TECHNICAL APPENDIX 8.6

Kilgallioch Windfarm Extension

Shadow Habitats Regulation Assessment (HRA) Report

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1 Introduction

1.1 Background and Purpose of Document

1.1.1 ScottishPower Renewables (SPR) is proposing an extension to the Operational Kilgallioch Windfarm, located approximately 9.5 km to the north west of Kirkcowan, Dumfries and Galloway. As described in **Chapter 4: Development Description** of the Environmental Impact Assessment Report (EIAR), the extension (hereafter referred to as the 'Proposed Development') would comprise 11 turbines and up to 20 MW of installed solar photovoltaic arrays along with associated infrastructure including:

- Turbine foundations;
- Crane hardstandings;
- Transformer/switchgear housings located adjacent to turbines and solar arrays;
- Solar photovoltaic modules
- Access tracks (existing, upgraded or new as required);
- Watercourse crossings (existing, upgraded or new as required);
- Underground electrical cabling to the Operational Kilgallioch Windfarm substation;
- Permanent anemometer mast, Lidar compound and up to two performance masts;
- Close circuit television mast(s);
- Communication mast(s);
- Permanent operations building;
- Up to two borrow pit search areas; and
- A temporary construction compound area.

1.1.2 As an extension to the Operational Kilgallioch Windfarm the Proposed Development would re-use and share existing infrastructure from the Operational Kilgallioch Windfarm. This includes sharing much of the access track and connecting to the existing Operational Kilgallioch Windfarm substation.

1.1.3 The location of the site and the Proposed Development layout are shown on **EIAR Figures 4.1a to d**.

1.1.4 It has been identified that the Site borders two Special Areas of Conservation (SACs), which are designated under the EC Habitats Directive (92/43/EEC): Kirkcowan Flow SAC to the north and River Bladnoch SAC to the west and along part of the southern Site boundary. The location and proximity of these two SACs to the development Site is shown in **EIAR Figure 3.1**. No other SACs or Special Protection Areas (SPAs) (collectively referred to as 'Natura 2000' sites) or Ramsar wetlands are located within 5 km of the Proposed Development.

1.1.5 Given the close proximity between the Site and the two SACs there is a potential for the activities associated with the Proposed Development's construction and operation to result in adverse effects on the qualifying interests of the qualifying interests. Consequently, a Habitat Regulations Appraisal (HRA) is considered to be necessary to identify the nature, extent and significance of any adverse effects and, if found, whether these are likely to impact the integrity of the designated site.

1.1.6 ITPEnergised has been commissioned by SPR to provide information to inform the HRA, which will be undertaken by the Energy Consents Unit as competent authority for the consideration of the Proposed Development application.

1.2 Kirkcowan Flow SAC

Description

1.2.1 Kirkcowan Flow is the largest of four relicts of the former flow-ground in south west Scotland and is most representative of this geographic region. It covers an area of 775.19 ha. The site contains a number of features not found on the other three sites, including extensive surface patterning with *Sphagnum cuspidatum* hollows. The core of the site displays a mixture of partially-patterned watershed bog and extensive flushed slopes very similar to Feur Lochain on Islay.

1.2.2 Annex I habitats of the EC Habitats Directive that are a primary reason for site designation:

- Blanket bogs (Priority feature).

1.2.3 Other Annex 1 habitats present as a qualifying feature but not a primary reason for designation:

- Depressions on peat substrates of the *Rhynchosporion*.

1.2.4 Annex II species that are a primary reason for selection of this site:

- Not applicable.

1.2.5 Annex II species present as a qualifying feature, but not a primary reason for site selection:

- Not applicable.

Site condition

1.2.6 Scottish Natural Heritage (SNH) have kindly provided ITPEnergised with the latest site condition assessment, which was undertaken in September 2013 (Peak Ecology 2014). The condition assessment examined a total of 29 sampling points within the blanket bog feature and eight sampling points within the depressions on peat substrates of the *Rhynchosporion* feature.

1.2.7 Ten of the blanket bog sampling points (and a total of twelve targets) failed, and therefore this feature as assessed as not in favourable condition. The main reasons for this failure were a high livestock pressure at Craigmoddie Fell and Eldrig Moss, conifer regeneration on Lodens Moss., past drainage and the spread of purple moor-grass (*Molinia caerulea*) (which were concluded to be the main issues on the feature as a whole), and vehicle tracks affecting parts of the feature. Some of these factors could interact; for example, the Peak Ecology (2014) report noted that dense purple moor-grass areas were difficult to move through, which in turn could increase livestock pressures on adjoining areas of blanket bog which were easier to move across. The assessors stated that blocking of drains and other management to control purple moor-grass was necessary to improve the condition of the feature, followed by removal of conifer samplings.

1.2.8 No sampling points of the depressions on peat substrates of the *Rhynchosporion* feature failed, although it was acknowledged that fewer samples were obtained. It was noted that the feature was only seen on Eldrig Moss and Lodens Moss, which are the wettest bogs within the SAC. It was concluded that the same issues apply as for the blanket bog feature but that the wetter conditions at Eldrig Moss and Lodens Moss may help protect the feature. It is also stated in the Peak Ecology (2014) report that paths and tracking may create new habitat for this feature. Overall, the depressions on peat substrates of the *Rhynchosporion* feature was assessed as being in favourable condition.

1.3 River Bladnoch SAC

Description

1.3.1 River Bladnoch flows from Loch Maberry in South Ayrshire for seven miles to Wigtown Bay. It includes the Tarf Water, which forms the Site boundary to the west and south. The SAC covers an area of 272.6 ha and supports a high-quality salmon population. The river drains a moderate-sized catchment with both upland and lowland areas, and this variety is reflected in the river's ecological and water quality characteristics. Whilst there are problems in

the river's headwaters arising from acidification, national and local initiatives are both reducing and ameliorating the worst effects of this pollution source.

1.3.2 Annex I habitats of the EC Habitats Directive that are a primary reason for site designation:

- Not applicable.

1.3.3 Other Annex 1 habitats present as a qualifying feature but not a primary reason for designation:

- Not applicable.

1.3.4 Annex II species that are a primary reason for selection of this site:

- Atlantic salmon (*Salmo salar*).

1.3.5 Annex II species present as a qualifying feature, but not a primary reason for site selection:

- Not applicable.

Site condition

1.3.6 SNH have kindly provided ITPEnergised with the latest site condition assessment, which was undertaken in 2011 (Rivers and Fisheries Trusts of Scotland 2014) and which included all Scottish SACs with Atlantic salmon as the primary or secondary reason for site selection. The work resulted in a data supporting site condition monitoring report with recommendations to enable SNH staff to formally undertake process of site condition monitoring and condition assessments. As described in the report, Site condition is an amalgam of assessments for juvenile and adult assessments, and both must be favourable in order for a SAC to be assigned favourable status.

1.3.7 The assessment of juvenile populations from quantitative electro fishing surveys completed and for 0+ and 1++ age classes separately indicated that Bladnoch should be assigned favourable status. The highest 1+ densities within the SAC were recorded in the Water of Malzie and the lowest in the Tarf Water. 2+ salmon were found only at one site on the main Bladnoch channel (Rivers and Fisheries Trusts of Scotland 2014). The assessment of adult populations based upon application of the rod catches and a simple trend analysis to the spring, summer and autumn run time components suggested that Bladnoch should be assigned unfavourable status. These juvenile and adult assessments were then combined to generate an overall conclusion that River Bladnoch SAC is "*unfavourable – recovering*."

1.3.8 Rivers and Fisheries Trusts of Scotland (2014) conclude that water quality is the key issue affecting Atlantic salmon in the River Bladnoch SAC. The catchment has been subject to substantial surface water acidification, and in some areas fish have been lost from the catchment completely. Negative impacts associated with forestry, and in particular forestry-mediated impacts on gravel movements and resulting degraded in-channel habitats, are also stated to be significant concerns. In some areas this has led spawning areas being left with either insufficient, or compacted, gravels. Grazing and the introduction of non-native fish species are also considered to have a negative impact on the SAC. Despite these concerns, the authors consider that new forestry activities, and better forestry practices (such as the establishment of riparian buffer zones), will benefit river processes and water quality.

2 Habitat Regulations Assessment (HRA)

2.1 Legislative Background

2.1.1 Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora ("The Habitats Directive"), provides legal protection for habitats and species of European importance. Articles 3 to 9 provide the legislative means to protect habitats and species through the establishment and conservation of an EU-wide network of sites. This network is known as Natura 2000 and is a European ecological network of special areas of importance for nature conservation, composed of sites hosting rare and vulnerable habitats and species. This network is designed to enable the natural habitat types and the species' habitats concerned to be maintained or, where appropriate, restored at a favourable conservation status in their natural range.

2.1.2 The UK has designated a number of sites of nature conservation importance which form part of a network of Natura 2000 Sites. As mentioned above, Natura 2000 Sites comprise SACs designated under the EC Habitats Directive and SPAs designated under the EC Wild Birds Directive. In addition, as clarified by paragraphs 207 to 211 of the Scottish Planning Policy 2014[1], proposed SACs and SPAs (i.e. sites which have been approved by Scottish Ministers for formal consultation but which have not yet been designated) are treated as if they had been fully designated, and wetlands of international importance designated under the Ramsar Convention (Ramsar sites) are also treated as designated Natura 2000 Sites and/or Sites of Special Scientific Interest (SSSI) and are therefore also considered in HRAs.

2.1.3 The procedures that must be followed when considering developments affecting Natura 2000 Sites are set out in Article 6 of the Habitats Directive. In Scotland, this process is implemented through the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) ("The Habitats Regulations").

2.1.4 Habitats Directive Article 6(3) set out the decision-making tests for plans and projects likely to have a significant effect on or to adversely affect the integrity of European sites (Annex 1.1). Article 6(3) establishes the requirement for Appropriate Assessment (AA):

"*Any plan or project not directly connected with or necessary to the management of the* [Natura 2000] *site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.*"

2.1.5 Both EU and national guidance exists in relation to Member States fulfilling their requirements under the EU Habitats Directive, with particular reference to Article 6(3) and 6(4) of that Directive. The methodology followed in this report to inform the Article 6 assessments has had regard to the following guidance and legislation:

- Guidance:
  - Scottish Natural Heritage (2018). Natura sites and the Habitats Regulations: How to consider proposals affecting SACs and SPAs in Scotland. The essential quick guide.
- Legislation:
  - Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (also known as the 'Habitats Directive');
  - Council Directive 2009/147/EC on the conservation of wild birds, codified version, (also known as the 'Birds Directive'); and

[1] Available at: https://www.gov.scot/publications/scottish-planning-policy/pages/7/ (accessed October 2019)

- The European Communities (Birds and Natural Habitats) Regulations 2011 to 2015.

2.2 Overview of Appropriate Assessment Stages

2.2.1 An HRA is a process to determine Likely Significant Effect (LSE) through **Stage 1** screening and (where such likely effects are identified) assess whether there are adverse impacts on the integrity of a Natura Site by means of an Appropriate Assessment (AA) (**Stage 2**).

2.2.2 The threshold for an LSE is treated in the screening exercise as being above a trivial or '*de minimis*' level. A *de minimis* effect is a level of risk that is too small to be concerned with when considering ecological requirements of an Annex I habitat or a population of Annex I (bird) or Annex II (non-avian) species present on a European site necessary to ensure their favourable conservation status. If low level effects on habitats or individuals of species are judged to be in this order of magnitude, and that judgment has been made in the absence of reasonable scientific doubt, then those effects are not considered to be significant.

2.2.3 Based on the outcome of the AA, the Competent Authority shall agree to a plan or project only after having ascertained that it will not adversely affect the integrity of the Natura 2000 site concerned.

2.2.4 The European Commission (2018) states that the 'integrity of the site' can be usefully defined as the coherent sum of the site's ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated. They go on to state the following:

"*The integrity of the site involves its constitutive characteristics and ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the habitats and species for which the site has been designated and the site's conservation objectives*."

2.2.5 When considering the '*integrity of the site'*, it is therefore important to take into account a range of factors, including the possibility of effects materialising in the short, medium and long-term.

2.2.6 The recent judgement (May 2018) of Case C-323/17 ("People Over Wind") affirms that ecological mitigation measures cannot be considered during Stage 1, and the European Commission (2018) therefore now considers that mitigation measures must be directly linked to the likely impacts that have been identified in Stage 2; they can therefore only be defined once these impacts have been described and assessed by the competent authority through an Appropriate Assessment.

2.2.7 Mitigation measures, which aim to avoid or reduce impacts or prevent them from happening in the first place, must not be confused with compensatory measures, which are intended to compensate for any damage that may be caused by the project. Compensatory measures can only be considered under Article 6(4) if the plan or project has been accepted as necessary for IROPI and where no alternatives exist.

2.2.8 Where a competent authority concludes through an AA that there will be an adverse effect on the integrity of a Natura 2000 Site, the Competent Authority may only agree to a plan or project if:

- It is evidenced that there are no alternative solutions (**Stage 3**); and
- There are Imperative Reasons of Overriding Public Interest (IROPI) for the advancement of the project (**Stage 4**).

3 Description of the Proposed Project

3.1 Site Location and Receiving Environment

3.1.1 As stated above, **EIAR Figures 4.1a and 3.1** present the Proposed Development and its associated infrastructure and the proximity of the Kirkcowan Flow SAC and River Bladnoch SAC, respectively.

3.1.2 A full description of the geology, hydrology and habitats within and surrounding the Proposed Development is provided in **EIAR Chapter: 7: Hydrology, hydrogeology, Geology and Soils** and **Chapter 8: Ecology and Biodiversity**. **EIAR Figures 7.5** and **7.2** shows the peat and surface water features, respectively, whereas **EIAR Figure 8.2** shows the National Vegetation Classification (NVC) survey results. Fisheries surveys were undertaken by Galloway Fisheries Trust and included as **EIAR Technical Appendix 8.4**. A summary of these works is provided in the following:

- Peat depths within the Site range from nil to over 3 m. Parts of the west, central, and far south east site areas are identified as being within areas of Class 1 Peat based on the SNH Carbon and Peatlands Map (2016). This is defined as "nationally important carbon-rich soils, deep peat and priority peatland habitat; areas likely to be of high conservation value." A small area of Class 2 Peat ("nationally important carbon-rich soils, deep peat and priority peatland habitat; areas of potentially high conservation value and restoration potential") is identified west of Loch Eldrig, mostly off-site but encroaching slightly into the eastern Site boundary.
- The plant communities reflect the very varying depth of the underlying peat substrate. As shown on **EIAR Figure 7.5**, parts of the Site comprise shallow (<0.5 m) peat, which **EIAR Figure 8.2** shows to be dominated by M25 *Molinia caerulea–Potentilla erecta* mire, often as large open stands but also in mosaics with other communities, most notably M15 *Scirpus cespitosus*[2]*–Erica tetralix* wet heath. Very deep (>2 m) peats also occur and notably dominate locations in the north central, south west and southern areas of the Site, and they are dominated by M17 *Scirpus cespitosus–Eriophorum vaginatum* blanket mire and sometimes M25 mire.
- M19 *Calluna vulgaris–Eriophorum vaginatum* blanket mire occurs locally as stands in the south east, north east and north west corners of the Site, occasionally in mosaic with or transition to M25 mire. However, the greatest extent of M19 blanket mire was recorded in areas north of the Site boundary, within the Kirkcowan Flow SAC. The M17 and M19 blanket bog within the Site has been subject to past draining to improve its value as grazing land, and moorland grips remain visible in many places, although many are now in-filled with vegetation. As shown on **EIAR Technical Appendix 8.7, Map 2**, moorland grips are also common within the Kirkcowan Flow SAC boundary.
- It is likely that areas of M25 mire on deeper peats have been derived from M17 or M19 blanket mire through frequent grazing combined with artificial drainage (Averis *et al.* 2004).
- M25 mire on shallow peat may also be derived from M15 wet heath through frequent grazing combined with artificial drainage (Averis *et al.* 2004).
- Acid M6 *Carex echinata–Sphagnum recurvum/denticulatum* mire is found mostly threading throughout the lower lying depressions and burn valleys within middle, eastern and southern parts of the Site.
- M23 rush-pasture is widespread across the Site but is mainly associated with the lower-lying areas, where it notably occurs along the depressions and creases of former watercourses or drains that have now filled in, as well as along existing watercourses and in the rides and other open areas within forestry across the Tarf Water to the south and west of the Site.
- Other widespread vegetation types include U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland and the U20 *Pteridium aquilinum–Galium saxatile* bracken community.
- No Nationally Rare or Scarce species (i.e. occurring in 15 or fewer 10km squares, and 16-100 10km squares respectively) were recorded in the surveys.

[2] Now known as *Trichophorum germanicum*

- The boundary with Kirkcowan Flow SAC is mainly characterised by shallow peat, but very deep peat is present on the eastern boundary, near Eldrig Moss. Areas of deep peat are also associated with the watercourse valleys for Ha' Hill Strand on the north western Site boundary, and Monandie Burn on the northern Site boundary, south of Airieglasson. There is general continuum of habitats across the Site boundary at these locations.
- The boundary with River Bladnoch SAC is mainly characterised by shallow peat supporting M23 rush-pasture or M6 mire, and M25 mire on either shallow or deeper peats. Tributaries to the Tarf Water include Ha' Hill Strand (and its own smaller tributaries), which drains the western part of the Site, Monandie Burn which drains the central part of the Site, and Loch Strand (and its own many tributaries, including grips and an outflow from Loch Eldrig east of the Site boundary), which drains the south eastern part of the Site and flows into the Tarf Water south of the Site boundary.
- Salmon fry were present in very low densities in Tarf Water, alongside very low densities of salmon parr. Trout (*Salmo trutta*) fry were recorded in a very low density and parr were recorded in a low density. No non-salmonid fish species were recorded in Tarf Water. In evaluating these survey results, Galloway Fisheries Trust (GFT) states in **EIAR Technical Appendix 8.4** that "*The presence of salmon in this site, however low the densities, is a very good sign and is furthest up the catchment that GFT have recorded salmon since surveys began in 1988. It indicates the recovery of the Tarf in its upper reaches and it will be important to monitor this site closely over the next few years.*"
- Salmon was not recorded in any of the other watercourses surveyed. Trout fry were absent on Ha' Hill Strand, but trout parr were recorded in low density. One pike (*Esox lucius*) and one eel (*Anguilla anguilla*) were also caught within this watercourse. Trout fry were also absent on Monandie Burn, but trout parr were recorded in moderate density. No non-salmonid fish species were recorded in Monandie Burn. Trout fry were recorded in moderate density on Loch Strand Burn together with a low density of trout parr, and one eel was also recorded. No fish were present within the Loch Eldrig outflow.

4 Stage 1: Screening for Likely Significant Effects

4.1 Kirkcowan Flow SAC

Elements of the Proposed Project with the Potential for Likely Significant Effects

4.1.1 The potential effects of the development on the qualifying interest of the Kirkcowan Flow SAC can be split into direct and indirect effects and include:

- Temporary or permanent habitat loss, change and fragmentation by Site infrastructure.

Analysis of the Potential for Likely Significant Effects

<u>Blanket bog and depressions on peat substrates</u>

4.1.2 As the Proposed Development Site does not overlap with the Kirkcowan Flow SAC there is no potential for any direct loss or fragmentation of habitat associated with the SAC. However, there is potential for indirect changes to the hydrological regime of blanket mire and depressions on peat substrates, both of which features require constant moisture. Drying of the peat body, e.g. as a result of drainage within the Site during construction of the windfarm, could lead to an associated change in the vegetation, both in terms of structure and species composition. Reduced moisture within peat depressions, especially during periods of little rainfall, could prevent the establishment of the pioneer and heliophilous *Rhynchosporion* vegetation on the exposed peat surfaces.

4.1.3 No turbines are sited on areas of peat which extend into the Kirkcowan Flow SAC, and construction in areas with hydrological connectivity to the SAC and where there is a potential for localised drawdown of the shallow groundwater table to result in drying of shallow peat deposits within the SAC. It is also noted that the SAC is up-gradient from the Site.

4.1.4 In addition, the distance over which drying impacts are measurable will vary between vegetation types as well as with geology and topography, and there is no agreed upper threshold for effects. For potential ground-water dependent terrestrial ecosystems (GWDTEs), SEPA (2017) considers effects possible up to 250 m from deep (>1 m) excavations, such as those needed for turbine foundations and borrow pits, whereas the distance is 100 m from shallow excavation, such as those needed for dug track infrastructure. These distances are likely to be highly conservative for peatland communities which are not groundwater-dependent, including M17 and M19 blanket mire, and depressions on peat substrates of the *Rhynchosporion*, which in Scotland is usually part of the transition between M1 and M2 bog pools and the surrounding blanket or raised mire vegetation (Joint Nature Conservation Committee, no date): Because the blanket mire system is characterised by being fed by precipitation and by occurring on a peat substrate of low permeability, drying impacts from drainage may only be measurable in the immediate vicinity of drains. In a study at Moor House National Nature Res Moor House-Upper Teesdale National Nature Reserve, County Durham, Coulson *et al*. (1991) concluded that the greatest effect of drainage and therefore desiccation would occur immediately downslope of each ditch, but there was no measurable change beyond 5 m in the composition of the flora relative to the position of the ditch. A similar finding has been recorded by SPR at Black Law Windfarm Extension, North Lanarkshire, where effects from drainage have only been measurable within a zone of 5 m either side of ditches cut around a turbine base and out to a maximum distance of 10m from the turbine foundation excavation itself[3]. These results reflect the practical rationale for installing moorland grips as parallel ditches located close together (15 – 35 m apart) in order to reduce wetness by increasing runoff from the bog surface and lowering the water table within the peat (Stewart and Lance 1983).

4.1.5 Drainage impacts from the proposed wind farm development are likely to occur on similar scales, i.e. within 10 m of any artificial drains created during the construction period. **EIAR Figure 3.4** shows the proposed wind farm layout and the boundary of the SAC. The distance between the two is never less than 50 m, except for the access track leading to Borrow Pit 2 in the southeast of the Site. However, this comprises an upgrade of existing track.

4.1.6 Consequently, there is no potential for LSE on either qualifying feature of the SAC.

4.2 River Bladnoch SAC

Elements of the Proposed Project with the Potential for Likely Significant Effects

4.2.1 The potential effects of the development on the qualifying interest of the River Bladnoch SAC can be split into direct and indirect effects and include:

- Temporary or permanent habitat loss, change and fragmentation by Site infrastructure; and
- Contamination of freshwater habitats through sedimentation and/or pollution from surface runoff during construction leading to a reduction in habitat quality and prey availability for salmon.

Analysis of the Potential for Likely Significant Effects

<u>Salmon</u>

4.2.2 Most of the Site drains into the River Bladnoch SAC. As shown on **EIAR Figure 3.4**, at its closest the Proposed Development's footprint or associated works areas are no closer than 150 m of the Tarf Water. However, a number of crossings are needed over watercourses, which drain into the Tarf watershed.

4.2.3 Salmon may potentially be affected by pollution related events associated with the construction phase of the proposed Development, such as sedimentation or fuel or oil spillages. Pollutants have the potential to enter watercourses within the Site and enter the Tarf Water where in turn they will affect the habitat and food resources

[3] THE IMPACTS ON PEATLAND OF CONSTRUCTING A TURBINE AT BLACK LAW WINDFARM PHASE 1 EXTENSION (2017): Report issued to SPR as part of Planning Condition 12 for Black Law Extension Windfarm

on which salmon depend. Such incidents are expected to be localised and small in scale, but impacts could be significant.

4.2.4 Consequently, there is potential for LSE on the qualifying feature of the SAC.

5 Stage 2: Shadow Appropriate Assessment

River Bladnoch SAC

Salmon

Pathways of effects

5.1.1 Most of the Site drains into the River Bladnoch SAC. At its closest the Proposed Development's footprint comes no closer than 150 m of the Tarf Water, but a number of crossings are needed over watercourses, which drain into the Tarf watershed. These are described in **EIAR Technical Appendix 7.3** and can be summarised as follows:

- Within the plantation to the north west of the main development area, water crossings (WXs) are needed on two watercourses:
  - Un-named watercourse north west of Cairn Hill – WX12, located within a recently felled area north of main body of the Site, is over a small ditch c 250 m upstream of the confluence with Tarf Water.
  - Back Burn – WX13, located on the border between the plantation to the north west and the turbine area, is over a narrow and fast-flowing burn with an estimated maximum channel section of 0.5 m x 0.5 m. The location is c 520 m upstream of the confluence with Tarf Water.
- Within the turbine area, water crossings are needed at the following locations:
  - Ha' Hill Strand – pipe culverts are needed at two minor tributaries in the upper reaches of this watercourse: WX14, located between operations building and Turbine 8 in the north west of the Site, is over a narrow ditch, estimated to be 0.3 m x 0.3 m maximum and c 1,450 m upstream of the confluence with Tarf Water. WX15, located on track leading to Turbine 3 from the north, is over a small ditch which is covered over with vegetation and is difficult to notice, and it is c 1,510 m upstream of the confluence with Tarf Water.
  - Monandie Burn – pipe culverts are needed at two locations on this watercourse: WX16, located east of Turbine 9, is over a small burn, estimated 0.3 m x 0.3 m maximum, and c 870 m upstream of the confluence with Tarf Water. WX17, located between Turbine 9 and Turbine 11, is c 420 m upstream of the confluence with Tarf Water.
  - Loch Strand – pipe culverts are needed at three locations on this watercourse or its tributaries: WX18, located west of Turbine 6, is over a very small channel which is difficult to identify within surrounding vegetation, and it is c 2,650 m upstream of the confluence with Tarf Water. The burn at WX19, located downstream of WX18 and west of Turbine 1, is slightly larger than at WX18 but is also very narrow and shallow at this location, and it is c 2,070 m upstream of the confluence with Tarf Water. WX20, located under the track leading towards Turbine 1 from the southeast, is over the outflow from Loch Eldrie that then flows into Loch Strand. A fording point is present upstream of this location that appears to be used by the farmer. The watercourse is small and straight at this point. It is c 1,750 m upstream of the confluence with Tarf Water.

5.1.2 Other water crossings are located out with the Tarf watershed.

5.1.3 Apart from WX13, which will be an open arch/bridge, all crossings will be new pipe culverts. All the crossings will be sized to allow continuous flow.

5.1.4 Works to install these water crossings and the immediately adjacent sections of track have the potential to generate pollution, including spillages and sedimentation incidents, which in turn could affect salmon of the SAC population either through direct toxicity or by changes to supporting habitats, e.g. through siltation of gravels. However, this potential will be reduced by increased separation distances between individual crossing points and the Tarf Water as well as by the topography, as earthworks in locations with a steep topography means that rapid run-off could quickly affect sensitive aquatic areas in the SAC.

5.1.5 Although some tree felling is required for the Proposed Development, this is not needed near watercourses draining to the Tarf. Note that WX12 is within an area which was recently clear felled. Acidification arising from tree felling is therefore not considered any further.

Temporary or permanent habitat loss, change and fragmentation by Site infrastructure

5.1.6 There will be no temporary or permanent loss or fragmentation of SAC habitat, with the nearest development area being c 150 m from the Tarf Water.

5.1.7 There will be works on and adjacent to tributaries to the Tarf Water, but as described above, the watercourses are very small and the crossings are typically separated from the SAC boundary by large distances (up to 2,650 m), and works to install crossings and adjacent track are therefore very unlikely to result in any significant habitat changes within the SAC. Possible exceptions to this are the three crossings within 500 m of the SAC boundary, i.e. WX12, WX13 and WC17.

5.1.8 The watercourses at WX12 and WX17 are very small and will require only pipe culverts, but they are located c 250 m and c 420 m from the Tarf Water, respectively, and sedimentation from the works could reach the SAC and affect gravels there. The watercourse at WX13 is the faster-flowing Back Burn, which will require an open arch/bridge a pipe and which is located c 520 m from the Tarf Water. Despite this greater distance, the larger size and faster-flowing nature of the burn may also mean that sedimentation from the works could reach the SAC and affect gravels there.

5.1.9 Effects of excessive deposition of fine sediment on salmonid spawning success and egg survival is relatively well documented. Infiltration of fine sediment is known to limit success of eggs hatching through the reduction of gravel permeability and oxygen availability (Michel *et al*. 2014, Greig *et al*. 2007, Ingendahl 2001). Salmonid eggs require a well-oxygenated environment during the embryonic development stage, and eggs are therefore laid in permeable gravel beds with interstitial pore spaces, which allow the passage of oxygenated water. The deposition of excess fine sediment can clog these interstitial pores, obstructing the circulation of oxygenated water and thus reducing egg survival (Magee *et al*. 1996, Carling 1984); for example, Turnpenny and Williams (1980) recorded salmonid egg mortality of between 98-100% within spawning gravels experiencing high siltation loads. The effect is particularly damaging when sediments contain a high organic component, as its subsequent decomposition also reduces oxygen from the water (Rubin 1998).

5.1.10 As stated in **Section 1.3**, the latest site condition assessment indicates that Tarf Water is among the least productive parts of the SAC, although the survey results summarised in **Section 3.1** confirm that recovery is ongoing, likely as a result of forest restructuring in the upper reaches. Most of the sediments potentially generated as a result of works at or adjacent to WX12, WX13 and WX17 are likely to be deposited in the watercourses before they flow into the SAC; after this initial deposition, sediments will gradually be released downstream through flushing and scouring. Some sediment may not have an initial capture but instead enter the SAC soon after being generated. However, there will be a dilution effect with distance, and because the works are relatively small in scale, the risk of major releases of sediments is also small. In addition, because the Tarf is not part of the productive part of the SAC, it is very unlikely that deposition effects from the works will be significant in the SAC as a whole. It is therefore concluded that the works are not likely to reduce the integrity of the SAC's habitats.

Contamination of freshwater habitats leading to reduced habitat quality and prey availability

5.1.11 The potential for effects on habitat quality is similar to that discussed above for habitat change, although pathways will also include potential spillages during works at notably WX12, WX13 and WX17, but could also involve an accident from the subsequent use of the water crossings by construction machinery or maintenance vehicles during the operational phase. The effects of this would materialise in the short term but could persist in the medium term.

5.1.12 Given the very small scale of works at the crossing locations, any spillage is unlikely to on a scale where it would cause a significant reduction in habitat quality within the SAC. However, in a worst-case scenario where a major fuel spill was to occur, this could result in a significant impact on habitat quality within the SAC. Moreover, such a spillage could also have a direct toxicity impacts on individual salmon as well as their prey. It is difficult to assess the scale of effects from such an event. Approximately half of the River Bladnoch itself within the SAC boundary is located below its confluence with the Tarf Water, and effectively most of the SAC would be susceptible to an effect, which would materialise in the short term but could persist in the medium term. Its potential magnitude would depend on the amount of pollutants being released and their type. It is concluded that the works are could result in contamination of freshwater habitats leading to reduced habitat quality and prey availability within the SAC.

5.1.13 As such, in the absence of mitigation adverse effects cannot be ruled out. However, a range of standard and specialised mitigation measures will be implemented, as described in Section 6.

6 Mitigation

6.1.1 The Stage 2 shadow Appropriate Assessment has shown that in the absence of mitigation, a significant effect on the River Bladnoch SAC cannot be ruled out. However, as described in **EIAR Chapter 7,** a range of standard mitigation measures will in fact be implemented. They include the following:

- Pre-construction baseline water quality sampling and analysis would be undertaken at the Tarf Water, Back Burn, Ha' Hill Strand, Monandie Burn, Loch Strand, and March Burn. A programme of regular monitoring and analysis of the water quality of the watercourses would be implemented throughout the construction period.
- With specific reference to the SEPA guidance 'Prevention of Pollution from Civil Engineering Contracts: Special Requirements' (SEPA 2006), the Principal Contractor will implement a Construction Environmental Management Plan (CEMP), agreed with SEPA, SNH and Dumfries and Galloway Council (DGC) prior to the commencement of construction activities, which contains a construction method statement that includes:
  - a detailed breakdown of the phasing of construction activities;
  - a pollution risk assessment of the Site and the proposed activities;
  - identification of all Controlled Waters that may be affected by the works and temporary discharge points to these watercourses;
  - planning and design of appropriate pollution control measures during earthworks and construction;
  - storage of all fuel and other chemicals in accordance with best practice procedures;
  - ensuring that concrete batching is undertaken only at a designated area at the temporary construction compound, 100 m from the nearest watercourse;
  - management of the pollution control system, including dewatering of excavations (if required) away from watercourses;
  - contingency planning and emergency procedures; and
  - on-going monitoring of construction procedures to ensure management of risk is maintained.
- All earthmoving works or similar operations will be carried out in accordance with BSI Code of Practice for Earth Works BS6031:2009.
- Prior to construction, a detailed Drainage Strategy (DS) will be developed and agreed with SEPA and DGC. The DS will detail the Site drainage design, including the type of surface to be used for the access track, the soft engineering and habitat enhancement measures proposed to slow surface water flows and any necessary ponds, swales, cross drains and bunds, to ensure that runoff from hard surfaces and borrow pit excavations would be controlled. The DS will also detail the dimensions and final design of the one proposed open arch/bridge water crossing, seven proposed new culverts, and one proposed upgraded water crossing, which would be designed to maintain continuous flows.
- All watercourse crossings, Site discharges, and temporary water abstraction will be regulated under the CAR licensing regime and all necessary licences will be sought from SEPA prior to the commencement of any operations onsite.

6.1.2 The measures have become standard measures for wind farm developments in Scotland; similar measures were implemented during the construction phase of the now operational Kilgallioch Wind Farm, and the continued improvement of Tarf Water demonstrates that the mitigation measures were effective.

6.1.3 In addition, EIAR **Chapter 7: Hydrology, Hydrogeology, Geology and Soils** commits the applicant to a range of additional mitigation measures, including the following:

- While it is acknowledged that best practice to minimise run-off would be to undertake construction and dismantling during the driest period of the year, given the location of the Proposed Development in Dumfries and Galloway, there are likely to be significant periods of rainfall throughout the year. Therefore, Site management would check the local weather forecast daily and prime all Site staff to ensure that everyone is aware of their responsibilities to maintain the pollution control system during wet weather or suspend sensitive operations during adverse weather conditions.
- Where topography dictates that working platforms are needed, these would be formed to ensure that surface water drains away from watercourses.
- To avoid unnecessary compaction and disturbance to Site soils, working areas and corridors would be established and demarcated, with construction operatives appropriately inducted and trained to avoid work outside the designated work areas. Further detail is provided in the Outline Peat Management Plan provided as **EIAR Technical Appendix 7.2**.
- A Habitat Management Plan (HMP) has been developed in outline, given as **EIAR Technical Appendix 8.7**. This would be updated to a detailed plan and agreed with SNH, DEPA and DGC prior to construction and would be implemented during the operation of the Proposed Development. This would involve blocking of drains in identified areas within Kirkcowan Flow SAC to allow the drains to gradually infill naturally and result in re-wetting of peat deposits in the vicinity of drains, which had been dewatered at shallow depth.

6.1.4 The range of mitigation measures outlined above will be highly effective in preventing or reducing the risk of works affecting the aquatic environment.

7 Conclusions

Kirkcowan Flow SAC

Blanket bog and depressions on peat substrates

7.1.1 There is no potential for LSE on either qualifying feature of the SAC and significant adverse effects can therefore be ruled out.

River Bladnoch SAC

Salmon

7.1.2 In the absence of mitigation, the shadow Appropriate Assessment has shown that significant adverse effects on salmon and the integrity of supporting habitats cannot be ruled out. However, a range of standard and specific mitigation measures will be implemented following which there will be no significant adverse effects.

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