Chapter 4

Development Description

SCOTTISHPOWER RENEWABLES

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4 Development Description

4.1 Introduction

1. This chapter provides a description of the Proposed Development and its geographical context. It also outlines the anticipated construction and operation activities connected with the Proposed Development. The final Proposed Development layout is illustrated in **Figure 4.1 Site Layout**.

4.2 Description of the Development

2. The Proposed Development would comprise up to 13 wind turbines, an Energy Storage Facility (i.e. battery)[1] and associated infrastructure comprising:

- wind turbine foundations;
- Aircraft Detection Lighting System (ADLS) activated lights fitted to each turbine;
- crane hardstandings and laydown areas;
- transformer/switchgear housings located adjacent to wind turbines;
- access tracks (upgrade of existing or new as required);
- watercourse crossings (upgrade of existing or new as required);
- underground electrical cabling linking the wind turbines to the substation;
- communication mast(s);
- LIDAR compound;
- close circuit television (CCTV) mast(s);
- up to four borrow pit search areas;
- Substation Compound (including substation, control building and energy storage facility);
- two temporary SPR construction compound areas (a main compound and second compound); and
- one SPEN construction compound.

3. The Proposed Development would also require forest restructuring works, which would require felling of forestry, to enable construction and operation of the windfarm.

4. It is proposed that one of the temporary SPR construction compounds (eastern compound) could be partially converted to a permanent car park for recreational users upon completion of construction works. The details of this would be agreed with Forestry and Land Scotland (FLS).

4.2.1 Access to Site

5. It is proposed that the wind turbines would be delivered to the King George V Dock in Glasgow. The wind turbines would be moved from the dock to the Site under escort. From the King George V Dock, the wind turbines would be moved west along Kings Inch Drive to the M8, where they would travel east before travelling south along the M74/M6 to Carlisle. Here, the vehicles would turn and continue to travel north along the M6 to the A75 and U52w then on to the A714 where they would travel north and onto the C46W public road before accessing the Site.

6. The proposed access to the Site is illustrated in **Figure 1** of **Appendix 4.1 Proposed Offsite Access Route Appraisal**. Permanent access into the Site is proposed from two existing entrances to the Carrick Forest from the C46W public road. Both the entrances will be constructed to the appropriate standards required, to facilitate access by both construction vehicles and abnormal loads. **Figure 4.2a Indicative Site Access (South)** and **Figure 4.2b Indicative Site Access (North)** illustrate the indicative junctions for both the north and south entrances.

7. Road upgrading works will be required along the C46W in order to accommodate abnormal loads during the construction phase. Until such time as a candidate wind turbine is selected and a detailed route to site assessment is undertaken, the specific upgrades required are not known. However, the Applicant has undertaken an appraisal of potential significant effects based on the wind turbine data and associated information at the time of writing. This Proposed Offsite Access Route Appraisal is included as (**Appendix 4.1**) of this EIAR.The upgrading works will be subject to a separate consent from the Proposed Development if required.

8. Following confirmation of the candidate wind turbine, all work on both site and public roads must adhere to the approved roads and transportation design guidelines. These guidelines will specify design criteria including, but not limited to road widths, acceptable gradients, running channel clearance, vertical curvature of the carriageway running surface and lateral crossfall. Any deviation from these guidelines would need to be agreed with both the wind turbine manufacturer, the Local Roads Authority and haulage contractor (if appointed at that time).

9. In addition, a transport assessment has been undertaken in support of the application for the Proposed Development and this provides detail on access routes to the Site for abnormal load vehicles and construction vehicles and provides an estimate of trip generation during construction. The transport assessment includes a review of the proposed route, construction traffic impacts, and an abnormal load route review based on the use of the King George V Dock. Traffic and Transport effects are discussed further in **Chapter 11:Traffic and Transport**.

10. Prior to construction, any required consents for improvement works to public roads would be sought, and works undertaken in accordance with such consents, and appropriate highway safety measures would be agreed with South Ayrshire Council as part of the Ayrshire Roads Alliance, Dumfries and Galloway Council, Transport Scotland and other relevant authorities, with necessary signage or traffic control measures implemented throughout the construction phase on the agreed basis.

4.2.2 Grid Connection

11. The electrical power produced by the individual wind turbines would be fed back to the Proposed Development substation via 33kV underground cables. The Proposed Development substation would be located within the footprint of the Substation Compound which is shown in **Figure 4.1 Site Layout**. The Proposed Development substation would be located directly beside the Transmission Owner (TO) Substation, which is to be designed, built and operated by SP Energy Networks (hereafter referred to as 'SPEN'). Energy generated by the windfarm would be exported to the Grid by a direct connection from the SPEN Substation in to the existing 275kV ScottishPower overhead line (OHL) which is directly adjacent to the south eastern edge of the Site. The Proposed Development substation would contain a 33kV/275kV transformer, switchgear, protection, control and metering equipment, and other high voltage and low voltage electrical equipment to connect to the SPEN Substation and facilitate the export of electrical power to the Grid.

12. The underground power cables would run along the side of the access tracks in trenches from each of the wind turbines to the Substation Compound. The indicative cable route is shown on **Figure 4.3 Indicative Cable Route.**

13. The cables would be laid in trenches, typically approximately 1.0 metre (m) deep and up to 1.3m wide surrounded by sand and then backfilled with suitable as-dug material. The trenches would also carry earthing and communication cables for the operation of the Proposed Development. The cables would be placed into ducts with concrete covers at road crossings where additional protection may be needed. An indicative cable trench is shown on **Figure 4.4 Indicative Cable Trench**.

14. While the point of connection at the Substation Compound has been assessed, the grid connection itself does not form part of the Proposed Development and is not the subject of the current application to which this Environmental

[1] Subject to landowner agreement.

Impact Assessment Report (EIAR) relates. The grid connection will be developed by SPEN , and is likely to be subject to consideration under a separate consent.

4.2.3 Wind Turbines

15. The Proposed Development would comprise 13 wind turbines of up to 200m tip height. The exact model of wind turbine to be installed would be selected through a competitive procurement process, however for the purpose of the assessments, currently available wind turbine models are being considered which fit this height parameter and which have an electricity generating capacity of up to 6.6MW, giving a total generating capacity for the Site of up to 86 MW. There are a number of potential wind turbine models which fit within the height parameter, but which differ in properties, such as noise emissions. In each instance a 'worst case' potential wind turbine has been used in the assessment as appropriate. An indicative wind turbine elevation is shown on **Figure 4.5 Indicative Wind Turbine**.

16. The proposed final locations of the wind turbines have been defined in order to enable the EIAR to describe fully the Proposed Development for which permission is being sought and are illustrated on **Figure 4.1 Site Layout**. The British National Grid coordinates for the location of each are provided below in **Table 4.1**.

Wind Turbine Number	Easting	Northing
1	234298.1	599031.6
2	235006.2	599144.2
3	235700.5	599334.3
4	234271.6	598307.7
5	234967	598502
6	235666	598647
7	236449	598947
8	237132.2	598584.1
9	237884.6	598580.8
10	238642	598676
11	237545.8	597897.2
12	238379.5	598000
13	238031.6	597330.5

Table 4.1: Wind Turbine Coordinates (British National Grid)

17. Each of the wind turbines comprises the following components:

- blades;
- towers;
- nacelle; and
- hub.

18. Each wind turbine would be mounted on a tapered tubular steel tower and would consist of a nacelle to which are attached a hub and rotor assembly including three blades. The wind turbines would be of a typical modern, three blade, horizontal axis design in semi-matt white or light grey with no external advertising or lettering except for statutory notices, to be agreed with South Ayrshire Council.

19. At the current time it is likely that the wind turbines may utilise some sulphur hexafluoride (SF6) insultation for electrical switch gear and wind turbine infrastructure.

4.2.4 Wind Turbine Foundations

20. Wind turbine foundations would be designed to accommodate the final choice of wind turbine and to suit site specific conditions. The final design would depend on the findings of detailed ground investigation at each wind turbine location. An illustration of an indicative wind turbine foundation is shown on **Figure 4.6 Indicative Wind Turbine Foundation**.

21. The wind turbines would typically have gravity base foundations approximately 30m in diameter and would be constructed using reinforced concrete. Foundation excavations would be approximately 3.5m deep, dependent on ground conditions. The sides of the excavation would be graded back from the foundation to an approximate 37m excavation diameter to ensure that they remain stable during construction. This would be indicative and would be dependent on the chosen wind turbine for the Proposed Development.

4.2.5 Wind Turbine Transformers

22. Each wind turbine would be served by an electrical transformer/switchgear unit which would either be located within the wind turbine tower or externally adjacent to the wind turbine base. If located externally, the transformer housing would measure approximately 10m(l) x 5m(w) and 4m(h) and be mounted on a concrete plinth. The external finishes would typically be metal or glass reinforced or moulded plastic. An indicative external transformer high voltage kiosk is shown on **Figure 4.6 Indicative Wind Turbine Foundation**.

4.2.6 Crane Hardstandings

23. The wind turbines would be erected using cranes brought on to the Site temporarily for the construction phase. To enable the construction of the wind turbines, a crane pad and hardstanding area at each wind turbine location would be required to accommodate assembly cranes, construction vehicles and component laydown areas. This would comprise a crushed stone hardstanding area measuring approximately 94m long by 34m wide, with a typical graded aggregate thickness of approximately 300mm, which would be on top of a cut or embankment surface suitably compacted but subject to the specifications required by the selected wind turbine manufacturer and crane operator and following detailed ground investigations prior to construction. Adjacent to the crane hardstanding would be laydown areas for the blades comprising a disturbance area of approximately 78m long by 28m wide.

24. Additional hardstanding areas would be required to accommodate auxiliary cranes needed to lift and assemble the crane boom sections. These areas would measure approximately 12m by 12m, be comprised of crushed stone and would be positioned along the access tracks. The assembly areas are typically required to be constructed to the same level as the main crane hardstanding.

25. The crane hardstandings and laydown areas would remain a permanent feature of the Proposed Development to facilitate maintenance. **Figure 4.7 Indicative Crane Hardstanding** illustrates a crane hardstanding.

4.2.7 Substation Compound

26. The Proposed Development's substation and control building would be located within the Substation Compound (**Figure 4.11 Indicative Substation Compound**), measuring approximately 189m x 126m which would also house the Energy Storage Facility (described in **Section 4.2.8**). The Substation Compound would also contain the TO's substation, which would be designed, built and owned by the electricity grid network operator (SPEN). The Proposed Development's substation and control building for the renewable energy technologies would be able to undertake a range of services for the national grid, including exporting and importing power (to the storage facility), frequency control, reactive power compensation and re-starting the electrical grid in the event of failure (black start).

27. The substations would host a range of electrical grid equipment, including but not limited to:

- transformers;
- heating, ventilation and air conditioning (HVAC) coolers;
- electrical cabling; and
- other electrical equipment.

28. The Proposed Development would be connected to the substation and electricity network via an onsite control building located at grid reference 238951, 597582 (refer to **Figure 4.1 Site Layout**). The control building would be single storey, built on a pre-cast concrete base and would measure approximately 23m x 14m and would be around 7m high. An indicative control building layout and elevations are shown on **Figure 4.9 Indicative Control Building.** The control building would also host solar panels on the roof to produce power for the control building and thus reduce the carbon footprint of the building and would likely include other energy efficient measures such as electric vehicle charging points and rainwater harvesting for flushing of toilets. The building would be used to contain the supervisory control and data acquisition (SCADA) facilities as well as office space.

29. The proposed location of the control building is provided in **Figure 4.1 Site Layout** and an indicative layout for the operations building is provided in **Figure 4.9 Indicative Control Building**.

4.2.8 Energy Storage Facility

30. An Energy Storage Facility (i.e. battery) is proposed within the Substation Compound (**Figure 4.11 Indicative Substation Compound**). It is anticipated at this stage that the Energy Storage Facility will consist of a battery array contained within storage units, with up to 20MW of energy storage equipment, located within the footprint of the Substation Compound.

31. The facility would be able to undertake a range of ancillary services as welcomed by National Grid, such as both importing and exporting power to the National Grid network as required and allowing the grid to manage both supply and demand (balancing services). The facility may also offer other services to National Grid such as frequency control, reactive power compensation and re-starting the electrical grid in the event of failure ('black start').Four energy storage container units (each capable of storing up to 5MW) are proposed to occupy an area of up to approximately 30m x 30m in size. The containers would be of steel construction, very similar to shipping containers in appearance. It is likely that each container would typically measure 17 m (l) x 8 m (w) x 4 m (h) with additional external ancillary equipment such as inverters. The preferred battery technology for the Energy Storage Facility is Li-ion batteries, however the battery manufacturing industry is continuously evolving and designs continue to improve, both technically and economically. The most suitable technology can change with time and therefore the final technological choice for the Energy Storage Facility would be made before construction, through a competitive tender process and technical evaluation. However, to help with the determination of the Proposed Development application, the EIAR considers Li-ion battery technology.

32. The final design of the Energy Storage Facility would be based upon the most appropriate technology available at the time of construction. It is likely that a separate switchgear container for the necessary electrical plant to operate the batteries would be required, and this too would be accommodated within the Substation Compound.

4.2.9 Access Tracks

33. Approximately 8,765m of the proposed access tracks for the Proposed Development would use existing forestry tracks used by Forestry and Land Scotland (FLS) for forestry operations and approximately 7,432m of the proposed access tracks would be new access tracks. All new access tracks have been designed to avoid sensitive environmental receptors. They would be made of locally sourced stone (from onsite borrow pits or imported from local quarries, if required) and have a minimum running width of approximately 5m, with a typical stone thickness of 300mm. Access tracks would widen on bends and junctions and at any new passing places which would be placed approximately every 500m if deemed appropriate in the final detailed design. Indicative cross sections of the proposed access tracks and plan of the passing places is provided in **Figure 4.8 Indicative Access Track Construction**.

34. The Site would be accessed via two existing forestry track access points from the C46W public road. Both of the entrances to the Site from the C46W require widening to allow wind turbine delivery vehicles to safely turn on to Site. Widening would involve constructing a wide-radius bend in crushed stone, with the section abutting the public road to be surfaced in tarmac.

35. Turning heads, to enable unloaded vehicles to turn, have been proposed to avoid significant distances of reversing. Typically, these are on tracks longer than 200m or where there is a significant slope gradient between the hardstanding and turning area. The turning heads measure approximately 35m in length with a 25m bend radius. The location and specification of wind turbine heads are subject to wind turbine manufacturer and site health and safety requirements.

36. The total length of access tracks (new and existing) for the Proposed Development is approximately 16,200m and can be sub-divided into the categories detailed in **Table 4.2** and as presented on **Figure 4.1 Site Layout**.

Type	Description	Length (m)	Percentage of Total (%)
Existing forestry tracks	Existing access tracks used for forestry access to be upgraded.	8,765	54.1
New access tracks	New access tracks required to allow access to individual wind turbines.	7,432	45.9

Table 4.2: Access Track Composition

37. Where there is a benefit, the construction of floating access tracks would be considered. Floating access tracks require the placing of a geotextile membrane on existing topsoil and vegetation followed by aggregate layers. Depending on ground conditions, two or more layers of geotextile would be placed in layers of 300mm to 500mm. The access tracks would be capped with layers of Type 1 aggregate or similar material. Type 1 is unbound aggregate mixture specified under Clause 803 of the Specification for Highway Works (2016) as suitable for vital load bearing foundation in road construction. For this EIAR, a worst case has been considered whereby floating access tracks are not possible. However, opportunities to minimise the impacts through the use of floating access tracks would be taken at a later design stage. An example of floating access track is shown in **Figure 4.8 Indicative Access Track Construction**.

4.2.10 Watercourse Crossings

38. Watercourse crossings have been minimised as far as possible in the design of the access track layout and where possible, existing crossings would be used. There would be seven watercourse crossings showing on the 1:50,000 scale ordnance survey map. There are two new watercourse crossings (WC05, WC07) and five existing crossings to be upgraded (WC01, WC02, WC03, WC04, WC06), as shown in **Figure 4.1 Site Layout**. Coordinates for each are provided in **Table 4.3**.

39. Further discussion on the water crossings proposed as part of the Proposed Development is provided in **Chapter 6: Hydrology, Hydrogeology, Geology and Soils** and **Appendix 6.5 Watercourse Crossing Report**.

Watercourse Crossing	Easting	Northing	Description
WC01	239869	598070	Existing culvert to be replaced by oversized circular culvert for this crossing.
WC02	239134	598209	Existing concrete pipe culvert (0.6m diameter) to be replaced by oversized circular culvert for this crossing.
WC03	239189	597349	Existing culvert to be replaced by oversized circular culvert for this crossing.
WC04	234948	598251	Existing culvert to be replaced by oversized circular culvert for this crossing.
WC05	234512	599022	No existing crossing. Oversized circular culvert to be placed at this crossing.
WC06	235641	598350	Existing culvert to be replaced by oversized circular culvert for this crossing.
WC07	238407	597303	No existing crossing. Oversized circular culvert to be placed at this crossing.

Table 4.3: Watercourse Crossings

4.2.11 Temporary Construction Compounds

40. The main construction compound (100m x 100m) would be utilised as the centre for all construction activities and to provide facilities for the day-to-day needs of the Proposed Development and the workforce. A second temporary construction compound (30m x 30m) is proposed for similar requirements on a smaller scale. The main temporary construction compound would be located near wind turbine 13 near the Substation Compound on the southern access track to the Site, and the smaller compound near the northern Site entrance as shown on **Figure 4.1 Site**

Layout. An indicative layout of a construction compound is provided in **Figure 4.10 Indicative Construction Compound**. The detailed size and engineering properties of both construction compounds would be confirmed prior to the start of construction, after the wind turbine supplier and model have been confirmed.

41. The main compound area would house temporary portable cabin structures to be used as the main construction office and welfare facilities, including toilets, clothes drying and kitchen, with the provision for sealed waste storage and removal. It would also be used for the storage and assembly of certain components, containerised storage for tools and small parts, and oil and fuel storage. Adequate parking would be provided for cars and light vehicles. A portable cabin would be located at the entrance to the compound and used by staff responsible for controlling access to the construction compound and Site, which would also house the mandatory signing in and out procedure for the Site. The smaller compound area would house some of these temporary construction related facilities, but on a smaller scale.

42. A concrete batching plant would be located within the main construction compound and would comprise aggregate and cement hoppers, water bowsers/tanks, a mixer and a control cubicle. Aggregates and sand would be stockpiled and contained adjacent to the plant. It would be necessary to provide a limited private water supply and foul drainage; this is considered further in **Chapter 6: Hydrology, Hydrogeology, Geology and Soils**.

43. On completion of construction works, it is proposed that all temporary structures in the main compound be removed and the existing hardstanding left in place.

44. The Applicant proposes to convert the second 30m x 30m temporary construction compound, near the northern access with the C46W into a permanent car park for recreational users of the Carrick Forest upon completion of construction works. The details of the car park would be agreed with FLS, and should consent be received, the Applicant will develop an access plan in consultation with South Ayrshire Council. This approach will help ensure access and recreation opportunities are maximised as a result of the Proposed Development.

4.2.12 SPEN Temporary Construction Compound

45. SPEN require a temporary construction compound (approximately 60m x 60m) to construct the TO Substation. This will be located in the south east of the Site to the north of the new access track, adjacent to the Substation Compound, as shown on **Figure 4.1 EIA Site Layout.**

4.2.13 Borrow Pits

46. To minimise the volume of imported material brought to Site and any associated environmental impact, borrow pits located within the Site would be used to source aggregate for construction of the Proposed Development, where suitable material is found to be present. A borrow pit is an area where stone material has been excavated for use at another location.

47. Four borrow pit search areas have been identified in order to provide a total of approximately 143,549m^3 of material required to construct the Proposed Development, (refer to **Table 4.4**). This includes base material for roads, hardstandings and foundations and Type 1 surface material. It is proposed that the actual borrow pit(s) would be located within these search areas, however, the actual area utilised may only be a portion of the search areas. The location of the borrow pit search areas are shown on **Figure 4.1 Site Layout**.

Borrow Pit	Easting	Northing	Est. of Volume (m^3)
1	237662	597950	41,016
2	237098	598458	20,060
3	235821	598504	47,190
4	235307	599005	231,000

Table 4.4: Borrow Pit Search Areas

48. Detailed site investigations prior to construction would be carried out to further confirm the rock type, rock characteristics and suitability, as well as potential volumes to be extracted from the search area. The final borrow pit(s) identified during the geotechnical evaluation would be defined within the Construction Environmental Management Plan (CEMP) (refer to **Section 4.3.5**). The pollution control measures to be implemented during usage of the borrow pit(s) and its reinstatement would also be covered within this document.

49. The borrow pit(s) would require the use of plant to both win and crush the resulting rock to the required characteristics. It is anticipated that rock would be extracted by breakers or other relevant methods that may be required, such as blasting. Noise associated with stone extraction is discussed in **Chapter 9: Noise**.

50. Environmental considerations have influenced the location of the borrow pit search area to minimise the effect on peat, ecology, cultural heritage and hydrology, and to allow successful reinstatement measures to be put in place as appropriate. Following construction, the borrow pit(s) would be restored and reinstated to agreed profiles.

51. If there is insufficient suitable material available from the borrow pits, stone would be sourced from local quarries and imported. The transport assessment in **Chapter 11: Traffic and Transport** assumes a worst case scenario of 100% imported material. However, given the volume of material likely to be available to be won on Site, it is highly likely that this scenario will not be realised.

4.3 Construction

52. The onsite construction period for the Proposed Development is expected to be approximately 22 months (refer to **Table 4.1**). Normal construction hours would be between 07:00 and 19:00 Monday to Friday and 07:00 to 13:00 on weekends, or as agreed with South Ayrshire Council's Environmental Health Officer (EHO). These times have been chosen to minimise disturbance to local residents. It should be noted that out of necessity due to weather conditions and health and safety requirements, some generally quiet activities, for example abnormal load deliveries (which are controlled by Police Scotland) and also the lifting of the wind turbine components, may occur outside the specified hours stated. **Table 4.5** provide an indicative programme for the main activities to be carried out.

Activity	Month																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Site establishment																						
Forest felling																						
Existing forestry track upgrades																						
Construction of new access tracks																						
Wind turbine foundations																						
Crane hardstandings																						
Substation Compound and electrical works																						
Onsite cabling																						
Wind turbine delivery and erection																						
Commissioning and testing																						

Activity	Month																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Site reinstatement/restoration																						

Table 4.5: Indicative Construction Programme

53. **Table 4.6** below summarises the approximate volume of material required for each of the main infrastructure elements described in **Section 4.2**. The transport assessment has been prepared on a 'worst-case' basis by assuming that a capping layer of construction aggregate would be imported to Site, and no concrete batching would take place on Site. However, if all base aggregate materials are sourced from the borrow pit(s) and concrete batching takes place on Site, then this would result in a reduction in delivery volumes/traffic. Further detail on traffic volumes associated with the import of construction materials is provided in **Chapter 11: Traffic and Transport.**

Infrastructure	Approximate Volume of Aggregate (m^3)
New access tracks	28,613.2
Upgraded existing forestry tracks	17,968.25
Crane hardstanding and laydown areas	54,999.6
Substation Compound	23,669.8

Table 4.6 Volume of Aggregate Per Infrastructure Type

4.3.1 Construction Materials

54. The materials likely to be required as part of the total for the construction of the access tracks, wind turbine, wind turbine transformers and control building foundations, hardstanding areas and cable trenches are described below:

- crushed stone;
- geotextile;
- cement;
- sand;
- concrete;
- steel reinforcement; and
- electrical cable.

55. Necessary excavations would be made, initially by stripping back the soil from the area to be excavated. This soil would typically be stored separately, either in a mound adjacent to the excavation area for backfill, if required, or stored at a designated area on Site for further use or reinstatement of temporary works areas. This soil will be required for restoration and should be stripped and stored carefully. The handling of soils would be undertaken in accordance with best practice techniques. Soil and peat storage is discussed further in **Appendix 6.2 Soil and Peat Management Plan**.

56. Should surface water run-off or groundwater enter the excavation during construction of the wind turbine foundations, appropriate pumping measures away from watercourses would be implemented to ensure the works are safely carried out and the excavation is sufficiently dry to allow concrete placement. Once the concrete is cast, the excavated material would be used for backfill and compacted to the required design density. Once this backfill is completed, the crane hardstanding areas would be constructed.

57. The wind turbines would be erected using two cranes, positioned on the hardstanding adjacent to the wind turbine base.

4.3.2 Site Restoration

58. As soon as practical once installation is complete, the immediate construction area would be restored to a profile to be agreed with South Ayrshire Council. Crane hardstandings would be retained for future maintenance. The soil would be replaced where appropriate and as advised by an onsite Environmental Clerk of Works (ECoW). Any surplus soil would be used to restore track edges after construction. This progressive reinstatement has been found to assist with re-establishment of the local habitats, as it minimises the time soil is stored.

59. The upper vegetated turfs would be used to dress infrastructure edges and to reinstate the surface of restoration areas. It is anticipated that most of the soil resources within areas directly affected by construction activities would be able to be stored and reinstated as close as possible to where they were excavated in accordance with good practice; so that the Site would be restored with minimal movement of material from its original location. It is not anticipated that any excavated material would leave the Site.

60. Further detail on restoration would be provided within the Construction Environmental Management Plan (CEMP), an outline of which is provided in **Appendix 4.2 Outline CEMP.**

4.3.3 Micrositing

61. During the construction process there may be a requirement to microsite (i.e. refine to a limited degree) elements of the Proposed Development infrastructure (e.g. due to unsuitable ground conditions and/or environmental constraints). A 50m micrositing tolerance of wind turbines and all other infrastructure is proposed for the Proposed Development subject to other environmental and design constraints. Within this micrositing distance, any changes from the consented locations would be subject to approval of the ECoW as required and in consideration of other known constraints.

4.3.4 Traffic and Transportation

62. Construction traffic associated with the construction and maintenance of the Proposed Development falls into two main categories, namely Abnormal Indivisible Loads (AIL) and construction/maintenance loads. AILs would require an escort, either by private contractor or by the police. Construction/maintenance loads do not require any special escort or permissions and are subject to normal traffic regulations.

63. The Applicant would ensure that the construction vehicles would be routed as agreed with South Ayrshire Council, Transport Scotland, Police Scotland and other relevant consultees, to minimise disruption and disturbance to local residents and road users. Further details regarding transport and access can be found in **Chapter 11: Traffic and Transport**.

4.3.5 Construction Environmental Management Plan (CEMP)

64. The Outline CEMP provided in **Appendix 4.2 Outline CEMP** would detail the mitigation measures which would be applied during construction of the Proposed Development.

65. As part of the construction contract, the Principal Contractor responsible for undertaking the construction works would produce a CEMP, which would build upon the measures detailed in **Appendix 4.2 Outline CEMP**.

66. The CEMP would be developed in accordance with the joint Scottish Renewables, Scottish Natural Heritage[2] (SNH), Scottish Environment Protection Agency (SEPA), and Forestry Commission Scotland[3], Historic Environment Scotland, Marine Scotland Science and Association of Environmental Clerk of Works (AEECoW) guidance on Good Practice During Wind Farm Construction (SNH, 2019).

[2] Now known as NatureScot.

[3] Now known as Scottish Forestry.

67. The Principal Contractor would consult with the Scottish Ministers, NatureScot[4], SEPA, Historic Environment Scotland and South Ayrshire Council on the production of the CEMP.

68. The CEMP would describe how the Principal Contractor would ensure suitable management of, but not limited to, the following environmental issues during construction of the Proposed Development:

- noise and vibration;
- dust and air pollution;
- surface and groundwater;
- ecology and ornithology (including protection of habitats and species);
- agriculture (including protection of livestock and land);
- cultural heritage;
- waste (construction and domestic);
- details of the size, location and volumes to be extracted from borrow pits;
- pollution incidence response (for both land and water); and
- Site operations (including maintenance of the construction compound, working hours and safety of the public).

69. The Applicant would engage an ECoW onsite during the construction phase. The services of other specialist environmental advisors, such as an Archaeological Advisor, would be procured to support on specific environmental issues as required. The ECoW would ensure that the construction activities undertaken by the Principal Contractor are carried out in accordance with the mitigation measures contained within the CEMP and any planning conditions relating to environmental matters, and this would be monitored by the Applicant.

70. To ensure all construction mitigation measures outlined within this EIAR are carried out onsite, the CEMP would form an overarching document for all Site management requirements, including:

- Traffic Management Plan;
- Construction Methodology Statement;
- Pollution Prevention Plan (including monitoring, as appropriate);
- Site Waste Management Plan;
- Peat Management Plan;
- Water Management Plan; and
- Access Management Plan.

71. The construction mitigation measures proposed by each of the environmental topics assessed in the EIAR are provided in the relevant EIAR chapters.

4.3.6 Temporary Peat Storage

72. Where possible, progressive restoration techniques would be used to place excavated peat material in its final destination rather than in temporary stockpiles. In some circumstances this may not be possible and there may be a requirement to temporarily store excavated peat onsite. It is important both for the peat itself and for the surrounding environment that the peat is not allowed to substantially erode or become dry while it is stored. Procedures to control the hydrology of stored peat would be covered by the CEMP and are outlined in the **Appendix 6.2 Soil and Peat Management Plan**.

73. The full details for peat storage areas and dimensions would be determined following detailed design, and the peat condition and requirements are better known.

4.3.7 Drainage

74. Surface or sub-surface water flow within the vicinity of the access tracks and hardstanding areas would be routed into drainage channels. The drainage channels would be situated on the upstream side of the infrastructure and run in parallel with them. These channels would pass under the hard areas, via small diameter carrier drains, to the downstream side where the run-off would percolate to the riparian zone.

75. Where ground conditions permit, channels may connect with infiltration trenches on the downhill side of the hard areas, with a small sump at the inlet to collect silt and treat run-off prior to infiltration to the surrounding soils. Silt traps would also be located along trenches to further facilitate the collection of silts. These would be cleaned out periodically, as required. Existing forestry drainage channels would be identified during the construction of new access tracks and protected accordingly. Further detail on forestry drainage channels can be found in **Chapter 6: Hydrology, Hydrogeology, Geology and Soils, Section 6.5.5 Hydrology.**

76. The edges of the access tracks would be flush to allow the surface water from the road to route directly into the collection channels or infiltration trenches. On steeper sections of track, regular cross drains, connected to infiltration trenches, would be installed to collect surface run-off and ensure longitudinal flow is intercepted, thus avoiding rutting and subsequent breakup of the track surface. Trenches would maintain linear flows to downstream areas avoiding point discharge of large flows. The adoption of the applicable good practice measures in the **Appendix 4.2 Outline CEMP** would reduce the impact of modification to surface water drainage patterns, with artificial drainage installed only where necessary and would, wherever practical, be installed in advance of ground being cleared of vegetation. All structures would be designed and constructed following good practice techniques and would be of sufficient capacity to receive storm flows with an allowance for increased flows due to climate change. Key measures identified to minimise alterations to surface water drainage patterns include:

- minimising the number of watercourse crossings, using and upgrading existing structures where applicable;
- application of sustainable drainage techniques to increase peak lag time and implementation of cross-drains at appropriate intervals and frequent discharge points to reduce scour potential;
- minimising the size and duration of in-channel works; and
- appropriate design of crossing structures to ensure sufficient capacity to convey 1:200-year storm flows and enable mammal and fish passage.

77. Further details on drainage are provided in **Chapter 6: Hydrology, Hydrogeology, Geology and Soils**, **Section 6.6.5**.

78. Where the access tracks follow contours, earthworks may be required. Where earthworks are required a collection ditch would be installed at the head of the cutting, with appropriate dams and sumps, to collect silt and prevent sediment transfer to watercourses.

79. A detailed drainage design would be undertaken and submitted to the Scottish Ministers, in consultation with the SEPA, for approval prior to construction.

4.4 Forestry

4.4.1 Felling

80. The Proposed Development would use a 'keyhole' approach to the siting of wind turbines within the forest, to retain as much forestry as possible. Where this is not possible the crops will be felled back to the nearest wind farm edge or management boundary and the restocking will be planted so that there is a keyhole around the Proposed Development post restocking. It is anticipated that construction of the Proposed Development would require approximately 223.48 hectares (ha) of commercial plantation woodland to be felled to facilitate construction works and installation of permanent features such as the wind turbines and access tracks; some of which would be subsequently restocked. The requirements and undertaking of felling would be in close consultation with FLS, Scottish Forestry and documented in the Forestry Report which is contained in **Appendix 13.1 Forestry**. **Figure 13.1.6 Windfarm Felling Plan** and **Figure 13.1.7 Windfarm Restocking Plan** illustrate the proposed tree felling and restocking required for the construction of the Proposed Development.

4.4.2 Compensatory Planting

81. As a result of the construction of the Proposed Development, there would be a net loss of woodland area. The area of stocked woodland in the Study Area would decrease by 96.68ha. In order to comply with the criteria of the

[4] Formerly SNH.

Scottish Government's Control of Woodland Removal Policy, offsite compensation planting would be required. The Applicant is committed to providing appropriate compensatory planting. The extent, location and composition of such planting would be agreed with Scottish Forestry and would take into consideration any revision to the felling and restocking plans prior to the commencement of operation of the Proposed Development.

4.5 Operation and Maintenance

4.5.1 Operational Life

82. There is no proposal to limit the lifetime of the Proposed Development. Therefore, the assessment considers the effects of the operational phase of the Proposed Development, without time limitations. Should decommissioning of any of the Proposed Development be required it is considered that any effects of decommissioning would be similar to, or less than, those during construction.

4.5.2 Lighting

83. Civil Aviation Authority (CAA) Policy Statement on Lighting of Onshore Wind Turbine Generators in the United Kingdom with a Maximum Blade Tip Height at or In Excess of 150m Above Ground Level (AGL) (CAA, June 2017) modifies the strict application of Article 222 to require only the hub to be lit by 2000 candela steady red lights, with a single set of intermediate steady red lights halfway down the tower at a reduced intensity of 32 candela. Aviation lighting would be installed as soon as practicable on erected wind turbines.

84. The wind turbines would be lit as described above, and as such, during hours of darkness may have a visual impact. The night time visual effect of lighting the wind turbines is assessed within **Chapter 5: Landscape and Visual**.

85. It is proposed that visibility sensors are installed on the Proposed Development wind turbines in line with the 2017 CAA Policy Statement so that where visibility is restricted to 5km or less from all the wind turbines in the Proposed Development, the lights would operate at 2000 candela and where visibility is greater than 5km from all the wind turbines, the nacelle obstruction lights would be dimmed to 200 candela. Further information can be found in **Chapter 13: Other Issues**.

86. In addition, the Applicant proposes to install an aircraft detection lighting system whereby the lights would only be switched on when an aircraft transits the Site[5]. Given the lights are only required for aircraft flying at night in the vicinity of the Site at altitudes of up to 3000ft above mean sea level, it is anticipated that the lights would be rarely on in this quiet airspace. Further detail on the Applicant's proposed mitigation measures and how they are being taken forward is provided in **Appendix 13.4 Indicative Aviation Lighting Landscape and Visual Impact Mitigation Plan (IALLVMP**).

4.5.3 Maintenance

87. The Proposed Development would be maintained throughout its operational life by a service team made up of operation management, operations technicians and support functions. During periods of scheduled maintenance, technicians who may be based in the local area would be required for up to several weeks per year. Additionally, the technicians would be required to undertake unscheduled maintenance throughout the year. This team would either be employed or contracted directly by the developer, by the wind turbine manufacturer or by the maintenance service provider. Management of the Proposed Development would typically include wind turbine maintenance, health and safety inspections and civil maintenance of tracks, drainage and buildings. Employment opportunities predicted to be generated by the Proposed Development are discussed further in **Chapter 12: Socio-economics, Tourism and Recreation**.

88. Maintenance activities would typically include, but not be limited to, the following:

- civil maintenance of tracks and drainage;
- scheduled routine maintenance and servicing;
- unplanned maintenance or call outs;
- electrical maintenance;
- blade inspections;
- fencing;
- snow clearing; and
- replacement of inverters approximately every 10-15 years.

[5] The Proposed Development will not be built until there is a transponder activated lighting solution.

4.6 Climate Change and Carbon Considerations

89. Whilst the Proposed Development would reduce carbon emissions by replacing the need to burn fossil fuels to generate electrical energy, carbon emissions would result from the component manufacturing, transportation and installation processes associated with the Proposed Development. There is also the potential for carbon fixers and sinks to be lost through the clearing of vegetation during construction, such as peat. There must, therefore, be a sufficient balance between the carbon reduction associated with the generation of renewable energy and that which is produced through construction/fabrication processes and lost through site preparation.

90. The electrical energy generating capacity of the Proposed Development would be up to 86MW, with the exact capacity depending on the model and type of wind turbine selected. It would be expected that the Site would generate around 255.5 GWh per year (depending on the wind turbine selected).

91. The average electricity consumption per household in the United Kingdom (UK) quoted by the Department of Business, Energy and Industrial Strategy is 3,578kWh (BEIS, 2020). Assuming generation of around 255.5 GWh annually, the Proposed Development would generate enough power to supply over 71,421 average UK households.

92. **Chapter 13: Other Issues** provides details of the assessment undertaken to calculate the carbon emissions which would be generated during the construction and operation of the Proposed Development as well as the carbon payback period resulting from the operation of the Proposed Development. The Proposed Development is expected to take around 3.5 years to repay the carbon exchange to the atmosphere (the CO_2 debt) through construction of the windfarm; the Site would in effect be in a net gain situation following this time period and can then claim to contribute to national objectives of reducing greenhouse gas emissions and meeting the 'net zero' carbon targets by 2050. The grid connection date of the Proposed Development is 2026 and it will therefore also make a contribution to the Scottish Government's ambitious targets in it's energy strategy to generate 50% of Scotland's overall energy consumption from renewable sources by 2030.

4.7 Public Access

93. Within the Site Boundary, there are several formal and informal recreation routes including the following:

- Core path SA47 and SA49;
- Old Road through Straiton Heritage Path;
- National Catalogue of Rights of Way (CROW) SKC/SKC7/1;
- Scottish Hill Tracks;
  - SKC/HT385/2;
  - SKC/HT385/3;
  - SKC/HT82/3;
  - SKC/HT82/6;
  - SKC/HT80/10;
  - SKC/HT76/9; and

- SKC/HT82/7.
- Forest Roads (roads within Galloway Forest Park).

94. More information on recreational and tourism use of the Site is discussed in **Chapter 12: Socio-economic, Tourism and Recreation**.

95. The Access Management Plan would ensure continued access for users of the recreational routes crossing the Site (core path SA47, core path SA49; Scottish Hill Track SKC/HT385/3, SKC/HT385/2, SKC/HT82/2; SKC/HT82/6, SKC/HT80/10; SKC/HT76/9; SKC/HT82/7; CROW SKC/SKC7/1; forest road within Galloway Forest Park and Old Road through Straiton Heritage Path). However, diversions would be implemented in order to allow continued access for these routes. Areas immediately surrounding the construction activities may be temporarily restricted during construction for informal recreational activities such as walking, cycling and horse riding. The area and duration of such restrictions would be kept to a minimum as is required for the work to be conducted safely and efficiently. In addition, in keeping with good practice for construction sites, notices would be placed in prominent locations around the Site with details of any areas with restricted access. The diversions and restricted access are not anticipated to be in place throughout the full 18 months of the construction period, but only during specific phases of the construction period.

96. Once construction is completed, any upgrades or new tracks associated with the Proposed Development would provide improved access and increased opportunities for informal recreation throughout the operational life of the Proposed Development.

97. It is anticipated that enhancement would be provided as part of the Proposed Development. These enhancement measures are currently being considered by the Applicant and include, for example:

- provision of waymarkers or signposts along the existing core path within the Site Boundary;
- improvement of the condition of sections of the existing core path within the Site Boundary;
- provision of bins and seating areas within the Site Boundary (locations to be agreed with FLS); and
  provision of information boards along the Old Road through Straiton heritage path within the Site Boundary to inform readers of the heritage of the route.

98. The Applicant is committed to working with local stakeholders and consultees to identify additional recreational improvement and enhancement opportunities, where these are within the Site Boundary or if on third party land they will be subject to the approval of landowners.

4.8 References

Department for Business, Energy and Industrial Strategy (BEIS) (2019). Sub-National Electricity and Gas Consumption Statistics, 2018 (based on average household consumption of 3618 KWh).

Forestry Commission Scotland (2009). The Scottish Government's Policy on Control of Woodland Removal.

Scottish Environment Protection Agency (2017). GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer. Available online at: https://www.netregs.org.uk/media/1460/gpp4-20171031-online-v1.pdf.

Scottish Government (2017). Electricity Works Act (Environmental Impact Assessment) (Scotland) Regulations 2017. Available online at: http://www.legislation.gov.uk/ssi/2017/101/contents/made.

UK Government (1989). Electricity Act 1989 (as amended). Available online at: https://www.legislation.gov.uk/ukpga/1989/29/introduction?view=extent.

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