Appendix 2-5 - Forestry Felling Report

Western Forestry Co-op
Your Local Forestry Co-op

Forestry Report

1.0 BACKGROUND

This report examines the effects of the proposed Cloghercor Wind Farm project across the existing forest area and the potential impact associated with forestry clearfelling for this development. It will describe the existing forest environment and the impact of the proposed wind farm in relation to the ongoing operation of the forest. Environmental impacts associated with forestry clearfelling and replanting e.g. ecology, water quality, landscape, soils etc. is addressed in the relevant technical sections of the EIAR.

1.1 STATEMENT OF AUTHORITY

This report has been prepared by the following staff of Western Forestry Co-op:

Marina Conway is the author of the report and holds a Bachelor and Master's degree in Agricultural Science in Forestry, a postgraduate certificate in Water Pollution Control and is professional Member of the Society of Irish Foresters. Marina has 26 years specialised experience as a professional manager in the field of forestry and environmental development. Her key skills are in forest management from afforestation to harvesting, reforestation, appropriate assessments and biodiversity. Marina has experience in project management, implementation, environment & climate change policy, capacity building, data analysis, auditing and government policy.

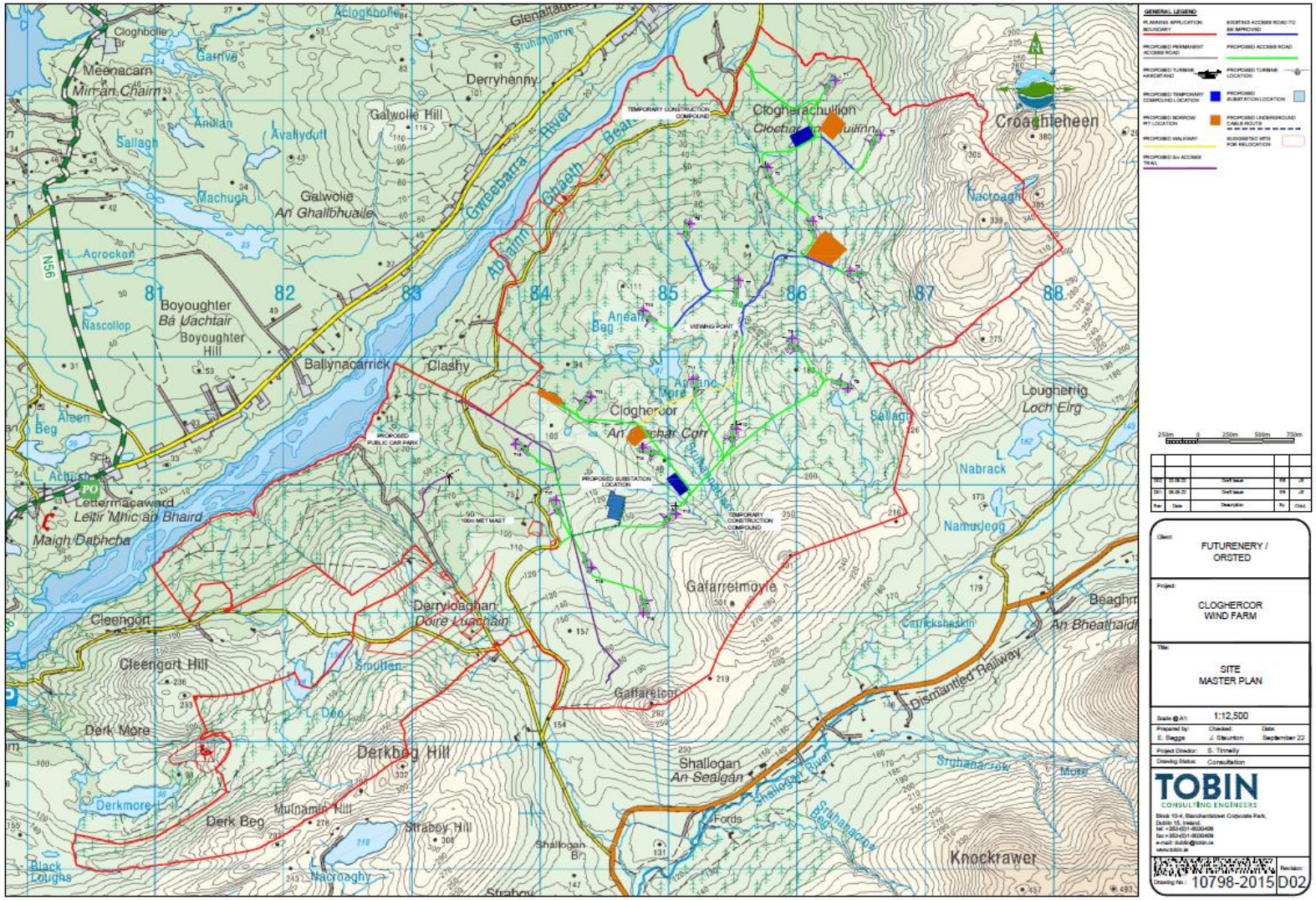
Joseph McManus holds a BSc in Forestry and is professional Member of the Society of Irish Foresters. Joseph has 6 years specialised experience in harvesting, forest inventory, field work, site assessment and mapping for harvest operations and health and safety. Joe assisted with the field work and the mapping.

Kenneth Moore holds a B Agr Sc in Forestry and is professional Member of the Society of Irish Foresters. Kenneth has 2 years specialised experience in forest inventory, field work and mapping for forest operations. Kenneth assisted with the field work and forest measurement data.

1.2 INTRODUCTION

The proposed Cloghercor Wind Farm project includes 19 no. turbines, and all associated infrastructure which is described in detail in Chapter 2 of this EIAR: Description of the Proposed Development. The study area of the proposed wind farm (Figure 1.1) measures 1972.7 ha and is predominantly covered in commercial coniferous forestry plantations and open peatland that is extensively grazed. The majority of the site is owned by Coillte with the remaining area comprising third-party owned areas, mainly of commercial forest. There is an extensive network of existing access roads across the site to facilitate the ongoing forestry operations.

Figure 1 - Site Study Area, Turbine and associated infrastructure layout



The site is located on an elevated area beside the Gweebarra river estuary with a topography between 0m and 265m above ordnance datum (AOD). Approx 12 streams transverse the site and flow in a general southeast to northwest direction into the Gweebarra Estuary.

As part of the proposed development there will be a requirement to clearfell some of this forestry in the areas immediately around the footprint of the wind farm infrastructure. As a commercial crop, this forestry is scheduled to be felled in the future regardless of the proposed wind farm being constructed or not, and within two years of felling the area would be replanted.

Felling is the process of cutting down trees. Clearfelling involves most or all of the trees in an area being cut down at the same time. The felling operations will be done both by manual (chainsaw felling) and mechanical means. For mechanical harvesting this includes a harvesting machine (Plate 1) which mechanically cuts, delimbs and processes the tree into different timber assortment sizes (pulp, stakewood, palletwood, sawlog) and an 8 wheel mounted forwarder machine (Plate 2) that collects the different timber assortments and stacks them at the road for removal by the timber lorries to the sawmill.

Plate 1 - Timber Harvester

Plate 2 - Timber Forwarder

Clearfelling for this proposed development will be in small compartments or coupes within the forest areas. Felling has the potential to impact adversely upon the environment if done in an uncontrolled manner; however, by the adoption of sound planning procedures, operating techniques and control measures as outlined in Section 1.6 below, this will considerably reduce any potential adverse environmental effects.

Subject to receipt of consent for the proposed Cloghercor Wind Farm project, the developer will apply to the Forest Service for a Felling Licence for clearfelling works, in line with the requirements of the Forestry Act, 2014. A felling licence granted by the Minister for Agriculture, Food and the Marine provides authority under the Forestry Act 2014 to fell or otherwise remove a tree or trees and to thin a forest for silvicultural reasons. The proposed development must have obtained planning consent before an application can be made for a felling license from the Forest Service, as per their policy on tree felling for wind farms. As part of this process, an area of at least an equivalent size to that which will be permanently felled must be replanted. This replanting land can be located anywhere within the state, provided an afforestation license is granted for the land.

The regulatory authority in Ireland, the Forest Service, has developed the Code of Best Forest Practice (Forest Service 2000b) which details forestry operations and the manner in which they should be carried out to ensure the implementation of sustainable forest management in our forest ecosystems and a suite of environmental guidelines which prescribe best practice in relation to Forestry and Water Quality and Forest Harvesting and the Environment (Forest Service 2000a, 2000b, 2000c), Felling and Reforestation Policy (2017) and Standards for Felling and Reforestation (2019).

The Coillte forest lands are certified to two forest management certification schemes, namely FSC (Forest Stewardship Council) certification of responsible forest management, and PEFC (Programme for the Endorsement of Forest Certification) certification of sustainable forest management. Both FSC and PEFC forest management certification schemes are independent schemes which audit and inspect forest managers to ensure their work meets strict forest management standards against social, economic and environmental criteria. For more information see https://www.coillte.ie/our-forests/public-goods/certification/.

1.3 METHODOLOGY

The methodology used to produce this report included a review of relevant legislation and guidance documents, a desk study, site walkthrough and field inspection of the proposed development footprint, evaluation of potential effects and an identification of measures to avoid and mitigate effects. Permanent felling requirements, which assume the worst-case scenario and may be less than estimated, while ensuring constructability, should be the minimal possible area and have been determined based on turbine manufacturers requirements and any environmental or other mitigations proposed. The requirements include the felling required for the wind farm to assess impacts in terms of runoff and nutrient mobilisation and present mitigation measures against all impacts.

1.3.1 Relevant Legislation and Guidance Documentation

The following documents have been referenced in the preparation of this report:

- Felling and Reforestation Policy, Forest Service, Department of Agriculture, Food and the Marine, Dublin. May 2017
- Standards for Felling and Reforestation, Forest Service, Department of Agriculture, Food and the Marine, Dublin. October 2019
- Forestry Act 2014 and the Forestry Regulations 2017 (SI No 191 of 2017) and SI 31 of 2020 - Forestry (Amdmt) Regs 2020 re reg 19AA procedures (pdf 99Kb)
- Forest Service. 2000a. Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin.
- Forest Service. 2000b. Code of Best Forest Practice – Ireland. Irish National Forest Standard. Forest Service, Department of the Marine and Natural Resources, Dublin.
- Forest Service. 2000c. Forest Harvesting and the Environment Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin.

1.3.2 Desk Study

A desk study was undertaken in order to collate and review background information in advance of the site survey. The desk study was carried out during September/October 2022. It involved the following:

Examination of the IFORIS (Integrated Forestry Information System) INET online mapping system, Department of Agriculture, Food and the Marine. To include assessment of the site against the following environmental GIS mapping layers:

    - EPA Hydrology
    - High status objectives waterbodies
    - OPW Flood Hazard areas
    - Fisheries Sensitive Areas
    - Landscape Sensitivity
    - Sites, Monuments and Records
    - NPWS Natura Sites
    - ESB Buffers
    - County Development Plan
    - Fresh Water Pearl Mussel
    - Acid Sensitive Areas
- Examination of the EPA Appropriate Assessment mapping
- Coillte Cloghercor Forest Sub-compartment data

1.3.3 Field Work

A detailed site assessment was carried during October 2022 by a project team of Marina Conway, Joseph McManus and Kenneth Moore. The purpose of the field work was to identify the forest type and the impact of the proposed felling on the forest environment. All of the proposed infrastructure locations that occurred within forest areas were visited. During the visit 0.01ha measurement plots were taken in order to verify the standing volume and estimate a yield class for the plots as an assessment of volume to be removed and associated carbon loss as a result of permanent forest removal. The baseline/existing conditions of the forest areas to be felled were assessed for:

- Area of impacted forest (felling area hectares)
- Age of forest
- Species planted
- Standing Volume

1.3.4 Evaluation of Potential Impacts

The significant effect of the proposed windfarm and the associated felling and forest impacts that will be identified and monitored include:

- Soil disturbance and compaction
- Carbon loss
- Water quality (sediment & nutrient)

A Site Hazard & Risk Assessment was undertaken to identify hazard and risk factors that have the potential to identify and protect social and environmental features and considerations, these are recorded in the harvest plan in section 1.6.1, potential hazards include:

- ESB/Gas lines
- Water Mains
- Steep banks
- Roadside harvesting
- Deep drains
- Erosion Risk
- Public Access/Rights of Way

1.4 EXISTING ENVIRONMENT (BASELINE DESCRIPTION)

The existing environment is discussed in terms of felling area, tree species, forest age, condition, estimated standing volume (m^3) and Yield Class (where appropriate, i.e. in younger trees it is not possible to take measurements in trees <7cm diameter at breast height), aquatic zones or relevant watercourses (any other watercourse that has the potential to act as a pathway for the movement of significant amounts of sediment and/or nutrients from the site to an aquatic zone, they are often artificial, and include existing drains and channels and other potential pathways that contain flowing water during and immediately after rainfall).

1.4.1 Description of Forestry plots

1.4.1.1 Area, age & species

The majority of the proposed windfarm site is covered in forestry, most of which is owned by Coillte. As part of the windfarm development, areas of forest will be felled to facilitate both infrastructure and construction felling, as set out in Table 1 Total Area to be felled for Windfarm Development. As per the Felling and Reforestation Policy, Forest Service, Department of Agriculture, Food and the Marine, the Infrastructure felling relates to trees that are permanently removed from the site in order to make way for infrastructure associated with the wind farm (Table 2) and the construction felling relates to areas that require temporary forest removal to facilitate windfarm construction such as borrow pits and a temporary construction compound where the land will be replanted once construction is completed (Table 3). Bat felling buffers were taken into account in the calculation of the areas required for permanent tree removal around the turbines (see chapter 6 of this EIAR – Biodiversity, Flora & Fauna).

The total area of forestry to be felled is 90.898 ha, if a smaller bat felling buffer were used (as per Chapter 6) it would be 69.753 ha, as shown in Table 1, Total Area to be felled for Windfarm development and outlined on maps in Figures 1 and 2.

Table 1 - Total Area (ha) to be felled for Windfarm Development

Windfarm Infrastructure & Construction Felling	**Area (ha) LBFB***	**Area (ha) SBFB***
Turbines	54.370	30.490
Turbine Hard Stand	2.076	4.811
Roads	16.435	16.435
Borrow Pits	8.183	8.183
Temporary Construction Compounds	4.453	4.453
Substation	3.015	3.015
Met Mast	0.276	0.276
Biodiversity Felling Area	1.129	1.129
Walkway	0.963	0.963
Total Felling Area	**90.898**	**69.753**

*LBFB (Large bat felling buffer); SBFB (Small bat felling buffer)

Table 2 - Area (ha) to be permanently felled for Windfarm Development

Windfarm Infrastructure	**Area (ha) LBFB***	**Area (ha) SBFB***
Turbines	54.370	30.490
Turbine Hard Stand	2.076	4.811
Roads	16.435	16.435
Substation	3.015	3.015
Met Mast	0.276	0.276
Biodiversity Felling Area	1.129	1.129
Walkway	0.963	0.963
Total Permanent Felling Area	**78.263**	**57.117**

*LBFB (Large bat felling buffer); SBFB (Small bat felling buffer)

Table 3 - Area (ha) to be temporarily felled for Windfarm Construction

Windfarm Construction	**Area (ha)**
Borrow Pits	8.18
Temporary Construction Compound	4.45
Total Temporary Felling Area	**12.63**

Figure 1 – Forest areas to be felled for Turbines, borrow pit, temporary construction compound, roads and biodiversity felling area.

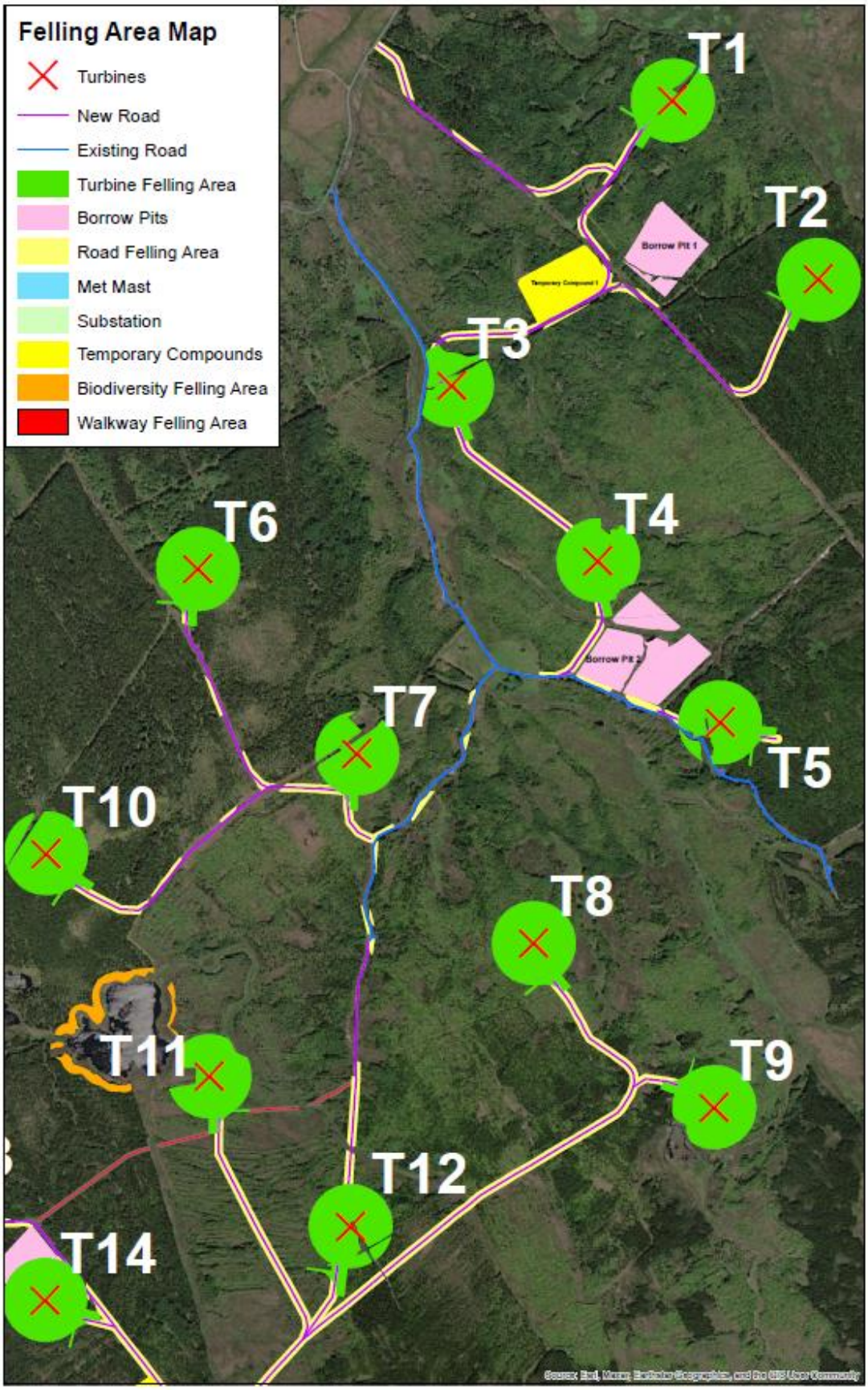
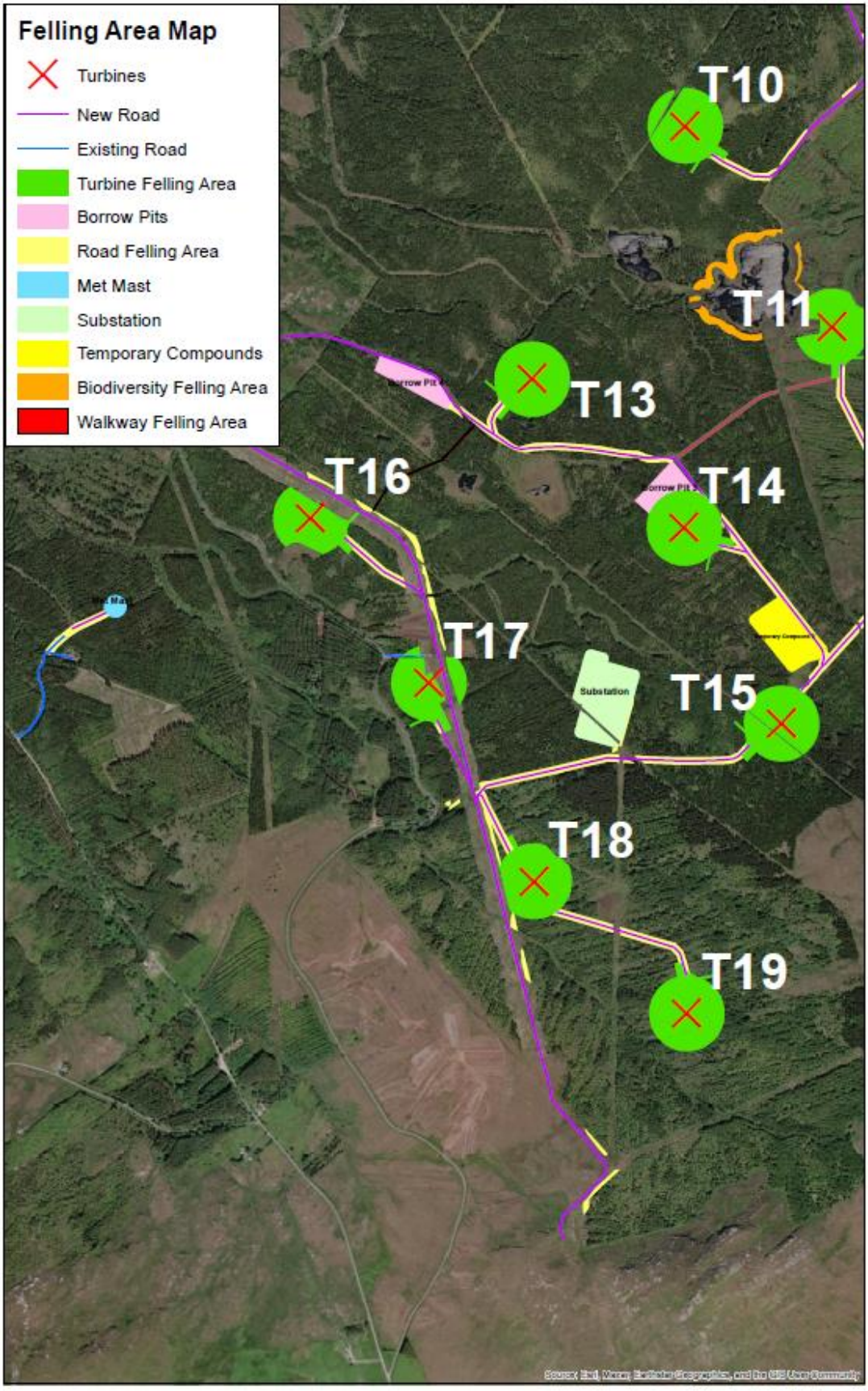


Figure 1 – Forest areas to be felled for Turbines, borrow pit, temporary construction compound, sub-station, roads and met mast.



The Coillte owned and privately owned forests in the proposed study area were planted as commercial forestry. The main tree species present is Sitka spruce planted pure and in mixture with Lodgepole pine (Plate 3). Commercial forestry includes multiple rotations of establishment, final harvest by clearfell and replanting for the forest cycle to start again. The rotation length of the different plots will vary depending on productivity, soil type and exposure. The site productivity is measured in yield class and the prevailing yield class across the site is quite low, averaging at yield class 10. The forests were planted mostly on blanket peat and have not thrived (Plate 4). There is no evidence of any harvesting having occurred, as the stands are simply not productive enough. There was very little evidence of windblow during the site visits, which is expected in a low yielding forest. The age of the forests ranged from 25 years (planted in 1997) to 38 years (planted in 1984). Many of the forest areas were in check (nutrient deficiency due to lack of nitrogen and phosphorus availability in the soil) (Plate 5), pre-thicket forest and thicket[1] (Plate 6) stage, there was very little closed canopy forest areas. The forest species and age in the infrastructural felling areas are shown in Table 4.

Table 4 – Infrastructural felling areas, Forest Tree Species, Area and Age

Infrastructure Type*	Tree Species^	Area (ha)	Planting Year
T1	SS	3.00	1989
T2	SS	3.26	1989
T3	SS	2.46	1991, 1992
T4	SS	3.04	1991
T5	SS	2.98	1992
T6	SS	1.48	1990
T7	LP	3.27	1990, 1991, 1993
T8	SS	3.16	1990, 1993
T9	SS	3.19	1993
T10	LP	4.40	1990, 1996
T11	SS	2.83	1991, 1993
T12	SS	3.18	1991, 1992
T13	SS	3.21	1992
T14	LP	3.27	1991, 1992
T15	LP	3.18	1991, 1992
T16	SS	2.33	1994
T17	SS	1.94	1993, 1994
T18	SS	2.99	1988
T19	SS	3.26	1984
TCC	SS/LP	4.45	1991, 1992
BP	SS	8.18	1989, 1991, 1992
MM	SS	0.28	1997, 1999
Roads	SS/LP	16.43	1984 to 1997
SS	SS/LP	3.01	1992, 1993
Bio	SS/LP	1.11	1990, 1992, 1993
Walkway	SS/LP	0.963	1991, 1992, 1993

* T – Turbine; Sub – Substation; TCC – Temporary Construction Compound; MM – Met Mast; BP – Borrow Pits; Bio – Biodiversity Felling Area. ^SS (Sitka spruce *Picea sitchensis*); LP (Lodgepole pine, *Pinus contorta*)

[1] Densely planted trees

Plate 3 – T17 Sitka spruce/Lodgepole pine planted in mixture

Plate 4 – T8 Unproductive Sitka spruce & Lodgepole pine pre canopy closure

Plate 5 – T5 Sitka spruce in Check (nutrient deficiency)

Plate 6 – Thicket Sitka spruce at T18

1.4.1.2 Standing Volume and Carbon

The standing volume in a forest refers to the volume in cubic metres of the standing trees present at the time of forest measurements. In order to calculate the standing volume, it is necessary to take sample measurement plots, these are laid out as 0.01ha plots. In these plots tree stocking, DBH (diameter at breast height) and Top height of the largest DBH tree is recorded. Forest measurement plots were only taken in areas where the trees were >7cm diameter at breast height as per standard forest practice. Where it was not possible to take measurements, a general yield class was taken from the forest sub-compartment data supplied by Coillte. A yield class is an estimate of the average volume production of a crop in m^3 per hectare per annum that it is estimated an even aged stand can achieve, it is an estimate of the productivity potential of the forest crop. Using the Forestry Commission Forest Yield the volume per hectare was calculated. Based on this the total volume to be removed for the windfarm development is 8,863 m3. Table 5 outlines the different Yield class, area and standing volume for the different forest areas that are to be cleared for the proposed windfarm development.

Table 5 - Standing Volume in Forest Areas to be cleared for Windfarm Infrastructure

Infrastructure Type*	Tree Species	Area (ha)	Yield Class	Total Volume
T1	SS	3.00	10	352.92
T2	SS	3.26	6	383.93
T3	SS	2.46	6	205.09
T4	SS	3.04	6	244.15
T5	SS	2.98	6	247.70
T6	SS	1.48	10	140.31
T7	LP	3.27	10	221.47
T8	SS	3.16	6	219.81
T9	SS	3.19	6	221.82
T10	LP	4.40	10	691.53
T11	SS	2.83	6	151.35
T12	SS	3.18	6	159.81
T13	SS	3.21	6	107.63
T14	LP	3.27	6	160.29
T15	LP	3.18	10	271.65
T16	SS	2.33	6	195.13
T17	SS	1.94	0	59.16
T18	SS	2.99	10	597.65
T19	SS	3.26	6	381.13
TCC	SS/LP	4.45	6 & 12	616.34
BP	SS	8.18	Various	855.86
MM	SS	0.28	14	87.06
Roads	SS/LP	16.43	Various	1801.09
SS	SS/LP	3.01	6	260.80
Bio	SS/LP	1.11	6	152.47
Walkway	SS/LP	0.963	6/8	77.22
Sub-total		**90.898**		**8863.26**

Forest Carbon

The ability of forests to store and sequester atmospheric carbon is well known and established. Indeed, forests represent the largest global terrestrial store of carbon, containing approximately 39% of global soil carbon and 77% of global vegetation carbon (Bolin et al. 2000). Trees absorb carbon dioxide from the atmosphere for growth, convert it to wood and release oxygen back to the atmosphere. Harvesting the trees before they die naturally (and return their carbon to the atmosphere) locks the carbon into the wood and harvested wood products. Replanting the trees then begins the cycle of carbon storage immediately.

The Carbon cycle in forests is characterised by a number of carbon pools. Pools are locations of carbon in the forest, such as the above- and below-ground biomass, forest floor and soil. The above ground biomass consists of stemwood, branchwood, bark and foliage and is the carbon pool that is referred to here.

Carbon sequestration in woodland biomass is restricted to the long-term average carbon stock that is projected to accumulate on the site in the woody biomass. Carbon values are based on those used in the UK Woodland Carbon Code (https://www.woodlandcarboncode.org.uk/), a voluntary standard for woodland creation projects and the amount of carbon dioxide they can sequester based on different types of tree species, yield class, stocking and forest management. The Woodland Carbon Code calculator has been chosen due to the choice of species and management and the similar assumptions and conditions that exist in forest management data in the UK and Ireland, and due to the absence of similar data in Ireland currently. The total forest carbon that would be removed due to the proposed windfarm development is 18,831 tCO^2e, Table 6 - Total Carbon (tCO^2e) in the Above Ground Woody Biomass. Much of this carbon will be locked up in the harvested wood products that are produced from the timber such as fencing material, decking, pallet wood, fibreboards, plywood, laminates or used as wood fuel to displace fossil fuels.

Furthermore, an equivalent area of land is being replanted to account for the permanently felled areas of 78.263 ha. The Temporary felled areas of 12.63ha will be replanted in situ and so the forest carbon cycle starts again, Please note he type of land that will be replanted under a current afforestation licence will not be peat soils, it would be mineral soils which will have higher yields and therefore carbon storage, so the forests planted on replacement lands will have higher carbon storage capacity than the forests to be felled at the proposed Cloghercor Wind Farm Site. Therefore, any loss of forest carbon due to this proposed windfarm development is only a temporary loss of carbon, which would occur at different stages through normal commercial forest management of harvesting and replanting.

Table 6 – Total Carbon (tCO^2e) in the Above Ground Woody Biomass

Infrastructure Type*	Tree Species	Biomass Sequestration (tCO2e/ha)	Total Carbon (tCO2e)
T1	SS	337	606
T2	SS	195	382
T3	SS	195	360
T4	SS	195	445
T5	SS	195	435
T6	SS	337	500
T7	LP	448	1465

T8	SS	195	617
T9	SS	91	289
T10	LP	385	1693
T11	SS	195	276
T12	SS	195	465
T13	SS	195	313
T14	LP	231	378
T15	LP	385	1103
T16	SS	91	211
T17	SS	269	260
T18	SS	337	1006
T19	SS	252	821
TCC	SS/LP	195	607
BP	SS	337	1928
MM	SS	280	55
Roads	SS/LP	337	3872
SS	SS/LP	195	411
Bio	SS/LP	195	152
Walkway	SS/LP	269	180
Total			**18831**

1.5 POTENTIAL EFFECTS

This section addresses the potential impacts on the surrounding environment due to the felling and removal of the trees for the proposed wind farm. The potential impacts include soil disturbance and compaction, carbon loss, water quality (sediment & nutrient) and potential effects on biodiversity from the proposed infrastructure works.

1.5.1 Do Nothing Scenario

In the do-nothing scenario, if the proposed wind farm development for which this EIAR has been prepared does not proceed, the existing practice of commercially managed forest would continue, i.e. it would be harvested in line with sustainable forest management practices on a continuous basis and replanted in line with the requirements of the felling license as per the Forestry Act 2014, on a continuous basis. Felling would normally take place when the crop reaches its MMAI (Maximum Mean Annual Increment) minus 20%. Due to the exposed nature of the site and incidences of windblow some areas may be felled before MMAI. It should be noted that any of the potential impacts in Section 1.5.2.1 Potential Effects Felling and Removal of Trees for the Construction Phase due to clearfelling and subsequent replanting would also occur in the do-nothing scenario under the normal felling cycle.

1.5.2 Construction Phase

1.5.2.1 Felling and Removal of Trees

A number of potential effects can arise from forest harvesting. Harvesting will be done by clearfelling. Clearfelling involves most or all of the trees in an area being cut down at the same time. The felling operations will be done by manual and mechanical means as outlined in Section 1.2.

The associated felling and forest impacts that will be identified and monitored include:

- Soil disturbance and compaction
- Carbon loss
- Water quality (sediment & nutrient)
- Biodiversity impact
- Landscape impact

The potential impacts of the proposed felling and onsite replanting activities are assessed in the EIAR.

1.5.2.1.1 Soil Disturbance and Compaction

The movement of harvesting machinery over the soil can contribute to soil disturbance and compaction. Potential adverse impacts include:

- Felling and extraction machines unsuited to the site and material, leading to crop, soil and machine damage
- Excessive haulage distances to roads, leading to site soil damage
- Damage to the soil such as rutting and compaction by extraction machines due to overloading
- Inadequate brash mats, leading to soil damage and sedimentation
- Machine damage to drains
- Site and environmental damage due to poor timing and failure to curtail operations in adverse weather conditions
- Sediment entering aquatic zones
- Brash and debris in aquatic zones
- Rutting and compaction through the overuse of tracks

The main sources of sediment in forest activities due to harvesting are:

- Disruption of the soil surface by harvesting machinery, removal of tree cover causing the soil to be exposed to erosion and eventually the transportation of the finer particles by overland flow.
- Weathering of parent material resulting in particle movement by overland flow.
- The transportation of loose or decaying organic particles.

Due to the fact there are many ages classes that are to be felled i.e. commercial and non-commercial timber, it is envisaged that any commercial timber will be removed from the site for haulage to a timber sawmill. A proportion of construction traffic for the windfarm development will be associated with the haulage of the timber from these felling activities. Based on the volume of timber to be harvested as detailed in Table 5 - Standing Volume in Forest Areas to be cleared for Windfarm Infrastructure, this will involve approximately 300 articulated timber truck movements. Any timber that is not of merchantable quality, i.e. less than 7cm diameter relates to the tops of trees and branches known as lop and top and will be left on site where the trees are felled. This protects the soil and provides deadwood for habitat Where full tree removal is required for infrastructure such as turbine hardstands, substation, met mast, roads etc. smaller trees can be removed by excavator and/or tree shears depending on size. In the bat

felling buffer areas, any timber that is not of merchantable value i.e. lop and top will be left on site so as to minimize disturbance.

1.5.2.1.2 Carbon Loss

There will initially be a decrease in the carbon sequestration potential of the forest due to the clearfelling of 90.898 ha for infrastructure and construction felling associated with the footprint of the proposed development. As referred to in section 1.4.1, infrastructure felling relates to trees that are permanently removed from the site in order to make way for infrastructure associated with the wind farm (Table 2) and construction felling relates to areas that require temporary forest removal to facilitate windfarm construction such as borrow pits and temporary construction compounds. The maximum total carbon that would be removed due to the felling of the 90.898 ha is 18,831 tCO^2e, if the smaller bat felling buffer area of 69.753 ha was used then the carbon loss would be approx. 13,382 tCO^2e. Some 78.263 ha will involve permanent forest removal for infrastructure felling and an equivalent area of bare land will be afforested as replacement land (this will happen elsewhere in the state, in a different water catchment and county and will be subject to separate consenting and assessment process) in lieu of this within 2 years of clearfelling as required under the Forestry Act 2014. The remaining 12.63 ha that will be temporarily felled will be replanted in the same location as soon as proposed development is completed. Therefore, although there will be a temporary loss of carbon, the overall impact on carbon stock will be neutral.

1.5.2.1.3 Water Quality Impact

Harvesting and associated activities such as extraction have the potential to cause temporary and local damage to soils and adversely impact on water quality, through increased erosion rates, sedimentation and nutrient losses. However, adherence to best practices will minimise this risk. All water and hydrological impacts are assessed in detail in Chapter 9. The main sources of sediment from harvest operations are described in Section 1.5.2.1. The key factors associated with sediment release and potential water quality impact during harvest operations are:

- Soil type, sensitivity and slope – the soil conditions at Cloghercor are peat soils (See Chapter 8 Land, Soils and Geology). As outlined in *Forestry and Water Guidelines* correct buffer zone management will help reduce the risk of sedimentation
- The felling and extraction system and harvesting machinery to be used including number and type of machine passes
- Operation details such as extraction routes, landing bays for harvested material, location of machine maintenance, refuelling and repair areas and storage areas for fuel, motor oils, lubricants and chemicals.
- Availability of brash material (lop and top) for placing under machines to protect the soil. This is more of a concern in forest thinning operations where brash availability is low then in clearfell operations as proposed here and would be a low risk.
- Environmental receptors such as water features, including aquatic zones, relevant watercourses, hotspots, water abstraction points and crossing points.

With regard to the source of nutrients, during clearfelling there is a higher potential for nutrient loss as there are no living tree roots left to take up the nutrients. Any organic matter (particularly recently dead material such as brash or roots) that is left on site to rot will release phosphorus

and nitrogen. Decaying brash resulting from the clearfell can generate nutrients which could potentially lead to nutrient enrichment of any small first order streams. The breakdown of brash, roots and other organic matter takes a number of years. Potentially a clearfell site continues to release phosphorus to the aquatic zone for at least three years after clearfelling. The rate of decomposition is influenced by temperature, moisture and humidity. Consequently, phosphorus loss tends to be greatest during the warmer months and may be particularly problematic during a flood event following a prolonged hot and dry period (Cummins & Farrell 1999 & 2003; Rodgers et al 2010)

In addition to sediment and nutrient release, accidental spillage or leakage of chemicals potentially used on site (herbicides and pesticides during reforestation operations and urea sprayed on freshly felled tree stumps to prevent the spread of disease as is a condition of all felling licenses in Ireland), fuel and machine oils (hydraulic, engine, gearbox, lubricant or cutting oils) are detrimental to aquatic flora and fauna and impair water quality; however adherence to best practices will minimise this risk; mitigation measures are outlined under Section 1.6.

It should be noted that potential impacts on water quality as outlined above as a result of clearfelling will also be relevant in the do-nothing scenario in the course of normal forest harvesting at Cloghercor.

1.5.2.1.4 Biodiversity Impact

Wildlife habitats can be affected during harvesting, especially the removal of the forest canopy. Mature conifer stands are important wildlife habitats for a variety of birds and other fauna.

In Chapter 6 of the EIAR, Biodiversity, the potential impacts section assesses in detail the potential impacts on habitats from the tree felling associated with the wind farm development.

It should be noted that any potential impacts on biodiversity as a result of clearfelling will also be relevant in the do-nothing scenario in the course of normal forest harvesting that would occur at Cloghercor.

1.5.2.1.5 Landscape Impact

The visual effect of the premature harvesting of trees is assessed in Chapter 13 of the EIAR, Landscape and Visual Impact Assessment.

Brash left onsite after clearfelling can be unsightly, particularly if the forest flanks a scenic route. The majority of the areas to be clearfelled for the proposed development occur within commercially managed forestry.

It should be noted that any potential impacts on the landscape as a result of clearfelling will also be relevant in the do-nothing scenario in the course of normal forest harvesting that would occur at Cloghercor.

1.6 MITIGATION MEASURES

1.6.1 Construction Phase

Comprehensive planning (as outlined in Section 1.6.1.1 Harvest plan) combined with best practice operating techniques will ensure the protection and enhancement of the environment at the proposed Cloghercor Wind Farm Development. Felling operations associated with this project will adhere to the *Felling and Reforestation Policy (Forest Service), Standards for Felling and Reforestation (Forest Service), Code of Best Forest Practice (Forest Service 2000b), Forest*

Harvesting and the Environment (Forest Service 2000c) and Forest and Water Quality Guidelines (Forest Service 2000a).

Notwithstanding the hydrological distance from the proposed development site to any Natura 2000 site or fisheries sensitive area, the potential sediment and nutrient loss risks will be managed through the application of the mitigation measures outlined hereunder and in the mitigation measures of the EIAR outlined in Chapter 5 Population and Human Health, Chapter 6 Biodiversity: Flora & Fauna, Chapter 7 Biodiversity: Ornithology, Chapter 8 Land, Soils and Geology, Chapter 9 Hydrology and Hydrogeology, Chapter 13 Landscape and Visual Impact and Chapter 14 Air Quality & Climate.

The Harvest Plan (Section 1.6.1.1) and associated Harvest Plan Maps, outline the measures to be implemented with regard to forest harvesting at the proposed development site for Cloghercor Windfarm development.

All forestry operations are to be undertaken in accordance with current best practice guidelines as listed in the Harvest Plan, which details practical measures to protect the existing environment.

Further information on mitigation measures for onsite activity are provided in the various EIAR chapters, as well as the CEMP (Appendix 2 to this EIAR).

1.6.1.1 Harvest Plan

A harvest plan outlines strict environmental guidance to minimise environmental and social disturbance. This harvest plan is specific to forest harvesting operations and is the standard plan used by the felling license authority of the Department of Agriculture, Food and the Marine. It encompasses all possible felling methods, social and environmental considerations and measures to protect same, only those of relevance to the tree felling at Cloghercor Windfarm have been selected.

Harvest Plan for Felling at Cloghercor Windfarm, Co Donegal

Proposed Felling & Reforestation Methods	
Thinning (incl. CCF)	☒ N/A ☐ Harvester ☐ Chainsaw ☐ Forwarder ☐ Tractor/Quad ☐ Skyline ☐ Other (specify):
Clearfelling	☐ N/A ☒ Harvester ☒ Chainsaw ☒ Forwarder ☐ Tractor/Quad ☐ Skyline ☒ Other (specify): Excavator with/without shear grab
Reforestation	☐ N/A ☒ Windrowing ☒ Pit planting ☐ Mounding ☐ Scrap mounding ☐ Scarification ☐ Other (specify):
Site access (i.e. via forest road)	☒ Present ☒ Planned ☐ Not required ☐ Other (e.g. temporary roading/forest track):
Social & Environmental Features & Considerations	

Social	Habitat & Biodiversity	Soil & Water
☐ Recreational usage	☒ Designated area (SAC, SPA, etc.)	☒ Aquatic zone(s) on/adjoining site
☐ Adjoining dwelling(s)	☐ Broadleaves/diverse conifers	☒ Relevant watercourse(s)
☐ Right(s)-of-way present	☐ Hedgerows	☐ Water-related 'hotspots'
☒ Utilities (power lines/water main)	☐ Old/veteran trees	☐ Water abstraction point
☐ Sensitive landscape	☐ Large scale deadwood	☒ Peaty or peaty/gley
☐ Important viewpoint(s)	☐ Badger sett, rookery, etc.	☒ Steep slope(s)
☐ Archaeological site(s) & feature(s)	☐ Protected fauna	☐ Water setback(s) present & intact
☐ Cultural feature(s)	☐ Protected flora	☐ Supply of brash limited
☐ Anti-social (dumping, fire, etc.)	☐ Wetland habitat	☐ Other:
☐ Other (specify):	☐ Other (specify):	☐ Other:

Proposed Measures to Protect Social & Environmental Features & Considerations	
☒ Consult with local residents	☐ Establish excl. zones around arch. sites/features
☒ Erect safety signage	☒ Temporary bridging points (TBPs) required
☒ Onsite briefing of all operators, pre-commencement	☒ Install water setback at refor.
☒ Carefully selected refuelling/repair/storage depot	☐ Install dwelling setback at refor.
☐ Measures to protect right(s)-of-way	☐ Install public road setback at refor.
☐ Measures to protect service features	☐ Install archaeological setback at refor.
☐ Measures to protect habitats & biodiversity features	☐ Install biodiversity setback at refor.
☐ Limit operations to dry weather	☐ Install landscape setback at refor.
☒ Daily visual monitoring of ground conditions	☐ Inclusion of Refor. Objective 'CCF'
☒ Daily visual monitoring of water	☐ Inclusion of Refor. Objective 'BIO'

Proposed Measures to Protect Social & Environmental Features & Considerations (Cont..)	
☐ Water sampling	☐ Forest edge planting
☒ Install silt traps/barriers	☐ Environmental setback planting
☒ Drain blocking/slow-water dams	☐ Other (specify)
☒ Utilise brash mats along extraction routes	☐ Other (specify)

☒ Exclude machinery in areas adjoining aquatic zones, water abstraction points & water-related 'hotspots'	☐ Other (specify)

Ancillary Information (include relevant information to expand on above & to detail important aspects such as the sequencing of operations, the width of environmental setbacks & contingency planning. Ensure accurate cross-referencing and consistency with maps)

The below listed guidelines will be adhered to for harvesting:

Interim Standards for Felling and Reforestation Forest Service, Department of Agriculture, Food and the Marine, Dublin. October 2019

Forestry and Water Quality Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forestry and the Landscape Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forestry and Archaeology Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forest Biodiversity Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forest Harvesting and Environment Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forest Protection Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Felling and Reforestation Policy, Forest Service, Department of Agriculture, Food and the Marine, Dublin. May 2017

Electricity at Work: Forestry Irish Forestry Safety Guide (IFSG) 804

Any person entering the site must report to the Forestry Works Manager (FWM), if you cannot contact the FWM then please contact the Site Safety Co-ordinator (SSC), as this is a live working site it is prohibited for any member of the public to access the site without first contacting the FWM or SSC and arranging to meet with them.

All contractors will be briefed prior to operations starting.

All local residents will be contacted to inform them that harvesting is about to commences.

<u>Harvesting</u>

Harvesting will be done by clearfelling. Clearfelling involves most or all of the trees in an area being cut down at the same time. The felling operations will be done by mechanical means which includes a harvesting machine which mechanically cuts, delimbs and processes the tree into different timber assortment sizes (namely pulp, stakewood, palletwood, sawlog) and a 8 wheel

mounted forwarder to collects the different timber assortments and stacks them at the roadside for removal by the timber lorries to the sawmill.

Low ground pressure harvester and forwarder is to be used for all clearfelling operations. In areas where it is not feasible to cut the trees by harvester due to the trees being too small (i.e. <7cm DBH) an excavator with tree shears will be sufficient to cut and windrow trees and stump removal. The brash will be left to decompose. For the footprint of the proposed infrastructure there will be full tree removal to facilitate the windfarm development infrastructure.

Clearfelling operations should be carried out during suitable weather conditions where feasible. Where felling is to be carried out adjoining any buffer zones or set back areas, the timber should be felled away from these zones. Any timber stacking for removal should also be outside these buffer zones and setback areas.

Maintenance and refuelling area will be stored on a dry elevated site 50 metre from aquatic zones and 20 metres from any relevant water courses. Fuel tanks are to be double bonded and lockable. Fuel, chemical and oil containers must not be rinsed on site. Fuel, chemical and oil are not to be emptied in relevant watercourses drains or sediment traps. All materials used for maintenance will be removed from site when work is completed.

Timber stacks will be no more than 4 metre height.

Brash will be used along harvesting and extraction routes for soil protection. Forwarder will be loaded to manufacturers specifications and not overloaded to avoid overloading and unnecessary soil compaction. On difficult terrain reduced loads will be used to avoid rutting. Brash will be used to repair and maintain extraction routes as required. Excessive tracking to be avoided. Extraction routes to be planned to minimise the number of crossing points. Extraction route marked with black arrows on harvest plan maps.

No harvesting machinery will operate on public roads. Public roads will be kept free of soil and debris.

Silt traps will be installed within the drains along roadside drains and along extraction routes and relevant watercourses as required to intercept sediment and needles. Silts trap will consist of straw bales placed in the drain. The bales will be anchored in place. A channel will be dug in front of the bales. This will allow the water to pool prior to passing through the straw bales.

Where crossing drains is required, this will be done by constructing a crossing point. This will be done by laying logs in the drain length ways so as not to restrict the flow of water (temporary bridging point). Brash (branches) will be placed across the logs. The crossing point will be maintained during its use and removed when works are completed. The crossing point will be monitored for any possible water flow restriction and material deposited in the drain. If any material is deposited in the drain, it is to be removed immediately. The removal of the crossing point will ensure that the banks will remain undisturbed, and the material removed that the sediment remains undisturbed. Crossing points will be at right angles to water flow.

Onsite supervision and checks are necessary to ensure that felling and extraction operations are carried out appropriately and that water protection measures are adequate and remain effective throughout, and also to trigger contingency measures, if necessary (e.g. to cease operations if rainfall creates a risk of sediment mobilisation and runoff).

Relevant water courses crossing will be crossed using a temporary log bridge. This will be done by laying suitable logs across the water course. The logs will be anchored in place with the use of stakes to prevent spreading. The bridge will be layered brash to prevent material failing into the relevant water course. Silt traps will be installed at relevant water course crossing. Where a relevant watercourse is to be in permanent use, a culvert will be installed.

Machine exclusion zones will be located on all aquatic zones adjoining area to be felled. There areas will be clearly marked on the ground. Trees within the exclusion zone will be felled by reaching in the harvester boom head into the exclusion zone and felling and removing the tree. Processing will take place outside the exclusion zone. Trees outside the reach of the harvesting boom will be felled by chainsaw to within reach of the harvesting machine boom for removal and processing. Trees that cannot be felled within reach of the harvester boom will be felled to waste.

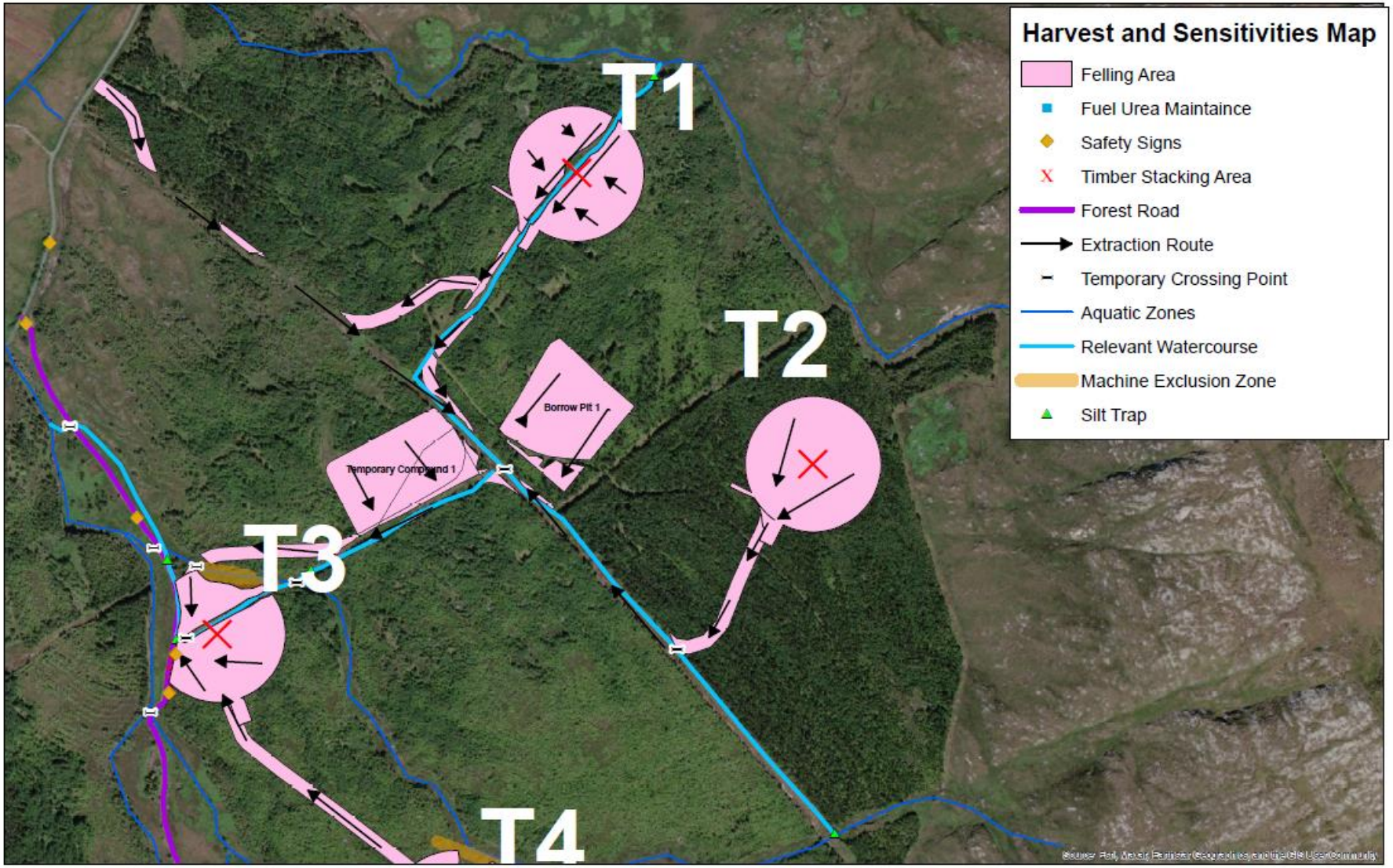
ESB will be contacted prior to felling along powerlines. Goal posts are to be erected with a minimum height of 4.2 metres with a safe corridor established under the powerlines. Warning signage to be erected.

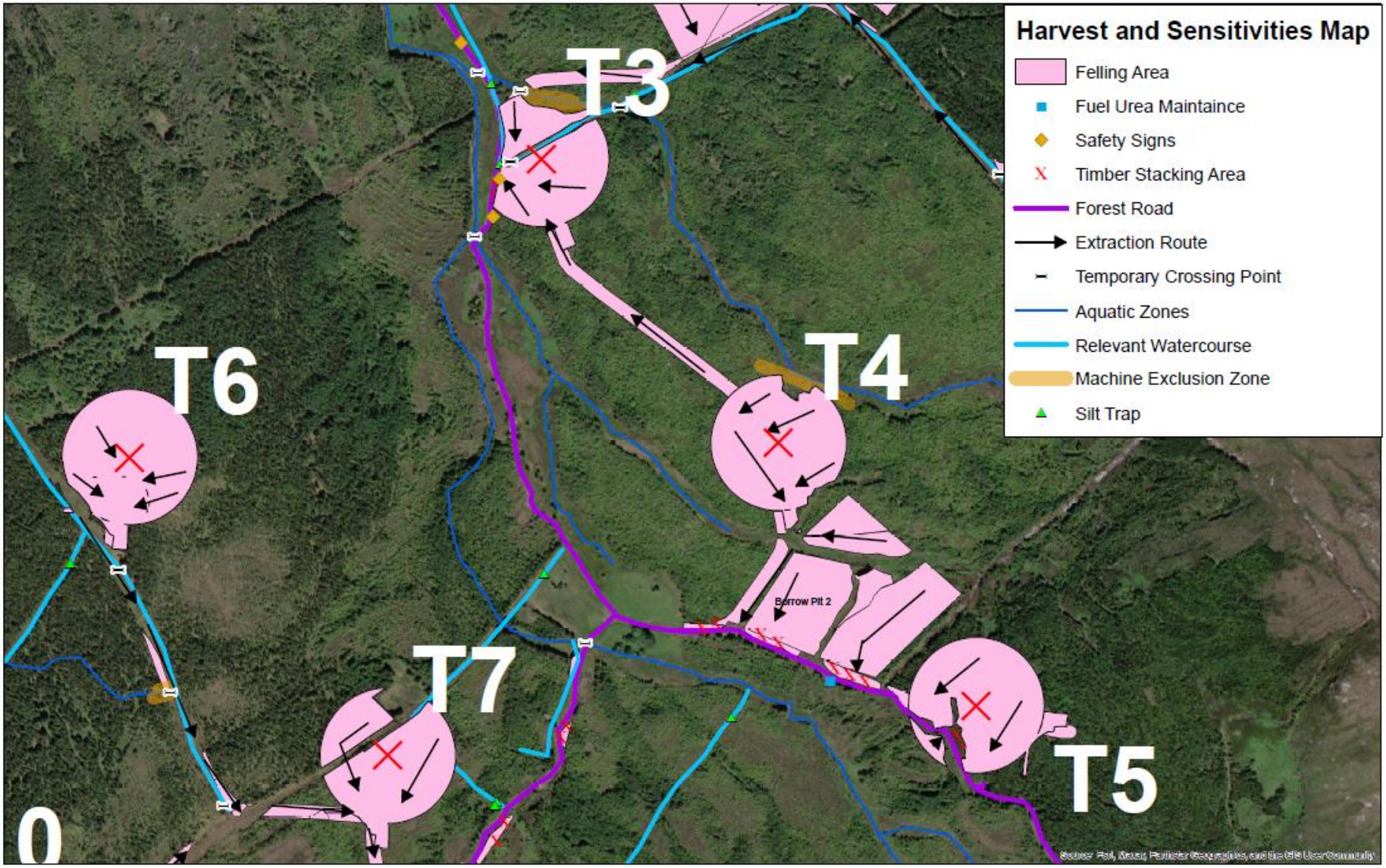
Urea will be applied immediately to tree stump after the tree has been cut. Urea will not be used within 10 metre of relevant watercourse or aquatic zone or where the peat dept is greater than 25cm.

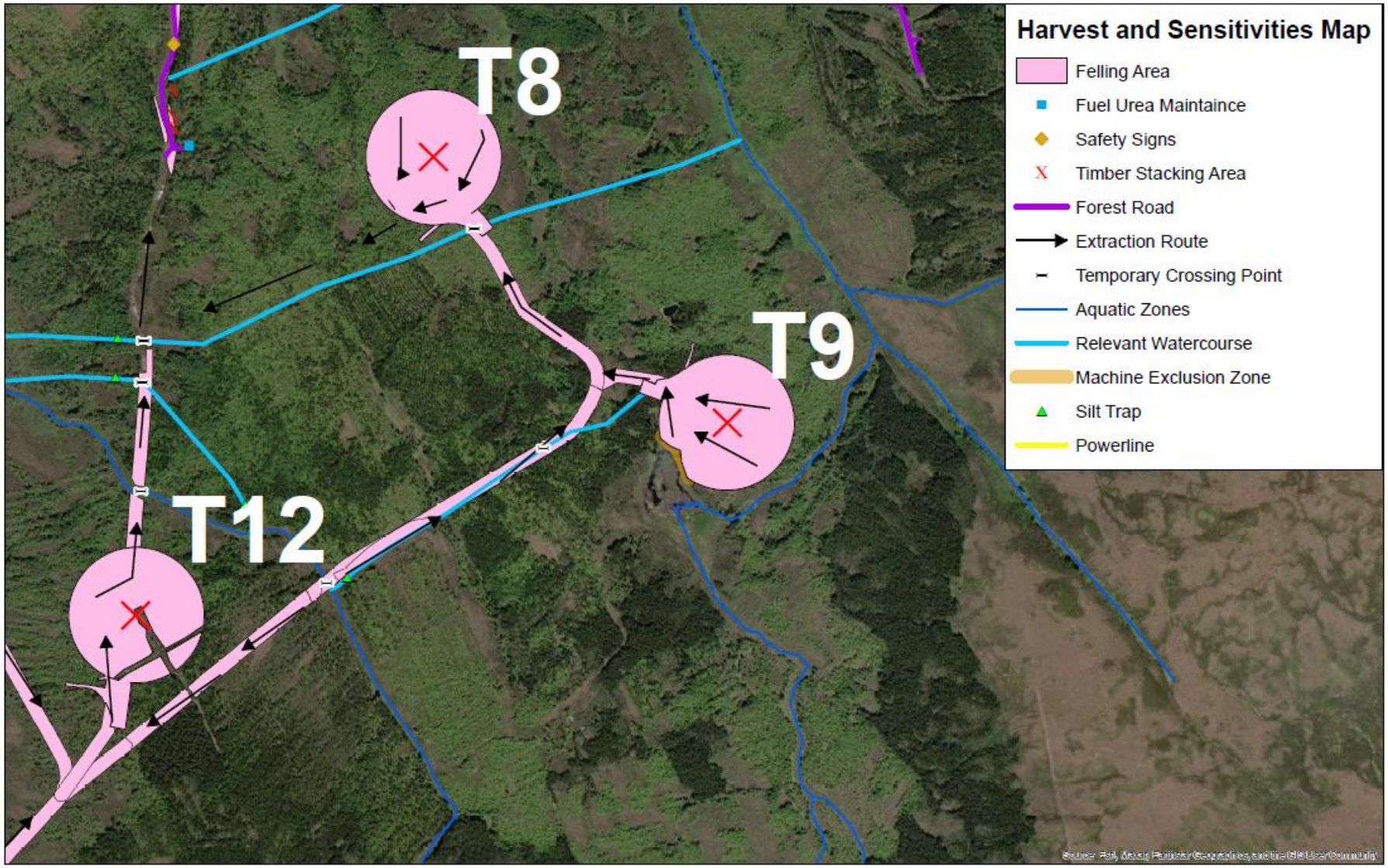
Onsite supervision and checks are necessary to ensure that felling and extraction operations are carried out appropriately and that water protection measures are adequate and remain effective throughout, and also to trigger contingency measures, if necessary (e.g. cease operations if rainfall creates a risk of sediment mobilisation and runoff).

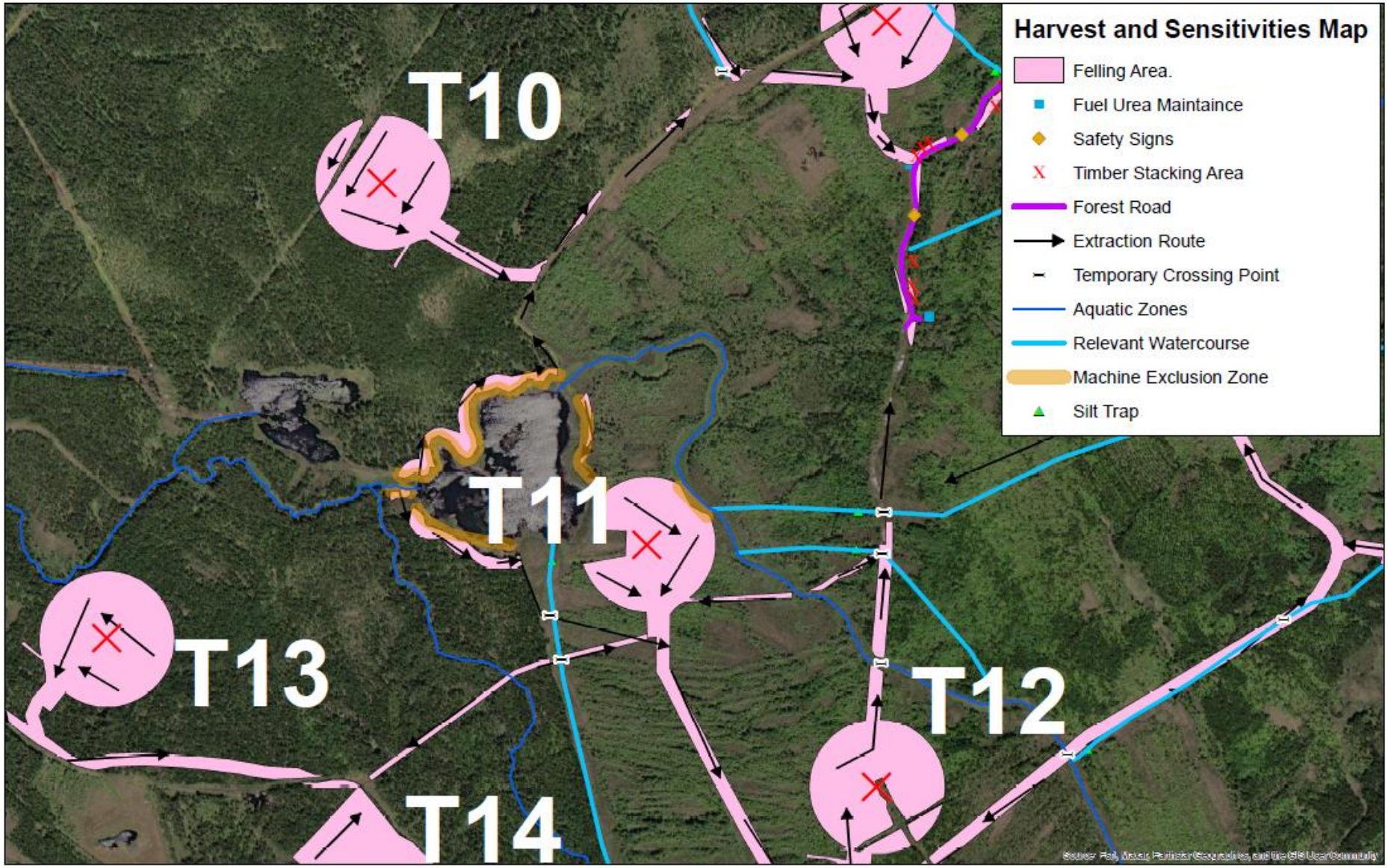
All sub-contractors should be briefed prior to operations starting and a copy of the Harvest Plan and Harvest plan maps made available to them.

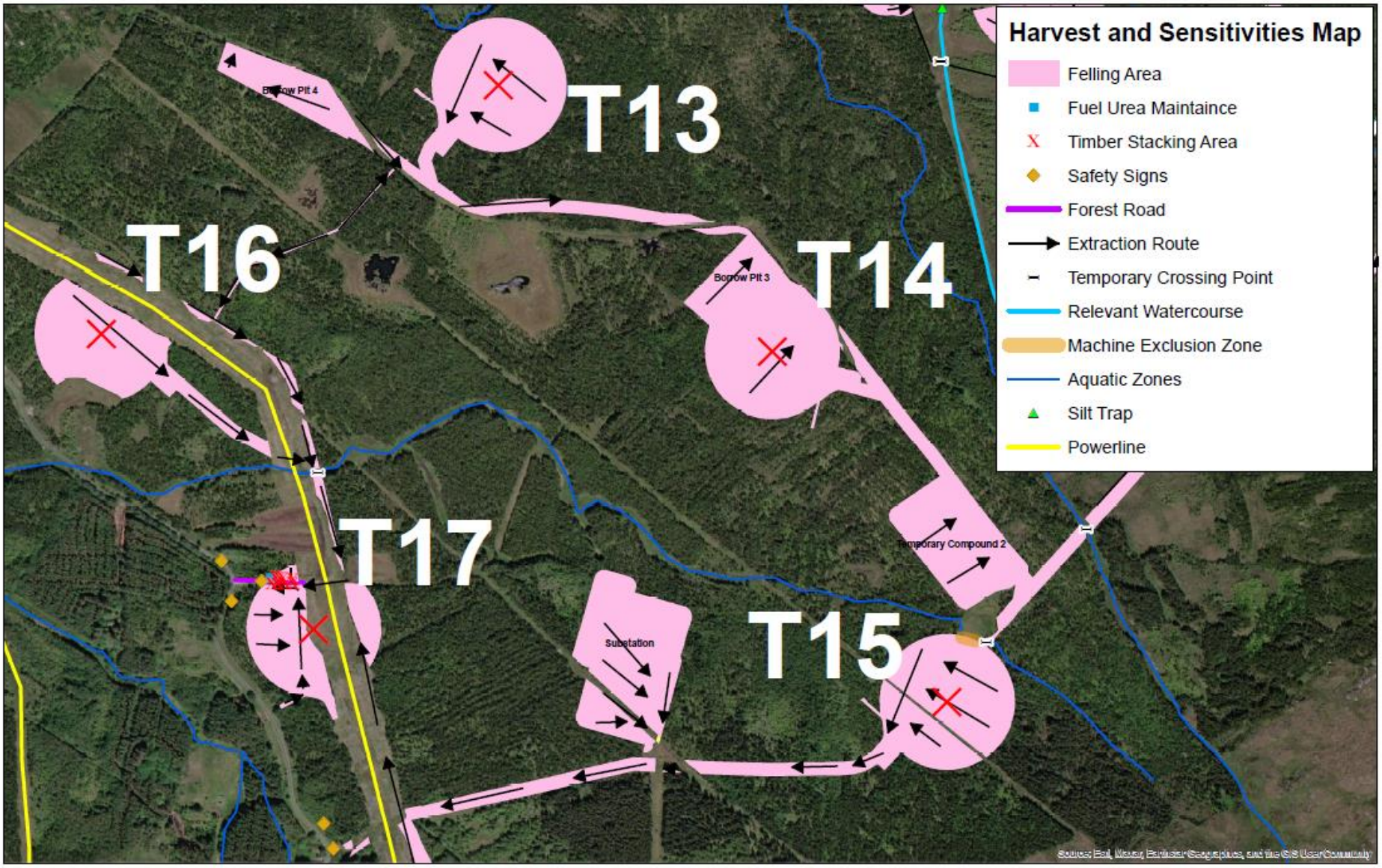
Figure 4 - Harvest Plan Maps for Turbines 1-19, Substation, Roads, Met Mast, Borrow Pits, Temp Construction Compounds, Bio Felling area

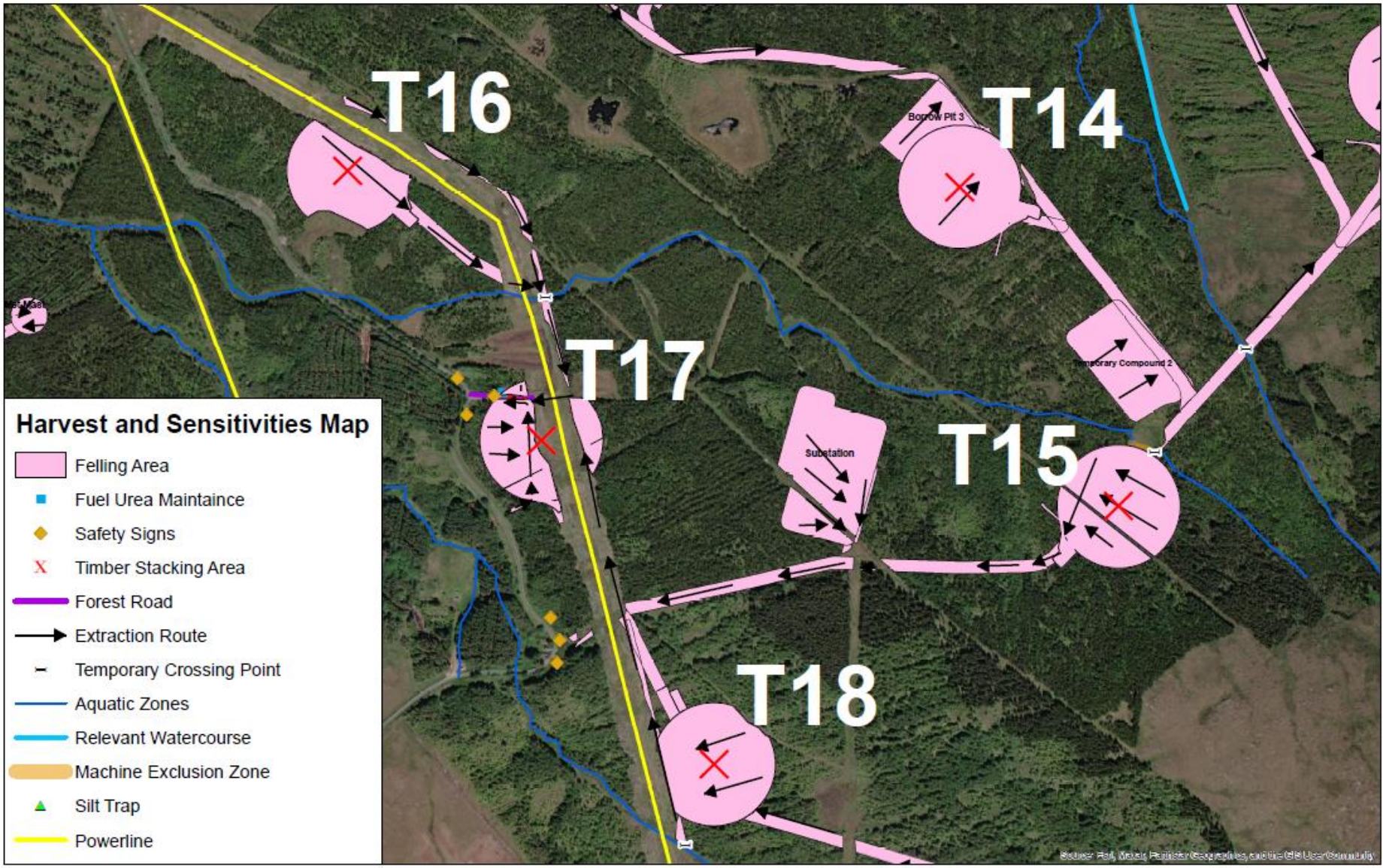


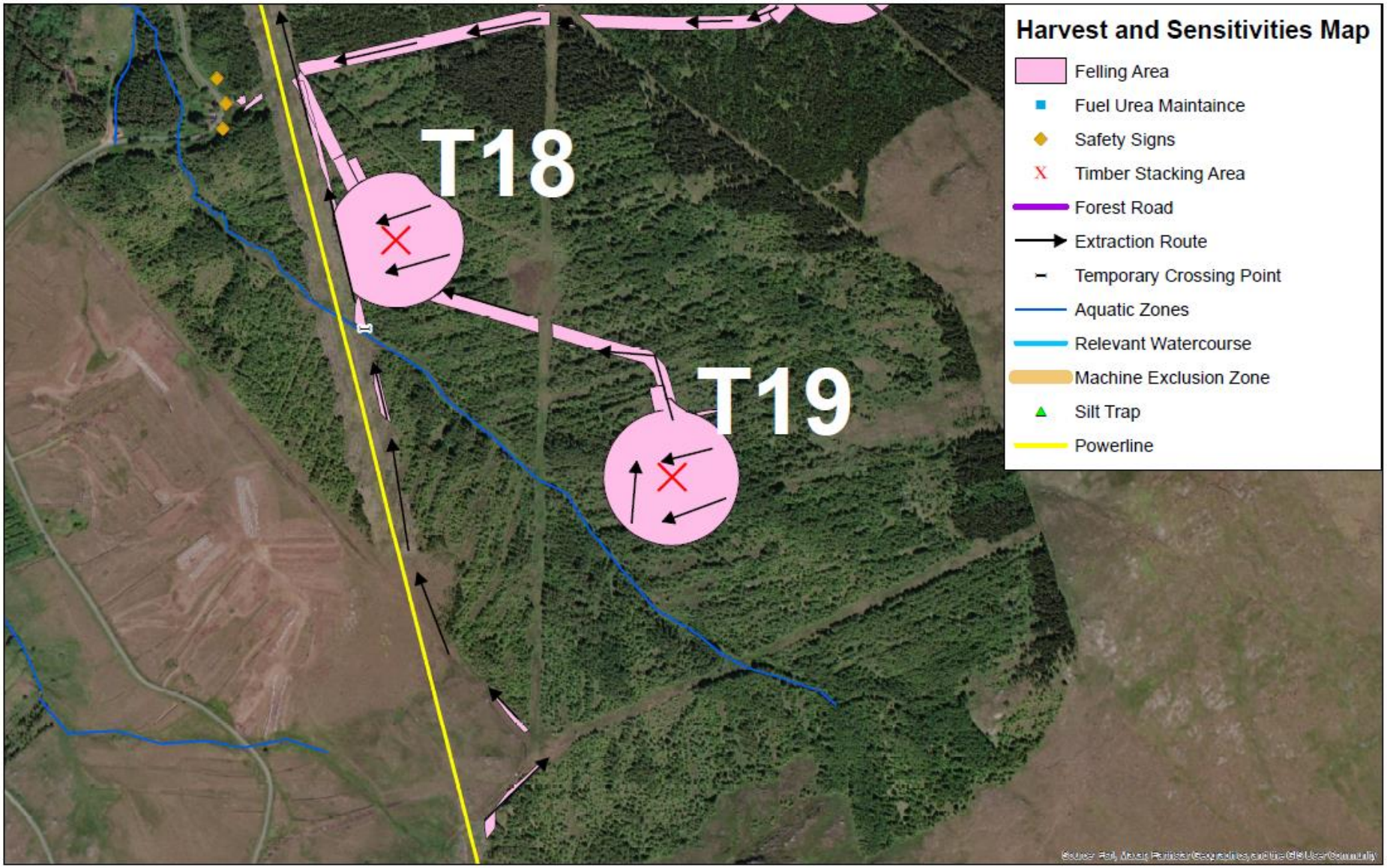

Harvest and Sensitivities Map
Felling Area
Fuel Urea Maintaince
Safety Signs
Timber Stacking Area
Forest Road
Extraction Route
Temporary Crossing Point
Aquatic Zones
Relevant Watercourse
Machine Exclusion Zone
Silt Trap
T3
T4
T5
T6
T7
Borrow Pit 2
0


T8
T9
T12
Harvest and Sensitivities Map
Felling Area
Fuel Urea Maintaince
Safety Signs
Timber Stacking Area
Forest Road
Extraction Route
Temporary Crossing Point
Aquatic Zones
Relevant Watercourse
Machine Exclusion Zone
Silt Trap
Powerline


Harvest and Sensitivities Map
Felling Area.
Fuel Urea Maintaince
Safety Signs
Timber Stacking Area
Forest Road
Extraction Route
Temporary Crossing Point
Aquatic Zones
Relevant Watercourse
Machine Exclusion Zone
Silt Trap
T10
T11
T12
T13
T14


Harvest and Sensitivities Map
Felling Area
Fuel Urea Maintaince
Timber Stacking Area
Safety Signs
Forest Road
Extraction Route
Temporary Crossing Point
Relevant Watercourse
Machine Exclusion Zone
Aquatic Zones
Silt Trap
Powerline
T13
T14
T15
T16
T17
Borrow Pit 4
Borrow Pit 3
Temporary Compound 2
Substation


T16
T14
T17
T15
T18
Borrow Pit 3
Temporary Compound 2
Substation
Harvest and Sensitivities Map
Felling Area
Fuel Urea Maintaince
Safety Signs
Timber Stacking Area
Forest Road
Extraction Route
Temporary Crossing Point
Aquatic Zones
Relevant Watercourse
Machine Exclusion Zone
Silt Trap
Powerline


Harvest and Sensitivities Map
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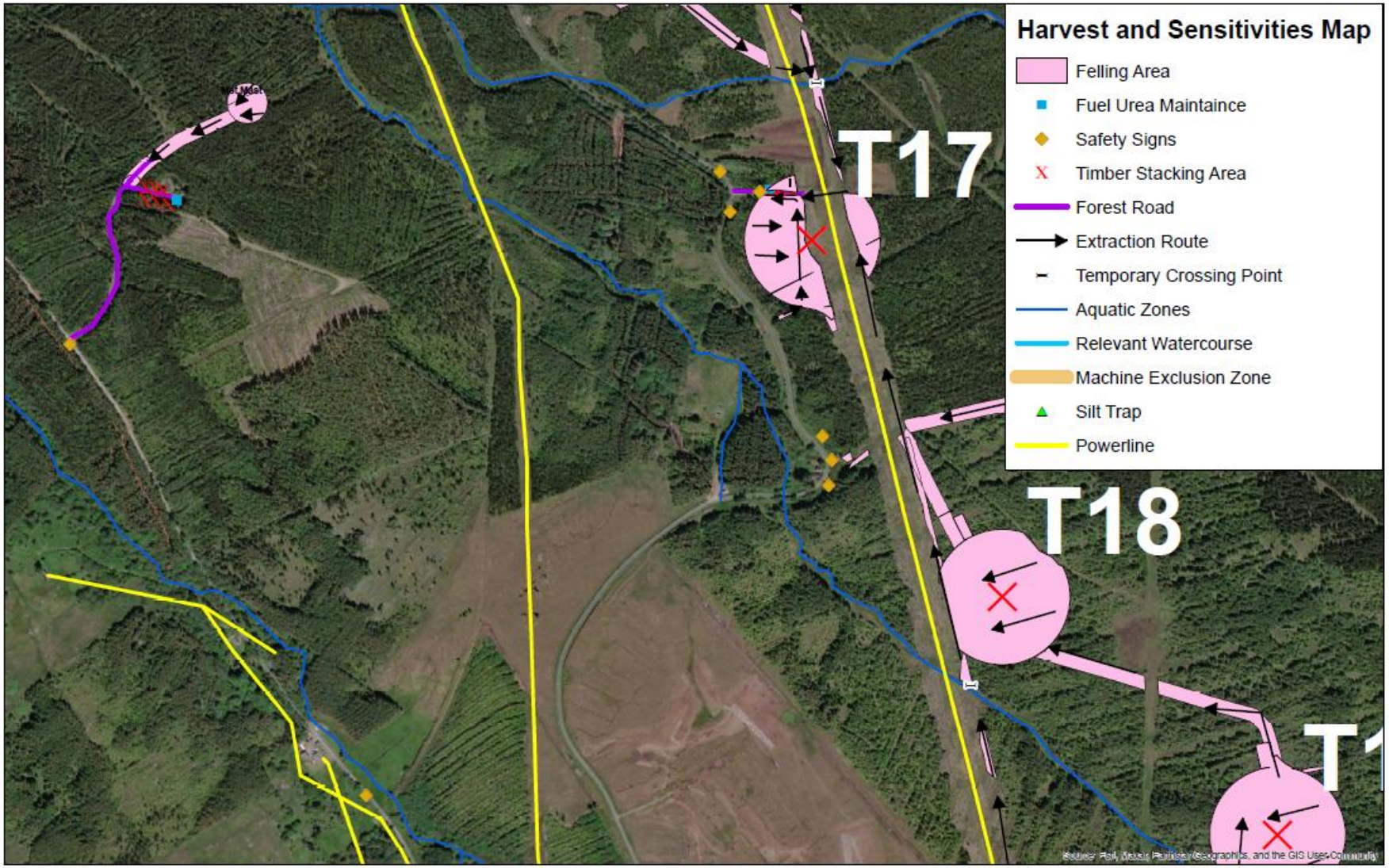
Forest Road
Extraction Route
Temporary Crossing Point
Aquatic Zones
Relevant Watercourse
Machine Exclusion Zone
Silt Trap
Powerline
T18
T19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Safety Signs
Timber Stacking Area
Forest Road
Extraction Route
Temporary Crossing Point
Aquatic Zones
Relevant Watercourse
Machine Exclusion Zone
Silt Trap
Powerline
T17
T18
T1

1.6.1.1.1 Harvesting Site Specifications

All staff must wear high visibility jacket and hard hat at all times. Chainsaw contractors must wear all required PPE equipment during operations set out in the Health & Safety Authority's (HSA) *Code of Practice for Managing Safety & Health in Forestry Operations*. All personnel on site must have appropriate Health and Safety training.

Agreed Truck Types: Artic ☑ Rigid ☐ Rigid and Trailer ☐

EMERGENCY CONTACT NUMBERS

Agencies	Telephone	Location
Coillte Forest Representative	TBC	Donegal
Garda Síochána	999; (074) 9551080	Glenties, Co Donegal
NPWS District Conservation Ranger, Donegal North	(01) 539 3433	NPWS Northern Region
Forest Service Inspector Martin Regan	087-2536562	Glenties, Co Donegal
Fire Station	999 or 112 (074) 955 1275	Glenties, Co Donegal

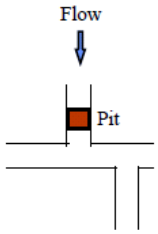
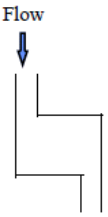
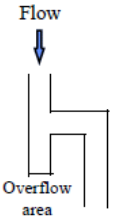
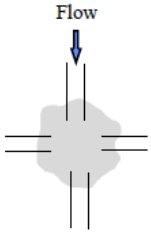
It is essential that all forest workers and machine operators involved in any forest operation are made aware of and understand the Forest Service Environment Guidelines, all relevant environmental issues relating to the site and the working practices which minimise environmental disturbance. All operators will have contact telephone numbers onsite for all relevant agencies (Owners, Local Authorities, Regional Fisheries Board, NPWS, Garda Síochána, etc.) in case of accidental damage to aquatic zones, archaeological sites, important wildlife habitats and other environmental features. Furthermore all Coillte forest workers and machine operators will have completed the Coillte Environmental Risk Assessment Training as well as all appropriate training and certification as required for harvesting operations.

Further information in relation to site safety and operations can be found in the Construction & Environmental Management Plan which forms Appendix 2 to Chapter 2 (Description of the Proposed Development) of this EIAR.

1.6.1.1.2 Silt and Sediment Control Measures

Best forest practice aims at minimising sediment mobilisation by reducing soil disturbance through planning, timing of operations and using appropriate machinery. Mobilised sediment transportation is minimised by the use of naturally occurring vegetated overland flow areas and the use of sediment traps. The following mitigation measures with regard to forest clearfelling will be followed:

- Prior to commencement of operations sediment or silt traps will be installed at intervals, as close as possible to the source of the sediment. Where required, correctly planned, installed and maintained sediment traps/drains for each individual felling site will help to ensure that water quality is protected. Typical sediment trap designs are illustrated below (source *Forestry Schemes Manual, 2011)*:

No. 1 (Pit)	No. 2 (Staggered Type)	No. 3 (Run Off Type)	No 4 (Swamp Type)
			
The end of the mound drain is slightly deepened for c. 0.3 metres before it enters the collector drain.	Forces water to slow down within the trap - more efficient than if the water ran straight through the trap. Minimum 1 metre long.	Caters for runoff events that exceed the design capacity. Useful on slopes. Overflows floods onto vegetation. Do not plant within 4 metres of the lower side in order to conserve dense vegetation.	Many drains may enter a natural depression to create a mini "swamp". Dimensions of the "swamp" depend on the needs of the site. May be c. 20 sq. metres. Do not plant within 4 metres of the "swamp".

Sediment traps will require monitoring and maintenance throughout the operations. Sediment traps are to be constructed and maintained in line with the requirements of the *Forestry Schemes Manual (2011), the Forest Road Manual and Forest Drainage Engineering – A Design Manual.* Sediment or silt trap mitigation measures are also included in Chapter 9 Hydrology & Hydrogeology.

- Silt traps and silt fences, such as geotextile membrane and straw bales, should be placed in the forest drainage network to minimise silt loss. Silt traps should be staggered along the length of the drain, and not only at the lower reaches towards its outflow. These should be inspected and cleaned regularly. A series of stepped silt traps/fences to trap any silt/debris will be installed. Their purpose will be to slow water flow and allow settlement of solids to occur. These will be regularly inspected and cleared out to ensure they are functioning properly. Traps should not be constructed immediately adjacent to natural water courses.
- Silt trap design can vary, from depressions added to the drain bed, to log sections laid lengthways into the drain or the use of geotextile barriers.
- Apply silt fences where necessary, to block pathway for silt in areas where overland flow is possible.
- Brash from the clearfell should be utilised as roading material to reduce impact on ground thereby minimising ground disturbance.
- Existing forest drainage shall be reinstated where damaged to allow use to be made of vegetated ground areas to reduce the flow of silt overland.
- A 15m buffer zone should remain between the silt trap and the watercourse with natural vegetation left intact so as to assist in silt interception.
- Within the buffer zone, forest harvesting, machine refuelling, forwarder movement and other forest operations are prohibited in order to protect water quality. Furthermore, drainage channels leading from the site must taper out before entering the buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone.

During a study of a harvesting site by Rodgers et al 2002 in Co Mayo, sediment concentrations, yields and release patterns upstream and downstream were compared before and after harvesting. These showed that harvesting did not significantly increase the sediment concentrations in the receiving water, confirming that if the Forests and Water Quality Guidelines are followed and care is taken on site, the aquatic zone need not be adversely affected by sediment releases from sites without a buffer strip.

1.6.1.1.3 Temporary Water Crossings

Temporary water crossings include forest drains, roadside drains, relevant watercourses[2] and aquatic watercourses. The following measures should be adhered to as per the *Interim Standards for Felling and Reforestation:*

Forest Drains:

- Minimise the crossing of drains during felling and extraction and restrict machine activity to brashed extraction racks and forwarding routes as shown in Figure 4 Harvest Plan Maps
- Where a drain crossing is needed, based on the size of the forest drain one of the following methods will be selected that prevents the breakdown and erosion of drain sides, namely:
    - For larger drains , deploy a heavy-duty plastic culvert lengthways into the channel and cover with brash material. The culvert must be of a diameter approximating the depth of the drain, to avoid any unnecessary undulation along the extraction route.
    - Where required, a solution for smaller drains is to temporarily lay log sections lengthways into the channel and overlay with brash. Again, select logs that approximate the depth of the channel to be crossed.

Aquatic Zones and Larger Relevant Watercourses:

- Minimise the crossing of aquatic zones and larger relevant watercourses during felling and extraction by choosing alternative routes which avoid the watercourses/aquatic zones where possible.
- Direct crossing over the stream bed is not permitted.
- If you must cross an aquatic zone or larger relevant watercourse install a temporary crossing point. When installing and removing the temporary crossing, ensure that no work is carried out within the aquatic zone, and that the stream bed and bankside remain undisturbed.
- Avoid crossing points in hollows where surface water gravitates towards, or in areas of the site more prone to sediment release, as indicated by terrain classification.
- Ensure the feature is crossed at a right angle to the flow of water.
- Where needed, any necessary crossing shall be via an appropriate structure that spans proud of the flow of water and prevents the breakdown and erosion of the banks.
- Typical solutions include the laying down of a bridge comprising logs overlaid with geotextile and brash to intercept soil falling off wheels.
- Alternatively, utilise temporary prefabricated concrete drop-in bridging

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[2] **Relevant watercourse:** Any other watercourse that has the potential to act as a pathway for the movement of significant amounts of sediment and/or nutrients from the site to an aquatic zone. Relevant watercourses are existing drains and channels that may contain flowing water during and immediately after rainfall.
Note, not every watercourse is a 'relevant watercourse'. For example, a well-vegetated agricultural drain or ditch draining a small area of moderately sloping ground may not be a relevant watercourse, as there will be little or no potential for it to carry significant amounts of sediment/nutrients

1.6.1.1.4 Brash Management

The objective of brash management is to contribute to the retention of the nutrients on site, thus preventing nutrients entering watercourses and to provide for access of machinery, specifically harvesters and forwarders, minimising damage to the soil.

The decay of brash takes place for some time after harvesting is completed and this process releases nutrients to the environment. These nutrients can be taken up by the soil or plants either within the forest or in a buffer zone/strip. Nutrients, which are not immobilised, can be washed away by overland flow, usually during the first significant rainfall event after their release.

Retention of the nutrients on site is achieved by the control of water, ensuring that the sediment and nutrients it contains are retained on site and as far away from the watercourse as possible. The following points will be implemented for this site:

- Where the brash is not required to form brash mats, it should be allowed to decay evenly distributed over the harvesting site. This allows for a more even distribution of the nutrient release on the site. If windrowing[3] is required, it should not be carried out until the needles have been shed
- Where the brash is required to form brash mats, it is laid out at harvesting stage as a mat to prevent soil disturbance by machine movement. Brash which has not been pushed into the soil may be moved within the site to facilitate the creation of mats in more demanding locations
- Extraction routes, and hence brash mats, should be aligned to the contour where possible. This assists in reducing the rate of water flow towards the receiving waters and consequently assists in onsite sediment entrapment
- Brash mats must be minimum 20m away from the watercourses, and
- The removal of brash mats in normal clearfell and replanting is not recommended as it is likely to be a source of sedimentation and ineffective in reducing nutrient loss.

1.6.1.1.5 Ancillary structures

The following ancillary structures will be required on site:

- Sediment traps in drains where considerable sediment flow is expected
- Brash mats to reinforce short sections of soft ground subject to high traffic usage
- Log steps on steep routes to prevent the flow of sediment-laden surface water along machine paths, especially where wheel ruts form.

Furthermore, prevent the accumulation of brash, logs and debris in drains and aquatic zones. The installation of heavy-duty plastic culverts with a protective brash cover is preferable for drain crossings. If logs are used for this purpose, they should be examined regularly and removed, if necessary, to avoid blockages and localised flooding. Remove temporary bridges and crossings as harvesting progresses.

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[3] Windrowing is the stacking of leftover vegetation, brash and other organic. matter into long narrow rows. The purpose of windrowing is to clear enough space for the replanting of new trees.

1.6.1.1.6 Site restoration

1.6.1.1.7 After felling has been completed, the felled areas will be checked to replace any damaged culverts, clear and repair drains, clean sediment traps, correctly dispose of hazardous materials such as machine oils or lubricants and remove log bridges and other temporary structures as necessary. Wildlife habitats and biodiversity

Assess harvest operations with due regard to the breeding and nesting seasons of important species, and associated features such as badger setts and red squirrel dreys, as discussed in Chapter 6 (Biodiversity) and Chapter 7 (Ornithology) of the EIAR.

1.6.1.1.8 Method of harvesting and the harvesting equipment

Load sizes recommended by machinery manufacturers will not be exceeded. Overloading will damage extraction machinery and will increase the risk and severity of soil compaction and rutting. Good management practices such as the use of brash mats and harvesting only in dry weather should be used to minimise soil surface disturbance and stream bank erosion. As some of the soils at the site are poorly drained soils, 8 wheeled harvesters should be used which will distribute the weight and reduce the loading and compaction and damage to the soil.

1.6.1.1.9 Storage and Handling of Chemicals, Fuels and Oils

Prepare and securely store all chemicals, fuel and machine oils under shelter on a dry, elevated site at least 50m from the nearest aquatic zone. Cleaning of equipment should not take place within 50m of an aquatic zone. All wash waters must be disposed of carefully. Spent oil must be collected and retained for correct off-site disposal. Biodegradable oil should be used as a substitute for mineral oil, where possible. Refer to the CEMP (Appendix 2) and Chapter 9 Hydrology and Hydrogeology for more information.

1.6.1.1.10 Landscape

Coupe sizes should reflect the scale of the landscape. Landscape issues favour asymmetric and irregularly shaped coupes which follow landform, with edges diagonal to the contour, rising in hollows and descending on spurs. Skylines need to be treated on a large scale, with the forest either left standing or cleared fully to reveal the shape of the underlying landform. Narrow belts of perimeter trees on the skyline tend to accentuate the negative visual impact of harvesting operations and generally, should not be retained. The coupe sizes for this proposed development are generally small in nature averaging 2-3 hectares.

1.6.1.1.11 Monitoring Requirements

Regular inspections during the course of harvesting operations will be undertaken to allow for immediate corrective action to be taken in the event of deviations from the plan or unforeseen problems. An assessment should involve an evaluation of the location and condition of roads, landings and machine routes, particularly in relation to drainage, compaction and rutting. Sites should be visited in the aftermath of an extended period of heavy rainfall to ensure that, if merited, operations are suspended. An assessment should be undertaken to determine whether protected areas are undamaged, and that fuel, lubricants and other hazardous compounds are stored correctly and removed from the site on the completion of operations.

1.6.2 Operational Phase

1.6.2.1 Onsite Replanting

Under the Forestry Act 2014, permanent forest removal is permitted under certain scenarios. Supporting renewable energy in the form of windfarm installation is an acceptable scenario as outlined in Table 7, Forest Service Felling and Reforestation Policy May 2017.

Table 7 – Requirements for each category of felling associated with wind farm development, regarding reforestation, alternative afforestation, and the refunding of grant and premiums.

Category of tree felling		Reforestation of felled area required?	Alternative afforestation required? (See Note 1)	Refunding of grant & premiums required? (See Note 2)
Infrastructure felling		No	Yes	Yes
Construction felling		Yes	No	No
Turbulence felling	≤20 ha	Yes	No	No
	>20 ha	Yes	Yes, 10% turbulence fell area – see Section 5.3.2.4	No

Note 1 If 'YES', the alternative site must be of an area equivalent in size. Section 5.7 sets out the procedures required. If the forest area proposed for permanent removal is still in receipt of premiums and / or is still in contract under the Afforestation Grant & Premium Scheme, the alternative site may be eligible under the Afforestation Grant & Premium Scheme.

Note 2 If 'YES', the refunding of any afforestation grants and premiums already paid out by the Forest Service is required if the forest area proposed for permanent removal is still in receipt of premiums and / or is still in contract under the Afforestation Grant & Premium Scheme. Also, if 'YES' or 'NO', if premiums are still being paid, premium payments on the area will cease.

As outlined in Section 1.4.1.1, it is estimated a total area of between 57.117ha and 78.263 ha will be required to be replanted under the Infrastructural felling, depending on the size of the bat felling buffer. Construction felling areas (12.63 ha) as outlined in section 1.4.1.1 will be temporarily felled and replanted at the same location once construction works are completed. There areas will be replanted with the same tree species that were felled, namely Sitka spruce and Lodgepole pine.

As part of the application for a Felling License for permanent forest removal, details of the replacement lands must be included. A Technical Approval for an afforestation license for any replacement lands must be granted by the licensing authority, the Department of Agriculture, Food and the Marine (DAFM), which will have assessed the silvicultural and environmental suitability for planting.

1.7 RESIDUAL EFFECTS

The premature and semi-mature felling of the different forest areas for the construction of the infrastructure (temporary and permanent) will result in a slight effect to the forest structure within the proposed development site as opposed to the do nothing scenario.

The residual impacts of the proposed felling and onsite replanting activities are assessed through the EIAR chapters for the relevant topic.

1.8 CONCLUSION

There is an extensive network of existing access roads across the site to facilitate the ongoing forestry operations and will subsequently facilitate the windfarm development. The area of forest to be permanently removed for infrastructural felling is estimated at between 57.117 ha and 78.263 ha (determined by bat felling buffer areas) distributed throughout much of the study area. This loss of forest area and carbon stored is temporary as an equivalent area of between 57.117 ha and 78.263 ha of bare land will be planted as replacement land elsewhere, and it is also noted that afforestation licences for the replacement land will be on mineral soils which have higher timber yields and therefore higher carbon storage capacity.

A further 12.63 ha will be felled to facilitate the wind farm construction phase and replanted once construction operations have ceased. It is expected that clearfelling works would be carried out over a 3 month period and during dry weather conditions.

It is concluded that, with the implementation of the Harvest Management Plan and associated mitigation measures, forestry operations associated with the proposed Cloghercor Wind Farm development will not give rise to significant impacts on the surrounding environment.

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