a range of turbine specifications could be used for the Tangy wind farm, the turbine with the largest buffer distance has been selected to minimise the risk to bats. This turbine has a blade length of 65m and a hub height of 85m. The feature height has been taken to be 10m (as planting following clear felling is to be allowed to grow up to a height of 10m). The above equation it looks like this:

$$b = \sqrt{(50 + 65)^2 - (85 - 10)^2}$$

$$b = \sqrt{(115)^2 - (75)^2}$$

$$b = \sqrt{13225 - 5625}$$

$$b = \sqrt{7600}$$

$$b = 87.2m$$

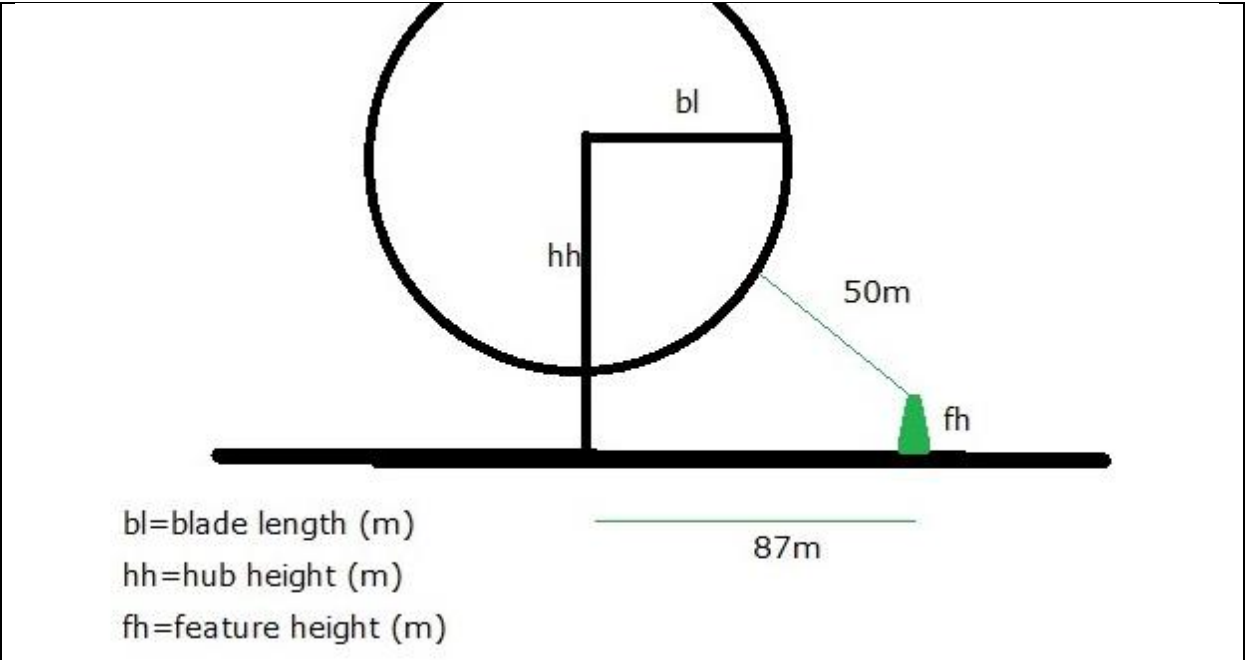


Figure 1 bat buffer illustration

The outline technical details for replanting are as follows:

Cultivation and drainage;

The purpose of cultivation within the areas selected for replanting is to assist early establishment through aeration of soils, providing local drainage and weed suppression. Cultivation may enable correct plant spacing determined by the species choice and silvicultural systems selected. In the longer term cultivation may help to develop good root architecture which assists satisfactory growth and may assist in preventing early onset of windthrow.

The most suitable method of cultivation for managing the restock of upland spruce is currently excavator mounding at 1.9m centres to provide a stocking figure of 2700 trees per hectare.

The associated drainage system will be planned and used with combinations of culverts and cut-off drains, sumps, silt traps and vegetated buffer zones to stop drainage water going directly into a watercourse as the guidelines for Forest and Water.

Follow the 'Keep Your Distance' guide for cultivation;

Minimum working distances from watercourses, including connected ditches and drains

Width up to 1m	Width 1- 2m	Width >2m	Fuels and Oils
5m	10m	20m	No refuelling within 10m* of any watercourse, No storage or
No ground prep machinery	No ground preparation	No ground preparation	

TANGY WIND FARM FOREST MANAGEMENT PLAN

				handling of fuels and oils within buffer areas
<p>*Construction Environmental Management Plan details may specify a greater distance.</p> <p>Ground Preparation and drainage operations will;</p> <ul style="list-style-type: none"> • Follow the 'Keep Your Distance' guide • Choose the most appropriate technique and machinery for the site • Identify all watercourses and ensure appropriate buffer areas are in place • Use silt traps/sumps and vegetated areas to reduce sediment run-off • Ensure drain gradients do not exceed 2 degrees • Block existing drains which connect directly to watercourses • Minimise water crossings and use pipes and log bridges <p>Won't</p> <ul style="list-style-type: none"> • Operate machinery or equipment in any river, burn or ditch • Connect drains directly to watercourses • Undertake ground preparation on waterlogged ground. <p>Planting stock;</p> <p>The proposed productive conifer crop for the long term contribution to objectives of the woodland area has been determined through the ESC process and forest owners objectives as Sitka spruce. With the understanding that the primary land use is wind energy production and as the trees grow they have an increasing impact on wind energy available and wind turbine performance it is proposed to use planting stock with slower growing characteristics.</p> <p>Whereas current research projects aim to increase the economic value of future Sitka spruce plantations substantially by using new breeding techniques to combine high growth rate with good timber qualities, the requirements for tree growth within wind farm sites require a modest to low rate of growth. A standard QCI or Alaskan provenance may be suitable.</p> <p>Typical bare rooted planting stock in the size range of 40-60cms will be suitable.</p>				

Table 3 – Felling

This shows the scale of felling within the felling phases in the context of the whole Forest Plan. This includes any areas of 'LISS – Fell' (i.e. removal of final overstorey).

Total Forest Plan Area:		289.60						
Felling	Phase 1	%	Phase 2	%	Long Term Retention	%	Area out-with 20yr plan period	%
Area (Ha)	270.75	100	0	0	0	0	0	0

Table 4 – Thinning

This shows the area of thinning over the first 10 years of the Forest Plan.

Species	Thinning (ha)
N/A	N/A
Total	N/A

Table 5 – Restocking

This table provides information on the restocking proposals for the first 10 years of your Forest Plan. Restocking should be listed on a coupe by coupe basis.

Felling Phase	Map Identifier(s)	Species to be planted	Area (ha) to be planted
Phase 1		Sitka spruce	197.07
		NBL	3.50
		Designed open ground	29.72
		Wind farm infrastructure including bat buffer zones includes an area at T9 outside the felling area.	31.73
		Peat restoration area	27.72
Total Restocking Area			289.72

C.2.6 Protection

Protection against weevil;

Hylobius spp remain a significant threat to the successful establishment of a replanted conifer site. Because the greatest damage is caused by adults developing and emerging from stumps at least 18 months from the time of felling, it should be possible for plants planted soon after felling to have grown through their most vulnerable period. However, in practice significant damage may be caused by insects invading from nearby older restocking sites within the first 18 months.

The proposed management strategy to reduce *hylobious* damage to enable successful establishment will be through restock cultivation (as above), healthy planting stock with a robust root collar diameter and rapid replanting after felling.

As current practice trees may be treated with pesticide before planting followed by a programme of top up pesticide application based upon survey observations. Continued engagement with ongoing research into biological control and physical barriers may provide alternative methods. Cooperation must be afforded to the Tangy Wind Farm forest owners' chemical reduction policies in accord with forest certification through UK Woodland Assurance Scheme.

All personnel applying pesticides will be suitably trained (NPTC PA1 and PA6).

Chemical usage will be in accordance with the leaseholders' chemical management instructions.

Protection against deer;

The three forest ownerships currently have their own deer stalking practitioners. Cooperation and coordination will be required to ensure browsing levels are kept to acceptable levels.

It is not envisaged that deer fencing will be required and only localised use of tree shelters to protect broadleaved trees will be considered.

The deer management plan will consist of this cooperation with acceptable levels of damage.

Protection against livestock;

The stock fence between the forest area and adjacent farmland will require maintenance or replacement to prevent stock trespass into the newly replanted woodland. Where newly constructed wind farm roads cross the agricultural and forest marches, adequate gates or grids will be required.

C.2.7 Fence erection / removal

The species selected for replanting have been proven to be established without the need for deer fencing in the neighbouring woodlands and are not being considered for the area of this Forest Plan.

There is no intension to erect additional fences for this Forest Plan area. Where internal fences denote ownership boundaries consideration will be made as to their removal or retention.

C.2.8 Road Operations

The road layout is illustrated on the layout wind farm layout plan.

Within the Forest Plan area the wind farm roads will be constructed in accord with the Construction Environment Management Plan which covers all aspects of borrow pits, water crossing, silt traps and other measures to prevent diffuse pollution.

C.2.9 Public Access

In accordance with the Land Reform (Scotland) Act 2003, Chapter 2 Part 6(1) (g), general public access rights are removed from the construction site for health and safety reasons.

There are no core paths within the study area that will be affected by the proposed development.

There will be some local access restrictions across the site during construction. The access restrictions would include the temporary suspension of activities such as hunting and fishing.

Any disruption to access during construction is considered to be short-term and temporary in nature.

In the longer term public access restrictions will be removed and the Forest Plan area will be open in accordance with the Scottish Outdoor Access Code.

C.2.10 Historic Environment

During felling and replanting the sites noted within the Forest Plan area will be protected as UKFS requirements detailed in Forests and Historic Environment.

Specifically, the areas will be avoided with timber harvesting machinery and replanting will be kept back some 20m from the area.

Site no. 3. Hut circle is within the wind thrown compartment and will be cleared using the benefits of a timber harvester to cut off and pull trees away from the area to be forwarded away from the site. On replanting the area as identified will not be replanted and a route connecting site 3 with the open ground associated with sites 1 and 2. Adjacent to the Forest Plan area.

Site no. 10. Sheiling huts is already identified within FCS LMP and will not be replanted as it sits within the Allt nan Creamh riparian open ground.

Site no. 13. Tangymoil cup marked stone will require marking and protecting during the timber harvesting operations. Open ground will be left around the historic feature which ties in with the open ground associated with Allt a' Ghoirtein riparian zone.

The unverified location of the Avro Anson I will be dealt with as found and additional advice at the time of timber harvesting.

Any other sites of interest released during timber clearance will be responded to by taking advice if or as they arise.

C.2.11 Biodiversity

The Forest Plan replanting design will improve biodiversity opportunity through the increase of open space throughout the site but with the primary benefit being associated with the opening up of watercourses allowing enrichment of the riparian environment on:

- Allt nan Creamh and its tributaries to the north
- Allt Ceardaich, Allt a Ghoirtein and Tangy burn with their associated tributaries to the west and south and
- Allt Harvie to the east

The Tangy Wind Farm Habitat Management Plan will detail the measures will be taken to promote the recovery of a peatland habitat, principally through raising the water table. These are likely to consist of blocking the existing forest drains and measures to manage unwanted natural regeneration of conifer species. The prediction of conifer regeneration is not an accurate science and influenced by the abundance of seed locally at the time of felling and prevailing winds. The site

conditions in the area to be cleared are favourable to natural regeneration in terms of maturing conifer seed source and peaty conditions. However, nearby felled and restocked forest areas do not appear to have an abundance of natural regeneration. Accordingly, a programme to monitor conifer regeneration with plans to react to the findings shall be in place.

C.2.12 Tree Health

The appropriate species selection and provision of healthy planting stock on correctly cultivated ground should promote a healthy second rotation on this site.

Forest monitoring will include tree health observations.

C.2.13 Invasive species

Forest monitoring will include invasive species monitoring and if noted plans drawn up in response.

C.2.14 New (Compensatory) Planting

Compensatory planting measures included within the Scottish Government Control of Woodland Removal Policy will be adhered to.

As a default, 'compensatory planting' (or compensatory natural regeneration) implies an equivalent woodland area, on appropriate site types and with at least the equivalent woodland-related net public benefits, and must take place in Scotland.

The area determined as required for compensatory planting will be based on the areas not replanted resulting from the wind farm infrastructure within the area of the Tangy Wind Farm Forest Plan.

Draft plans identify some areas adjacent to the wind farm location providing environmental connectivity to lower ground. A separate area with potential for new planting is located south of the B843 Machrihanish – Campbeltown, near Bleachfield Farm.

An agreed compensatory planting plan will be submitted prior to commissioning of the wind farm.

The UK Forestry Standards will be referenced throughout all activities in relation to Forestry activities, using the General Forestry Practice Guidelines.

C.2.15 Other:	Deer Management Plan
---------------	----------------------

The outline deer management plan is provided.

Deer management within the wind farm area would largely follow the existing deer management practices currently employed in the area, balancing the requirements of landowners both internal to the site, those of the neighbouring forest, as well as farming interests.

A collaborative approach shall be adopted to provide a deer management plan for the wind farm area.

Sika and Roe deer present are estimated to be in low numbers; only limited signs of bark stripping by Sika has been evidenced during forest survey work.

Adequate protection of young trees should be included for and areas of broadleaved planting will require additional specific protection in terms of tree shelters.

This protection will be extended to any areas of Compensatory Planting.

C.3 Environmental Impact Assessment and Permitted Development Notifications

Please indicate the total area (hectares) for each project type and provide details as requested by sensitive or non-sensitive area.

Type of Project	Sensitive Area		Non-sensitive Area		Total
Afforestation	0 %Con	0 %BL	0 %Con	%BL	ha
Deforestation	0 %Con	0 %BL	100 %Con	0 %BL	31.73 ha

Provide further details on your project if required.

31.73 ha reflects the ground taken by the wind farm infrastructure including open ground associated with the Bat buffer clearance zones. This is the figure carried forward as Compensatory Planting.

C.4 Tolerance Table

	Map Required (Y/N)	Adjustment to felling period*	Adjustment to felling coupe boundaries**	Timing of Restocking	Changes to Restocking species	Changes to road lines	Designed open ground ***	Windblow Clearance* ***
FC Approval normally not required	N	Fell date can be moved within 5 year period where separation or other constraints are met	Up to 10% of coupe area	Up to 2 planting seasons after felling	Change within species group e.g. evergreen conifers or broadleaves		Increase by up to 5% of coupe area	
Approval by exchange of email and map	Y		Up to 15% of coupe area	Between 2 and 5 planting seasons after felling subject to the wider forest and habitat structure not being significantly compromised		Additional felling of trees not agreed in plan Departures of more than 60m in either direction from centre line of road	Increase by up to 10% Any reduction in open ground within coupe area	Up to 5 ha
Approval by formal plan amendment may be required	Y	Felling delayed into second or later 5 year period Advance felling into current or 2 nd 5 year period	More than 15% of coupe area	More than 5 planting seasons after felling subject to the wider forest and habitat structure not being significantly compromised	Change from specified native species Change between species group	As above, depending on sensitivity	More than 10% of coupe area Colonisation of open areas agreed as critical	More than 5 ha

Note

*Felling sequence must not compromise UKFS in particular felling coupe adjacency. Felling progress and impact will be reviewed against UKFS at 5 year review.

** No more than 1 ha, without consultation with FCS, where the location is defined as 'sensitive' within the Environmental Impact Assessment (Forestry) 1999 Regulations (EIA).

*** Tolerance subject to an overriding maximum of 20% designed open ground.

****Where windblow occurs, FCS must be informed of extent prior to clearance and consulted on clearance of any standing trees.

D. Production Forecast

Append your production forecast.

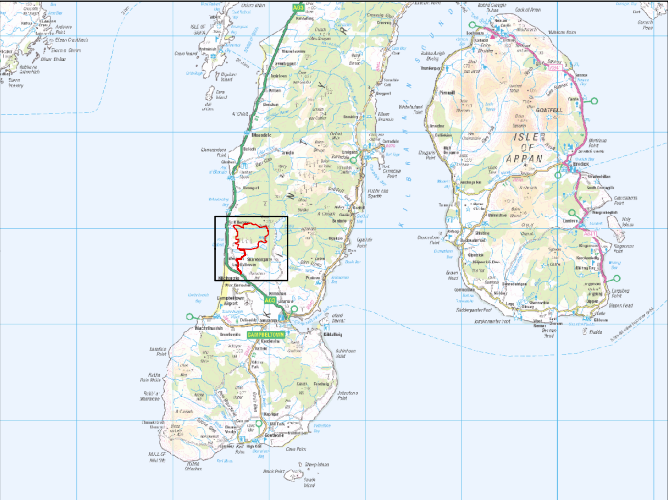
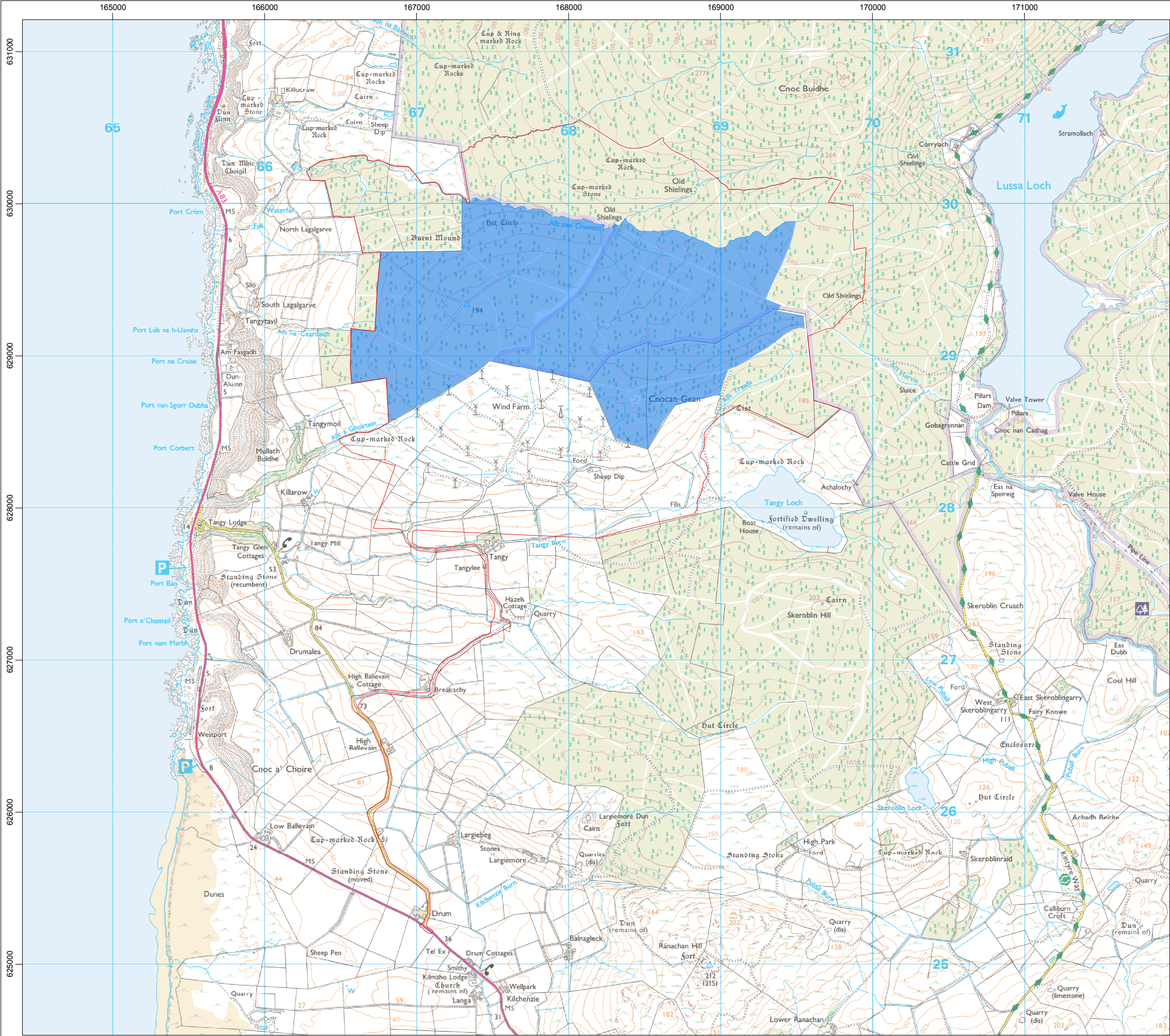
		YC 16		
Planting year	Age at 2020	m ³ /ha	ha	Total m ³
1974	46	643	101.09	65,001
1975	45	623	124.43	77,520
1986	34	412	44.92	18,507
Total timber volume			270.44	161,028
At a conversion rate of 1.43 m ³ /green tonne				112,606.85
This equates to number of timber lorry loads				5,119

(nb minor area discrepancy of 0.31 ha)

Appendices

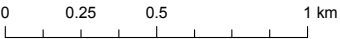
Provide a list of appendices:

Item number	Title
Fig 1	Site Location
Fig 2	Current species plan
Fig 3	Concept plan
Fig 4	Felling plan
Fig 5	Timber haulage plan
Fig 6	Restocking plan
Plate 1	Low productivity on deep peat
Plate 2	Checked spruce on deep peat
Plate 3	Limited broadleaf potential
Plate 4	Watercourse will benefit with opening
Plate 5	Quality spruce within Lagalgarve
Plate 6	Wind thrown crop within Lagalgarve
Plate 7	Some evidence of bark stripping
Plate 8	Cup marked stone



Legend

- Forest Plan Area
- Wind Farm Site Boundary



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Project Name

TANGY

Drawing Title
**FOREST PLAN
SITE LOCATION**

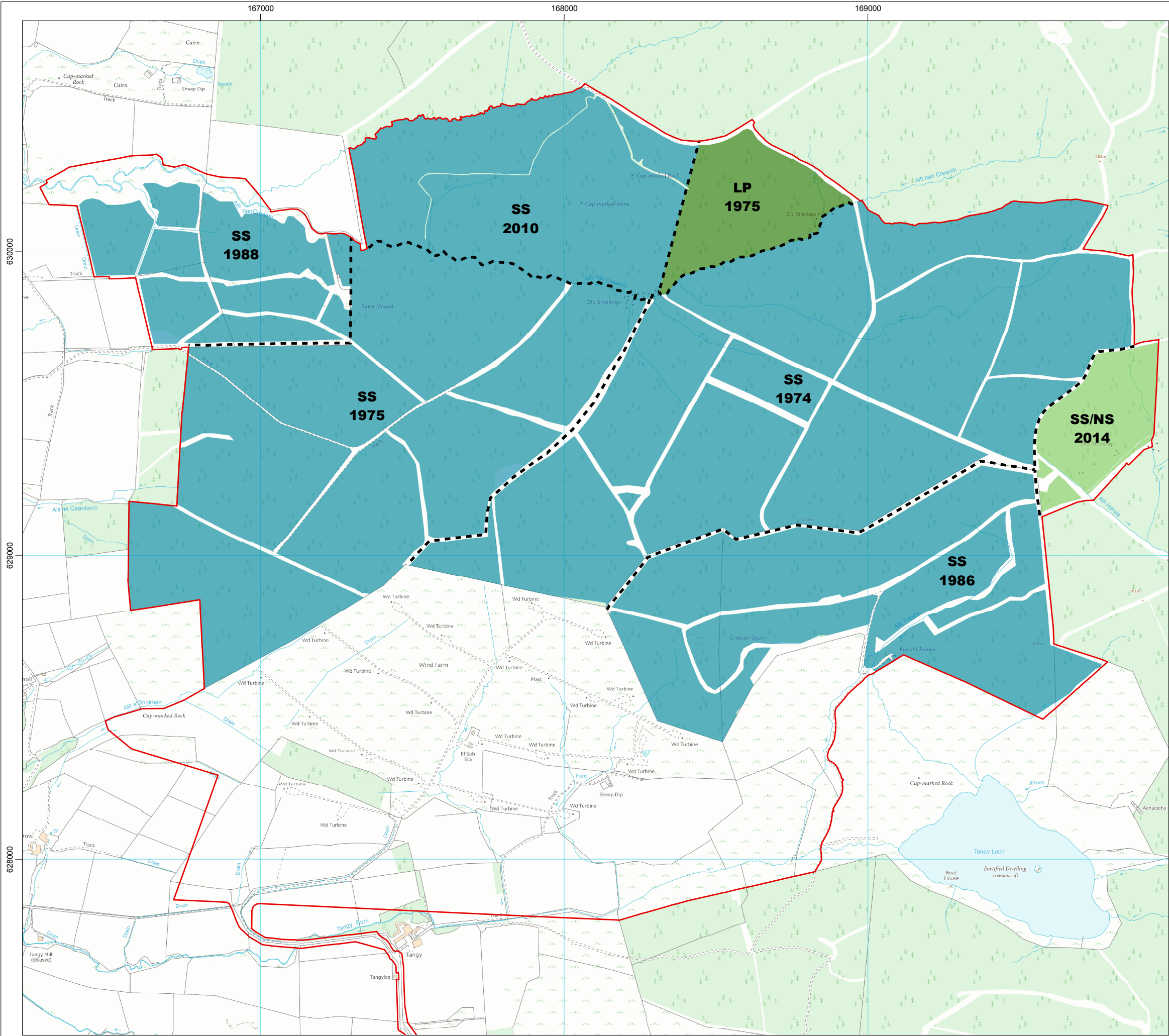
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R0	02/07/2018	First issue	CaT	NM

Drawing Number
LN000082-TGY4-ENV-SK-0011-01

Scale	Plot Size	Datum	Projection
1:25,000	A3	OSGB36	BNG

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Legend

- LP
- SS
- SS/NS
- Wind Farm Site Boundary

0125250500 Meters

N

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Project Name

TANGY

Drawing Title

FOREST PLAN -
CURRENT SPECIES

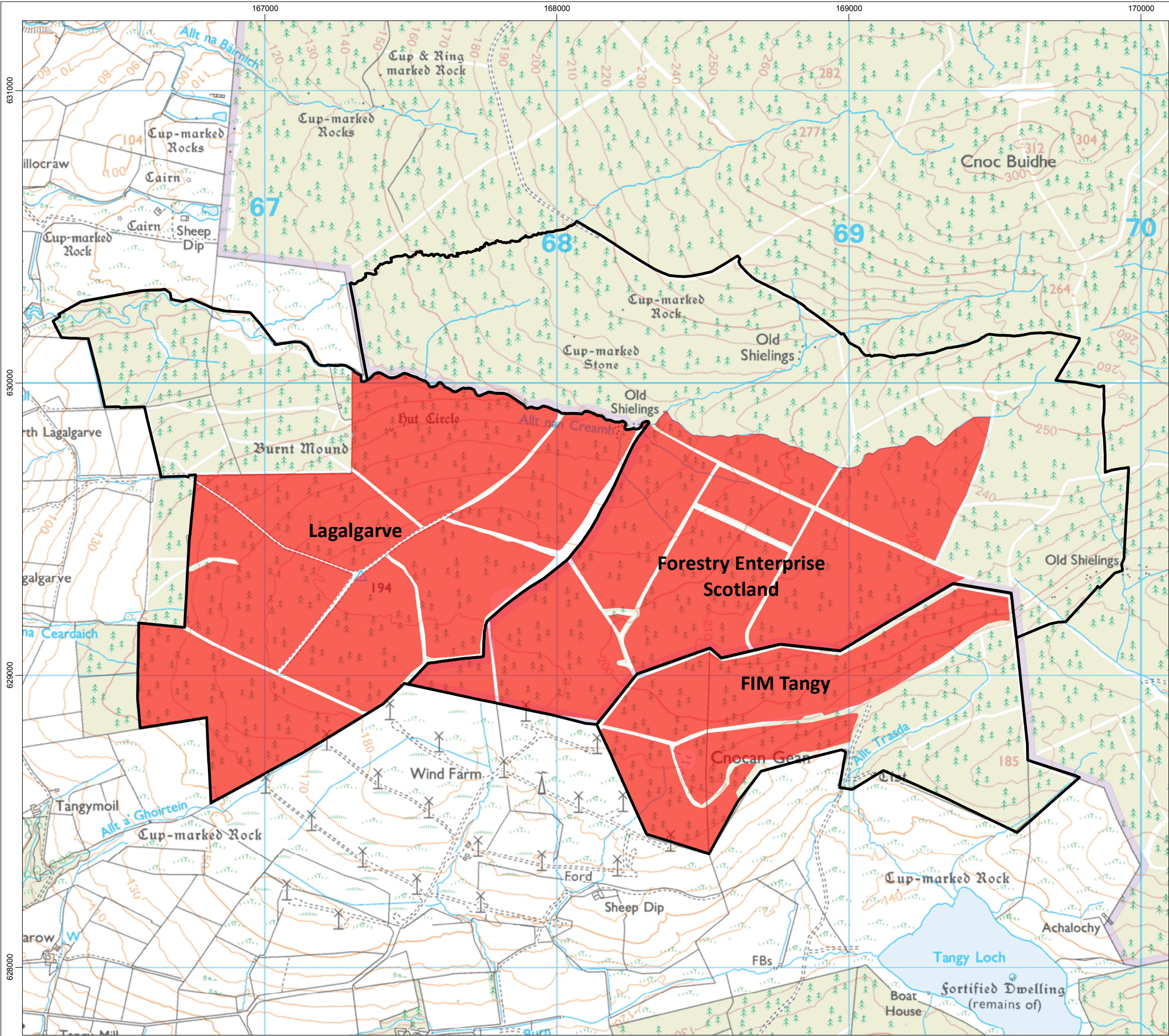
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R0	02/07/2018	First issue	CaT	NM

Drawing Number

LN000082-TGY4-ENV-0005-02

Scale	Plot Size	Datum	Projection
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Legend

- Landowner
- Phase 1 Felling (270.75ha)

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Project Name

TANGY WIND FARM FOREST PLAN

Drawing Title
FELLING

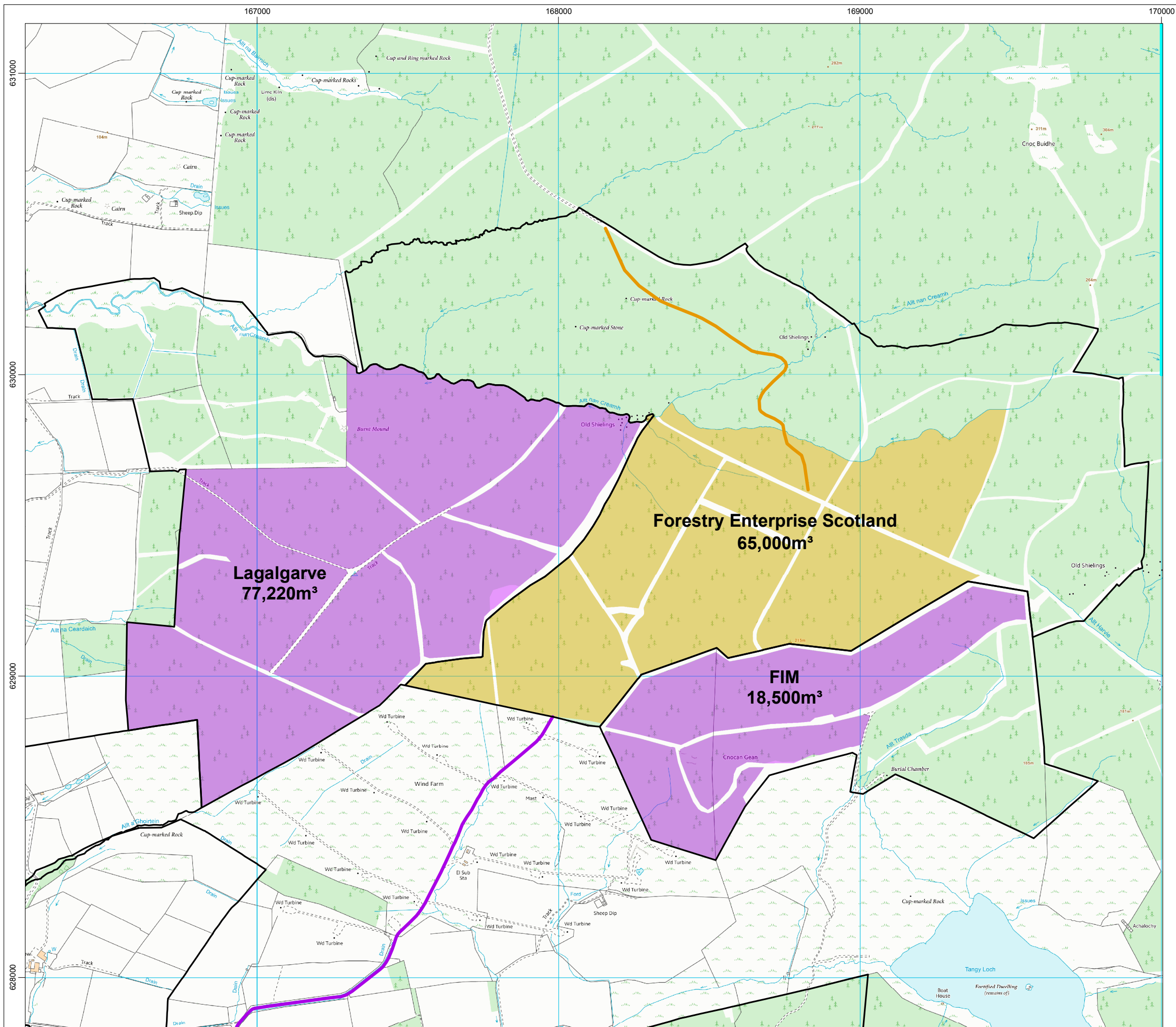
Rev	Date	Remarks	Drwn	Chkd
R0	17/07/2018	First issue	CaT	NM

Drawing Number
LN000082-TGY4-ENV-SK-0011-04






Scale	Plot Size	Datum	Projection
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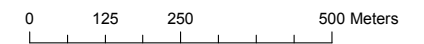
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Legend

-  Timber Haulage to A83 via public roads at NR 655 280
-  Forestry Enterprise Scotland Timber Haulage
-  FIM and Lagalgarve Timber
-  Forestry Enterprise Scotland Timber
-  Landowner



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Project Name	
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TANGY WIND FARM FOREST PLAN

Drawing Title

TIMBER HAULAGE

Rev	Date	Remarks	Drwn	Chkd
R0	17/07/2018	First issue	CaT	NM

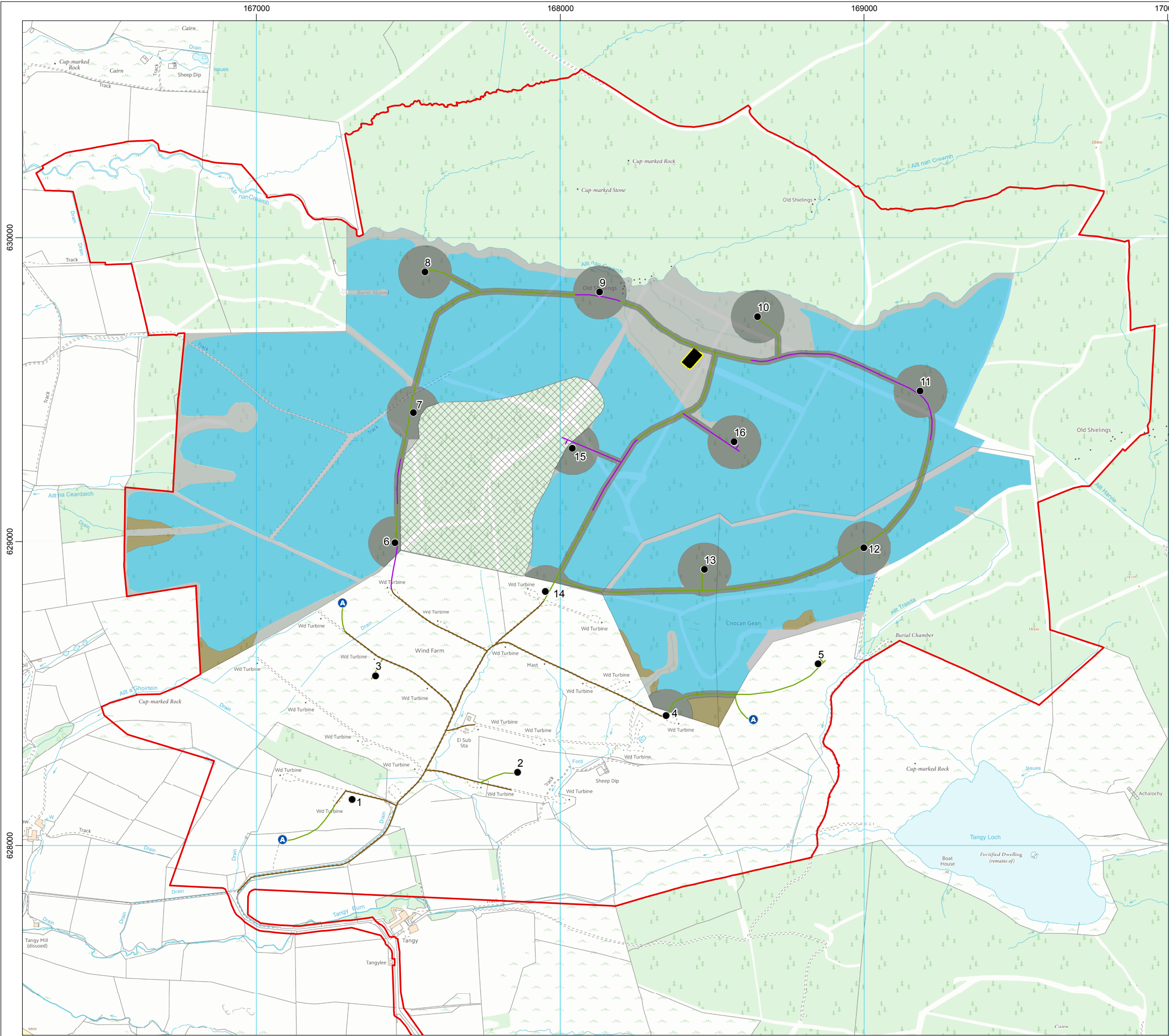
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LN000082-TGY4-ENV-SK-0011-05

Scale	Plot Size	Datum	Projection
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Legend

Permanent Infrastructure

- Turbine
- Permanent Met Mast
- New Cut Track
- New Floating Track
- Existing Track to be Reused
- Substation
- Site Boundary

Replanting Plan

- NBL Replant (3.50ha)
- SS Replant (196.35ha)
- Peat Restoration Area (27.72ha)
- Designed Open Ground (30.43ha)
- Wind Farm Infrastructure and Bat Clearance (31.73ha)

0125250500 Meters

N

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Project Name

TANGY WIND FARM FOREST PLAN

Drawing Title

RESTOCKING

Rev	Date	Remarks	Drwn	Chkd
R0	06/07/2018	First issue	CaT	NM

Drawing Number

LN000082-TGY4-ENV-SK-0011-06

Scale	Plot Size	Datum	Projection
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Plate 1



Plate 2



Plate 3



Plate 4



Plate 5



Plate 6



Plate 7



Plate 8