Malachy Walsh and Partners
Engineering and Environmental Consultants

Request for Further Information
Response to Item 4

Carrownagowan Wind Farm (ABP-308799-20)

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1 INTRODUCTION

Coillte CGA, care of Malachy Walsh and Partners, received a request for further information regarding the Carrownagowan Wind Farm application from An Bord Pleanála in a letter dated 23rd February 2021. This report addresses the further information request outlined in Item 4 of the letter.

1.1 CONTRIBUTORS TO THIS REPORT

This report has been completed by Peter Barry and Helen Burman-Roy of Malachy Walsh and Partners.

Peter Barry authored Chapter 14 of the EIAR, Air and Climate Change, and Helen Burman-Roy managed the project and authored Chapter 1 Introduction, Chapter 4 Alternatives and Chapter 16 the Interaction of the Foregoing.

Peter Barry (B.Sc. M.Sc. AIEMA, AIOA), is an environmental scientist and environmental impact assessment practitioner with 20 years' experience in the measurement, assessment, prediction and control of environmental noise. Peter is a member of the Institute of Acoustics (IOA) and has completed the IOA Diploma in Acoustics and Noise Control. Peter has prepared numerous noise, air and climate impact assessment reports for various developments including major infrastructural developments, mixed use developments and wind energy development projects. Peter has prepared numerous carbon calculations for wind farm developments in support of wind energy planning applications. He has presented evidence as expert witness on noise and air and climate at oral hearings including a strategic infrastructure development (SID) wind farm development.

Helen Burman-Roy (BSc, MSc, PIEMA), is a senior Environmental Consultant with over 20 years commercial experience gained in both the US and Ireland. She is an environmental impact assessment project manager and practitioner having managed EIA projects including Lettercraffroe, Toberatooreen, Scartaglen and Beennanaspuck wind farm projects. Helen has a BSc (Hons) in Geology and a Master of Science in Sustainable Development. She has been a contributing author on numerous EIA projects and has authored numerous specialist reports including land, soils and geology, population and human impact and material assets assessments for infrastructure projects. Helen is a practitioner member of IEMA and is on the Republic of Ireland steering committee.

2 ITEM 4 OF THE FURTHER INFORMATION REQUEST

Item 4 of the request for further information from An Bord Pleanála is as follows:

The applicant is requested to submit details of the quantum of carbon storage that would be lost as a result of both the removal and the drainage of peatland areas, and how the proposed development would not exacerbate climate change through the loss of carbon to the atmosphere.

3 RESPONSE TO ITEM 4

The response to the request for further information is set out under a number of topics as follows;

- Calculating the carbon loss of a Wind Farm;
- Peat as a Carbon Sink; and
- Quality of Peatlands at the Carrownagowan site and its surrounds.

The carbon loss associated with the construction of the wind farm was calculated using the accepted Scottish Government method (Calculating carbon savings from Wind Farms on Scottish peatlands; 2019) and it was submitted as part of the planning application (**Section 14.3.3.4** of Chapter 14 of the EIAR). Calculating the carbon loss of a wind farm is further explained and addressed in the next section.

The quality of the peatland as a means of carbon storage is also explained below. It is worth noting from the outset that the development is proposed at the site of a conifer plantation. Furthermore, the Carrownagowan Forest was established in the 1960s and is on 2nd rotation in part. This means that parts of the 1st planted forest was felled and a 2nd stage of afforestation occurred, with associated movement of the underlying soil.

3.1 CALCULATING THE CARBON LOSS OF A WIND FARM

Air and Climate Change was assessed in Chapter 14 of the EIAR submitted in support of the Carrownagowan Wind Farm application. As part of that assessment, a carbon calculation of losses and savings was included in the EIAR and the background and results are described below.

The carbon losses and savings associated with the development of the proposed Carrownagowan Wind Farm were described in **Section 14.3.3.4** of Chapter 14 of the EIAR.

The chapter states that:
there will be some carbon losses due to the manufacturing process of the wind turbines and the drainage and excavation of organic soil/ peat during the construction phase.

It is worth stating from the outset that carbon losses associated with the drainage and excavation of organic soil/ peat during the construction phase was addressed by applying a 'worst-case-scenario' assumption that the peat removed was an undamaged, intact, carbon store (which is not the case – see Section 3.3 below).

While there will be carbon losses, there will also be savings as once operational, the electricity generated by the wind farm will displace electricity that would otherwise have been produced by burning fossil fuels.

There must therefore be more savings than losses associated with the wind farm development to ensure that the proposed development will not exacerbate climate change through the loss of carbon to the atmosphere.

These potential losses and savings are described in **Section 14.3.3.4** and it was concluded that any carbon losses due to the manufacture and construction of the wind farm will be re-paid within 1.8 years.

This *payback* period was calculated using an established methodology which has been approved by the Scottish government and Scottish Environmental Protection Agency (SEPA). This methodology was developed in response to concerns on the reliability of methods used to calculate reductions in greenhouse gas emissions arising from large scale wind farm developments on peat land, specifically undisturbed upland or fen peat lands, in Scotland.

In order to demonstrate that the carbon savings will significantly outweigh any potential carbon losses a methodology made available by the Scottish Government in an excel worksheet titled *Calculating carbon savings from wind farms on Scottish peatlands* was applied to the Carrownagowan development (**Chapter 14** of the EIAR).

As mentioned earlier, this is an established methodology, which has been approved by the Scottish government and Scottish Environmental Protection Agency (EPA). Submissions in support of planning applications made by Developers in Scotland using this tool are regularly audited by the Scottish EPA. In the absence of an Irish equivalent, it is considered appropriate to use this tool for the proposed development and it is the tool applied in Ireland to calculate carbon savings and losses in wind farm applications.

The theoretical worst case carbon losses due to the proposed Wind Farm are presented in **Table 14-3** (copied below as Table 3-1). The results are **theoretical worst case** as the site is not an undisturbed acid or fen bog, rather commercial forestry. The actual results will therefore be much lower than those calculated.

Table 3-1 CO2 Losses due to Wind Farm

Source	CO_2 Losses (tonnes CO_2 equivalent)
Losses due to turbine manufacture, construction & decommissioning	76,329
Losses due to reduced plant fixation	2,309
Losses due to leaching	3,503
Losses from soil organic matter	51,078
Losses due to felling forestry	26,534
Total	**159,754**

The calculations show 159,754 tonnes of CO_2 equivalent losses over the Wind Farm's 30-year life span. 76,329 tonnes CO_2 equivalent or 48% of the losses come from the turbine lifecycle. The remainder accounts for 83,425 tonnes or 52% of the CO_2 equivalent losses. The early felling of the forestry accounts of 26,534 tonnes CO_2 equivalent losses or 17% of the total.

The total losses were calculated at 159,754 tonnes CO_2 equivalent. The loss from soil organic matter attributed to excavation of undisturbed bog is 51,078 tonnes CO_2 equivalent, although as previously outlined, this is a very conservative assumption for the proposed development site and is based on a worst-case scenario assuming the peat excavated was an undisturbed, pristine bog. Overall, the carbon calculation and balance spreadsheet show that carbon losses due to the manufacture and construction of the wind farm will be re-paid within 1.8 years. This is very positive given the 30-year life span of the Wind Farm project.

The recent study (Wind Power and Peatland) by Scottish Renewables (2020), states that;
Wind farms which are to be built on peatlands are assessed using the Scottish Government's Carbon Calculator to ensure that the carbon payback is taken into account during decision making. A review by the University of Edinburgh has shown that all wind farms included in a number of studies achieved carbon payback ***within two years.***

Given the payback period for the Carrownagowan Wind Farm is 1.8 years, it is in line with these findings.

3.2 PEAT AS A CARBON SINK

This section of the report looks at carbon storage in peatlands in the general sense. The quality of the peatlands in the Carrownagowan Forest are addressed in the following section. The sections below present the key points from relevant organisations and current scientific studies in terms of the classification of peat as a carbon sink or store.

Peatlands can act as either a source or a sink of carbon – depending on their condition. Undisturbed peatlands, in their natural state, having a persistently high, water table, provide a function as a long-term carbon store. Bogs and peatlands thrive under waterlogged conditions. Under such anaerobic conditions, organic material does not readily decompose, therefore, the carbon content of the material remains in-situ. However, this delicate balance between production and decay easily causes peatlands to become carbon sources following interference.

Dissection of any peatland, by means of constructing drains, roads, turf cutting and the disturbance from planting and felling of trees by rotation in a commercial forest, are activities which damage the peat and alter the hydrology.

The Irish Peatland Conservation Council (IPCC) website describe peatlands, in their natural state, as long-term sinks for atmospheric carbon dioxide (www.ipcc.ie). A persistently high, water table is necessary for this function. Peatlands are the most important long-term carbon store in the terrestrial biosphere. They sequester and store atmospheric carbon for thousands of years. The IPCC identify the pressures and damage to peatlands as arising from drainage, agricultural conversion, forestry, and the burning and mining for fuel and horticultural peat. The Irish Peatland Conservation Council has reviewed the status of Irish peatlands and found that 299,192ha remains relatively intact within 895 sites of conservation importance. This however is only 25% of the original peatland area in the Republic of Ireland (IPCC, 2021). The IPCC has calculated the loss of peatland habitat to forestry in Ireland as 28% and further states the long-term carbon storage function of 47% of our original peatland area has been severely diminished through domestic and mechanical peat extraction.

The International Union for Conservation of Nature (IUCN) recognises that peatlands are the largest natural terrestrial carbon store. However, damaged peatlands are a major source of greenhouse gas emissions. In order to function in carbon storage, IUCN states that year-round waterlogged conditions are necessary in undamaged peatlands.

According to the EPA (Ireland's Environment - factsheets), almost one-fifth of land in Ireland is categorised as peatland and this includes raised bogs, blanket bogs and fens. Natural peatland acts as a long-term carbon store. However, when peatland is damaged this function is reversed and carbon is released to the environment. Release of terrestrial carbon from soil and biomass is a major source of carbon dioxide (CO2), the main contributor to climate change. Losses of carbon from degraded peatlands and associated activities (e.g. combustion of peat) mean that, at a national level, Irish peatlands are a large net source of carbon.

There is the possibility that climate change will exacerbate CO_2 release from peatlands. Forestry Focus, which is an initiative of the Society of Irish Foresters, notes that a significant portion (approx 40%) of Ireland's forests has been established on peatland sites. In the Forestry Focus note on Climate Change, it states that predicted rising temperatures, accompanied by a likely decrease in summer rainfall, will increase the moisture deficit of peatlands both in amount and in duration. Dryer conditions will increase the rate of oxidation of the peat leading to CO_2 release, shrinkage, erosion, nutrient loss and maybe irreversible drying on certain sites.

A paper published in May 2021 (Jovani-Sancho, Cummins, and Byrne), investigated the soil carbon balance of afforested peatlands and concluded that afforested blanket peatland soils are net sources of CO_2 emissions from oxidation of soil carbon. Losses from decomposing peat, following from oxygen entry due to drainage, are larger than above and below ground carbon inputs. The result of the study is that the carbon input is too small to give net carbon sequestration.

The key and common points above are that peatlands, only when water-logged and undamaged, act as carbon sinks, but once they are damaged – act as carbon sources. In afforested peatlands, it is the forest itself that is sequestering carbon.

Land use and land management at the Carrownagowan site indicate a damaged peatland. This is also the case peripherally where land use extends from the site, for example, existing forestry, turbary, roads and drainage extending from the site. An exception to this is the Slieve Bernagh Bog SAC, adjacent to the site to the south and east and somewhat at a remove to the northwest. The Slieve Bernagh Bog is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive:

[4010] Wet Heath
[4030] Dry Heath
[7130] Blanket Bogs (Active)

The Slieve Bernagh Bog SAC is further considered in the section to follow.

3.3 QUALITY OF PEATLAND ON THE CARROWNAGOWAN SITE

The Carrownagowan site is not an undisturbed peatland with a persistently high, water table. It is the site of a large commercial forest, planted originally in the 1960s and having second rotation forestry in part. The site is highly modified and has been drained to facilitate commercial forestry. The hydrological regime across the proposed development site has already been significantly altered. The roads, drains and soil disturbance associated with the conifer planting have long released the carbon store, such that the most significant carbon store on the site is now the trees themselves. Those permanently felled for the renewable energy infrastructure will be replanted (in replacement forestry lands elsewhere), thus there is no net carbon loss from tree felling.

While there is peat across the site, the development site is not by definition a fen or acid bog, but a commercial forest. The site boundary includes a total land area of c.750ha which principally consists of commercial conifer plantation of various rotations, with sections of bogland, cutover bog, and

grasslands in unplanted areas within the site. The forestry operations have modified the overall site, which would have supported peatland habitats prior to initial forestry planting. The peat remaining on the site is described in excerpts from the Biodiversity Chapter below.

The forestry extends from the development areas in the south (centre area), north east and north west, such that the hydrological connectivity to the surrounding peatland has already been severed by land management practices. The Slieve Bernagh Bog SAC, where it is present to the south and east, lies topographically above the development site. Furthermore, a large firebreak constructed between the Carrownagowan site and the Slieve Bernagh Bog SAC to the south and east has already changed the site hydrology significantly. The firebreak excavation ranges from 2-3m deep and 8-10m wide, and mineral soil is exposed at the base of the firebreak excavation. The firebreak is a definitive slice into the peat mass, and it represents a clear and significant break in the peat mass and its associated hydrology. Connectivity to areas of the Slieve Bernagh Bog SAC to the northwest has also been severed through land management and use, including forestry and roads and the presence of natural watercourses. Therefore, as the Carrownagowan site is not, in the first instance, an intact peatland, proposed excavation works within the site will not result in the destruction of an intact carbon sink either at the site or in surrounding peatland areas. As the peatland at Carrownagowan has been altered, the connectivity to the surrounds has been severed.

The firebreak is a significant excavation, as shown in Figure 3-1 below.

Figure 3-1 Significant fire break and hydrological break from peatland to the site.

Chapter 6, Biodiversity, described the predominant habitat within the study area as conifer plantation (WD4). It further states that sections of upland blanket bog (PB2), raised bog (PB1), cutover bog (PB4), and wet heath (HH3) occur in unplanted areas between large forestry blocks. Wet heath occurs in a mosaic with the blanket bog and wet grassland.

These peatland habitats have been disturbed by on-going forestry operations at the site. Drainage is an obvious negative influence on these habitats with many drainage ditches (FW4) recorded

throughout these areas. Discrete areas of higher value peatland habitats were identified during initial constraints surveys and excluded from development.

A number of areas of wet grassland (GS4) occur, which are reverting from previous agricultural improvement. This habitat type sometimes occurs in a mosaic with wet heath (HH3). The site is drained by a number of first and second order streams (FW1), in the upper reaches of the catchment area, largely draining to the Owengarney River. This habitat type has been planted for commercial forestry, and diverse flora is absent.

The following habitat descriptions (related to peatlands) are relevant *excerpts* from **Chapter 6 Biodiversity** (Section **6.5.2.2)** which describe the quality of the peat at various locations on the development site.

Upland blanket bog (PB2) and Upland blanket bog/Wet heath (PB2/HH3)

This habitat type occurs in two areas within the red line boundary (to the east of T17, and to the west of T16). The blanket bog occurring to the west of T16 occurs in a mosaic with wet heath, where topography, peat depth reduction, and the installation of drainage ditches has resulted in the regeneration of wet heath from the original blanket bog.

The blanket bog has been degraded greatly as a result of forestry operations at the site. Both areas of PB2 occurring within the wind farm site boundary are isolated, surrounded by conifer plantation. A large proportion of the peat mass remains, however the drainage ditches have altered the hydrology in these areas. Deep drains have been installed along all margins along this habitat type, and some overgrown internal drains (some deep, with water flow still present during surveys), bisect through this habitat type.

To the east of T17, peat depth ranges from 1m to 2m on a relatively flat land area, gently sloping to the south, and southwest. The dominant species by far is ling heather (*Calluna vulgaris*) (dominant, often forming mono species with 80% cover over vast areas of this habitat). Deer grass (*Trichophorum germanicum*) and purple moor grass ranged from frequent to abundant. The ling heather in some areas is becoming woody and is difficult to walk through.

Upland blanket bog (PB2) has links to the following Habitats Directive Annex I habitat types;

- Blanket bog (if active bog) [7130]
- Depressions on peat substrates of the Rhynchosporion [7150]

The species occurring within these areas best correspond to the BB5 classification; high altitude bog that can be dry, often lacking any appreciable Sphagnum cover. While the vegetation supports typical upland blanket bog species, the active drains have dried out significant proportions of the bog, which has likely resulted in the significant increase in heather cover, particularly ling heather. During surveys at the site, it was noted that the surface was dry, and the hydrology has been severely affected by the installation of drains. While sphagnum mosses are present, they occur in scattered pockets, and few hummocks were noted, and pool topography is absent. The management of the site, including the network of drainage ditches, the associated dominance of ling heather, to some extent the encroachment of spruce and pine trees, and the occurrence of rhododendron are negative indicators of links to Annex I habitats.

(Excerpt taken from Section **6.5.2.2.13** within 6.5.2 Habitats of **Chapter 6 Biodiversity**)

Raised bog (PB1) (degraded)

This habitat occurs towards the west centre of the site. This bogland has been significantly impacted by forestry drainage, and to some extent peat harvesting. Therefore, it is not Annex I habitat. The habitat type does contain discrete patches that support species of active raised bog, and degraded raised bog.

(Excerpt taken from Section **6.5.2.2.14** within 6.5.2 Habitats of **Chapter 6 Biodiversity**)

Cutover bog (PB4)

Small, isolated sections of this habitat type occur throughout the site, mainly occurring in areas of one-time blanket bog that was drained for forestry, or cutaway as a result of peat harvesting, resulting in shallow peat depths. The largest area of this habitat type occurs towards the south-western end of the site, at the location of T1. Conifer plantation surrounds this area. The gradient increases northwards, resulting in the southern section being wetter. Peat harvesting has been carried out throughout this area, likely mechanical, with peat banks spread throughout. The site has largely re-vegetated, with little to no bare areas of peat remaining. There is now a dominance of ling heather (*Calluna vulgaris*), and purple Moor-grass (*Molinia caerulea*). Small discreet patches of this habitat type also occur in association with the upland blanket bog (PB2) habitat within the red line boundary (to the east of T17, and to the west of T16). As described above, this area of upland blanket bog and cutover bog is influenced by the current land management practices and drainage regime which are limiting the regeneration potential and subsequent ecological value of these habitat types.

During surveys, there were little to no exposed areas of bare wet areas of ground, or bare peat areas to support Rhynchosporion communities. The peat harvesting at this location would have ceased for some time, and the cutover has recolonised mainly with ling heather, and cotton grass (*Eriophorum spp.*). Favourable stripped humid areas to support the Annex I type habitat do not occur.

(Excerpt taken from Section **6.5.2.2.15** within 6.5.2 Habitats of **Chapter 6 Biodiversity**).

The above *excerpts* from **Chapter 6 Biodiversity** on the descriptions of peat related habitats show that Annex I habitat is not present or the conditions supporting Annex I are not favourable, due to current land management practices associated with the forestry.

In terms of connectivity with peatlands surrounding the site, the hydrological linkages have similarly been severed by forestry, turf cutting, roads and drainage, and the construction of the aforementioned large firebreak.

The following excerpts are taken from **Chapter 8 Water (Section 8.4.2.9)** and provide a summation of the hydrological connectivity to the SAC.

The closest designated site to the proposed development is the Slieve Bernagh Bog SAC (Site code: 002312). This SAC borders the proposed development site and extends both north, east and south of

the proposed wind farm development site. The southern part of the Slieve Bernagh bog is at a higher elevation (up-gradient) to the proposed wind farm site, therefore no part of the proposed development site will drain towards this section of the bog. The northern part of Slieve Bernagh bog is situated at a lower elevation (down-gradient) than the proposed wind farm, and part of the proposed development site will drain towards this area. An assessment of elevation differences and hydrological connections is presented below. This SAC includes downstream sections of the Killuran and Owenogarney Rivers.

Southwest - T1, T2, T3 and T4

The natural slope in this area is from Slieve Bernagh Bog SAC area down towards the forestry site and the proposed wind farm site. The natural elevation changes along this boundary are significant, e.g. between the SAC and proposed T3 location the elevation change is 27.4m, i.e. the ground elevation at the turbine location is 27.4m lower than at the SAC boundary over a separation distance of 199.3m. The SAC is up-gradient of turbines T1, T2, T3 and T4.

In addition, there is a very significant firebreak excavation along this boundary between the SAC and turbines T1, T2, T3 and T4. This excavation ranges from 2-3m deep and 8-10m wide, and mineral soil is exposed at the base of the fire break excavation. The excavation effectively breaks any shallow hydrological link between the peat water levels in the SAC and the downhill area. Peat water drains into the fire break excavation, and discharges to downstream drainage via surface water drainage outlets.

In addition to these prevailing conditions, downhill of the fire break the forestry plantation has an altered drainage regime with mound drains installed in the peat. There is also ongoing tree felling and replanting in this area of the forestry plantation.

Based on separation distances (>150m buffer to SAC boundary), the elevation differences between the SAC boundary and proposed development, the presence of significant bounding fire break, and the existing altered drainage regime there is no potential for alteration of the natural peatland hydrology within the SAC as a result of the proposed wind farm development.

Southeast - T8, T12, and T13

The natural slope in this area is from the SAC area down towards the forestry plantation and the proposed wind farm site. The natural elevation changes along this boundary are significant, e.g. between the SAC and proposed T12 location the elevation change is 36.6m, i.e. the ground elevation at the turbine location is 36.6m lower than at the SAC boundary over a distance of ~275m. The SAC is up-gradient of turbines T8, T12, and T13.

In addition, there is a very significant forest road between the SAC and turbines T8, T12, and T13. This excavation ranges from 6-8m wide, and mineral soil is exposed on the upstream side of the forest road excavation. The excavation effectively breaks any shallow hydrological link between the peat water levels in the SAC and the downhill area. Peat water drains into the road drains, and discharges to downstream drainage via surface water drainage outlets.

In addition to these prevailing conditions, downhill of the forest road the forestry plantation has an altered drainage regime with mound drains installed in the peat. There is also ongoing tree felling and replanting in this area of the forestry plantation.

Based on separation distances (>150m buffer to SAC boundary), the elevation differences between the SAC boundary and proposed development, the presence of significant dividing forest road, and the existing altered drainage regime there is no potential for alteration of the natural peatland hydrology within the SAC as a result of the proposed wind farm development.

Eastern - T14, T15, T16 and BP3

The natural slope in this area is from the SAC area down towards the existing forestry plantation and the proposed wind farm site. The natural elevation changes along this boundary are moderate, e.g. between the SAC and proposed T15 location the elevation change is ~11m, i.e. the ground elevation at the turbine location is ~11m lower than at the SAC boundary over a distance of ~412m. The SAC is across gradient of turbines T14, T15 and T16, and the SAC is upgradient of BP3.

In addition, there is a very significant firebreak excavation along this boundary between the SAC and turbines T14, T15 and T16 and borrow pit 3. This excavation is approximately ~1-2m deep and 6-8m wide, and mineral soil is exposed within the fire break excavation. The excavation effectively breaks any shallow hydrological link between the peat water levels in the SAC and the downhill area. Peat water drains into the fire break excavation, and discharges to downstream drainage via surface water drainage outlets.

In addition to these prevailing conditions, downhill of the firebreak the forestry plantation has an altered drainage regime with mound drains installed in the peat. There is also ongoing tree felling and replanting in this area of the forestry plantation.

Based on separation distances (>150m buffer to SAC boundary), the elevation differences between the SAC boundary and proposed development, the presence of significant bounding fire break, and the existing altered drainage regime there is no potential for alteration of the natural peatland hydrology within the SAC as a result of the proposed wind farm development.

Northern - T19, and Met Mast, Delivery Works Areas

The natural slope in this area is from the Turbine 19 and met mast area down towards the SAC. The natural elevation changes along this boundary are significant, e.g. between the Turbine 19 and the SAC is ~25m, i.e. the ground elevation at the turbine location is ~25m higher than at the SAC boundary over a distance of ~432.5m. The SAC is across gradient of all infrastructure at T19 and the Met Mast. There is an east-west flowing stream between the proposed development (T19 and Met Mast are the closest proposed infrastructure) and the SAC to the north. All natural drainage in this area flows from east to west towards the Inchaluchoge River. The stream effectively breaks any shallow hydrological link between the water levels in peat to the south of the stream and the SAC to the north. Peat water from the south drains into the existing natural stream.

In addition to these prevailing conditions, within the proposed development the forestry plantation has an altered drainage regime with mound drains installed in the peat. There is also ongoing tree felling and replanting in this area of the forestry plantation.

Based on separation distances (>150m buffer to SAC boundary), the elevation differences between the SAC boundary and the proposed development, the presence of hydrological boundary, and the existing altered drainage regime there is no potential for alteration of the natural peatland hydrology within the SAC as a result of the proposed wind farm development.

The above *excerpts* from **Section 8.4.2.9 of Chapter 8 Water** of the EIAR outline that development of the wind farm, will not alter the hydrology of the SAC.

Within Chapter 8 of the EIAR, the impact on up-gradient groundwater levels and peat water levels within Slieve Bernagh Bog SAC was characterised as "negative, indirect, imperceptible, long term, unlikely". Regardless of the status of the surrounding peatland in the SAC, the Carrownagowan Wind Farm is not going to alter it or its status as a carbon sink or source.

Furthermore, Appendix 3-5 of Volume III of the EIAR presented the results of trial pits across the site. What is apparent is the overall lack of groundwater ingress encountered in the peat layer and the underlying clay and gravel layers. Occasionally water was encountered at the bedrock level. There is a distinct lack of a high, water table at the site. Overall, the site is influenced by surface water flow.

The above information shows that the Carrownagowan forest is a damaged peatland, lacking both the high water table and the species, which would indicate an undisturbed peatland, in a natural state, having a persistently high water table, providing a function as a long-term carbon store.

Thus, as stated in Section 3.1 above, the excavation and drainage of peat at the proposed development site has been overestimated (as a worst-case scenario) in the SNH Carbon calculator. The proposal is for a Renewable Energy development which is aligned to the decarbonisation goals and policies of the government. The conservative, worst-case estimate of the carbon calculation and balance spreadsheet show that the carbon losses associated with the wind farm construction will be re-paid within 1.8 years. This is very positive given the 30-year operational life of the Wind Farm project. Therefore, the proposed wind farm development will not exacerbate climate change through the loss of carbon to the atmosphere but is a key project towards the decarbonisation goal which is crucial to limiting global warming and thus protecting biodiversity.

4 CONCLUSION

The EIAR concluded that any carbon losses due to the manufacture and construction of the wind farm will be re-paid within 1.8 years. Following from that, the proposed wind farm project will facilitate decarbonisation objectives at local and national levels as set out in the 2019 National Climate Action Plan and the 2017 - 2023 Clare County Development Plan which states that Clare County Council *will facilitate the development of energy sources which will achieve low carbon outputs*. The proposed development as described herein, is by definition such an energy source.

The proposed development will not exacerbate climate change through the loss of carbon to the atmosphere. The operation of the Wind Farm will ***displace*** CO_2 emissions and air pollutants that would otherwise have been produced by fossil fuel generated electricity. As concluded in Chapter 14 of the EIAR, this project, in combination with other renewable energy projects deemed necessary in the National Climate Action Plan, will result in a long term significant positive impact on air quality and climate.

The response to the request for further information focused on three key items. A concluding statement is provided for each item below.

Calculating the carbon loss of the proposed Carrownagowan Wind Farm	The established methodology approved by the Scottish Government and Scottish Environmental Protection Agency was used to calculate the carbon loss from the development of the wind farm. This included the maximum peat excavation volume, assuming a pristine peatland. This was a worst-case scenario application of the tool with a result of a payback period of 1.8 years, which is very positive for a wind farm, with a 30-year operational life. Decarbonisation is critical to reducing rising global temperatures and addressing climate change.
Peat as a carbon sink	To function as a carbon store, a peatland needs to be undisturbed and waterlogged. These are the specific conditions required for the carbon content of organic material to remain in-situ. When peatlands are damaged and drained, oxidation occurs, there is interference with the carbon balance, net carbon sequestration cannot occur, and the peatland becomes a carbon source.
Quality of peat at the Carrownagowan site	Overall, the Carrownagowan forest is an altered peatland, lacking both the high water table, and the species, which would indicate an undisturbed peatland, in a natural state, having a persistently high water table, providing a function as a long-term carbon store. It is the site of a commercial forest. Furthermore, construction works within the Carrownagowan forest will not impact on the surrounding peatland or on the Slieve Bernagh Bog SAC as the hydrological linkages are absent.

5 REFERENCES

Environmental Protection Agency (2013) EPA Note on *Ireland's Environment* Land and Soil.

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