4.0 Project Description

Introduction

4.1 This chapter describes the Application site and the proposed development and the changes from the already consented development.

4.2 The chapter also outlines the proposed construction programme, the proposals for operation and the approach to decommissioning.

The Application Site

4.3 The Application site is wholly located within the East Ayrshire Council area, immediately to the north of the Dumfries & Galloway Council border. The boundary of the site is shown in **Variation Figure 4.1A**. The Application site lies within part of an extensive area of forestry plantation known as Carsphairn Forest. The grid reference of the centre of the site is NS 60507 06671.

4.4 New Cumnock is the closest settlement to the Application site, lying to the north some 5.4 km from the nearest turbine. Dalmellington is located some 11 km to the west. The Application site boundary is contiguous with the boundary of the operational Afton Wind Farm to the southeast. Afton Reservoir lies about 1.5 km to the southeast from the nearest Pencloe turbine.

4.5 The land cover across the majority of the Application site comprises mature commercial forestry plantation. All of the Application site is owned and managed by Forestry and Land Scotland (FLS). The northern part the site comprises grazing land adjacent to Pencloe Farm, there is also some open moorland grazing at the southern end. The site contains a series of ridges between 400 m and 526 m Above Ordnance Datum (AOD) and these are separated by relatively steep sided stream valleys. The site drains to the north via the Carcow, Glenhastel, Glenshalloch, Lochingerroch and Bolt Burns, which in turn feed into the Afton Water.

4.6 The Application site occupies an area of about 871 ha (approximately 2,152 acres). The site is surrounded by further conifer plantations to the south and southwest and open agricultural grazing moorland to the north, east and west. Afton Road, which roughly follows the course of Afton Water, runs to the east of the site. The nearest properties to the proposed turbines are listed in **Table 4.1.**

Table 4.1: Nearest Properties

Property	Distance / direction to nearest turbine (km)
Lynn View	1.32 km northwest
Craig an Dhu	1.33 km northwest
Craig Braneoch	1.61km west
Corbyhill	1.62 km west
Craigdarroch Farm	1.78 km west
The Craigs	1.89 km west

The Proposed Development

4.7 The proposed development is intended to increase the capacity and yield from that which could be achieved from the consented development. The main design changes proposed are:

- The tip height of the proposed turbines would increase from 125 m to up to 149.9 m;
- The blade length will increase from around 50 m to up to 67 m; and
- Turbines 6 and 15 have been relocated (to previous locations T1 and T2 in the Original 21 Turbine Design).

4.8 A review of overall buildability and access has taken place, and in order to accommodate the increase in blade length amendments have been made to track alignment and routing and hardstanding size, orientation and positioning in relation to ground contours.

4.9 The changes proposed for the variation are summarised below. The layout is shown in **Variation Figure 4.1A**, and for comparison purposes the footprint of the consented development is shown in **Variation Figure 4.1B**.

4.10 The main components of the s.36c variation application are listed in **Table 4.2** below.

Table 4.2: Wind Farm Components and Summary of Changes to Wind Farm Layout

Component	Change to Consented Layout
19 wind turbines, each with an anticipated maximum rated capacity of around 4.5 MW and up to 149.9 m to tip	Yes – two of the consented turbines (T6 and T15) have been moved to locations 1 and 2 in the Original 21 Turbine Design.
Permanent foundations supporting the wind turbines and associated crane hardstandings (used during construction, operational repair and decommissioning)	Yes – the diameter of the turbine foundations has increased from c.20 m to c.24 m. The area of crane hardstandings has significantly reduced.
Transformers (one per turbine) which will be housed externally at the base of the turbine	No change
One new access bell mouth arrangement at the entrance to Pencloe Farm from the C90 Afton Road	No change
Seven water crossings to accommodate the access tracks	No change
Permanent access tracks into the Application site from the public highway and between turbines, including upgrade to existing tracks	Yes – Realignment of various sections of track to meet the delivery requirements for the increased blade length. The overall length of track has increased from an estimated 15.53 km to 15.86 km. The width of track for use just by construction vehicles has reduced to 4 m.

Component	Change to Consented Layout
A control building and substation compound, including electrical metering, stores, office and welfare facilities	Yes – The overall dimensions of the compound have reduced from 100 m x 50 m to 75 m x 50 m
Underground cabling between turbines and control building / substation compound, running alongside access tracks	No change
High voltage export cable or overhead line to SPEN Blackhill collector substation immediately to the south of the site.	No change
Five onsite borrow pits	No change
Three permanent free-standing anemometry masts up to 85 m in height with associated foundations and hardstanding	No change
Two temporary construction compounds and a temporary security office	No change

4.11 The revised layout has resulted in an estimated reduction in the area of hardstanding by about 4.5 ha, primarily due to the use of smaller crane hardstandings. The length of track has increased from 15.53 km to an estimated 15.86 km due to the addition of some spur roads to facilitate felling.

Location of Components

4.12 **Table 4.3** provides grid coordinates for the principal components of the proposed development. Each component is also described in more detail below in **Table 4.3** and illustrated in **Figures 4.1A, 4.2- 4.12.**

Table 4.3: Locations of Wind farm Components

Component	NGR	Easting (NGR)	Northing (NGR)
Wind Turbines (T)			
T1	NS	261284	607224
T2	NS	261240	606828
T3	NS	261219	606412
T4	NS	261572	606326
T5	NS	261365	605944
T7	NS	260977	605598
T8	NS	261100	605193
T9	NS	260686	605784
T10	NS	260515	606055
T11	NS	260253	606260
T12	NS	260182	606617
T13	NS	2260008	606898
T14	NS	260382	607050
T16	NS	259717	605357
T17	NS	259215	605384
T18	NS	259090	605686
T19	NS	259134	606033
T20	NS	259463	605922
T21	NS	259740	605785
Anemometry Mast A	NS	261287	607431
Anemometry Mast B	NS	259306	605638
Anemometry Mast C	NS	260185	606822
Northern Temporary Construction Compound	NS	261512	608646

Component	NGR	Easting (NGR)	Northing (NGR)
Southern Temporary Construction Compound	NS	260319	605583
Control Building & Substation Compound	NS	260937	605367
Site Access Point	NS	261975	609801
Temporary Security Office	NS	261938	609796
Borrow Pit 1	NS	261024	608432
Borrow Pit 2	NS	261020	607353
Borrow Pit 3	NS	259802	606707
Borrow Pit 4	NS	261523	608540
Borrow Pit 5	NS	260946	607716

Detailed Design and Micrositing

4.13 Where possible, identified environmental constraints have been avoided, including areas of deep peat, particularly sensitive habitats, locations occupied by protected species, watercourses and cultural heritage features. Where avoidance has not been possible, mitigation measures have been proposed to prevent significant effects, as described in the relevant EIAR chapters.

4.14 In the event of s.36c consent being granted for the proposed development; intrusive site investigations will be undertaken to inform the detailed design of the wind farm layout including crane hardstandings and detailed track construction methods. It is possible that unforeseen ground conditions will require the route of the access tracks and positions of individual turbines and other wind farm components to be microsited to facilitate construction and / or reduce potential environmental impacts. It is proposed that micrositing within 50 m from a stated location be permitted. Such micrositing will be overseen by the Ecological Clerk of Works (ECoW) and will be in accordance with the identified environmental constraints such as the 50 m standoff from mapped watercourses.

Wind Turbines

Wind Turbine Generators

4.15 Each of the proposed wind turbines will be a 3-bladed modern design, with a capacity of around 4.5 MW. The nacelle (which houses the power generation equipment) will be supported by a tapering cylindrical steel tower. The maximum height of the blade tip from ground level will be 149.9 m. There are a number of candidate turbines that would be suitable for the Application site. For the purposes of the EIAR, each environmental assessment topic has considered the model with the potential to have the greatest effect in terms of that particular topic, for example

a blade tip height of 149.9 m with a hub height of 82 m and rotor diameter of 136 m has been used for the landscape and visual impact assessment (see **Variation Chapter 7: Landscape and Visual Impact Assessment**). The noise impact assessment has used the turbine with the higher noise emissions of those currently being considered. The final selection of turbine model will result from a competitive tendering process.

4.16 It is expected the proposed wind turbines will be erected using two large mobile cranes. The main lifting crane will have a lifting capacity of up to 900 tonnes while the second (or tail) crane will have a lifting capacity of circa 500 tonnes. The two cranes will lift turbine tower sections and blades from the delivery vehicles and into their assembly position. The larger crane will be used to lift the tower sections, turbine nacelle and the hub and blade assembly into position. The tail crane will help to align and position the components whilst being installed. Once each turbine is assembled and installed, the two cranes will be moved to the next turbine position.

4.17 The turbines will then undergo a series of commissioning tests, after which they will be ready to generate electricity under normal operation.

4.18 A typical turbine, with maximum dimensions of 149.9 m to blade tip is included **in Variation Figure 4.2.** It is proposed that the turbines will be of a pale-grey colour with a non-reflective semi-matt finish coating Wind Turbine Foundations

4.19 The wind turbines will be supported on concrete foundations, measuring approximately 24 m in diameter and 3.5 m in depth, dependent on ground conditions **(see Variation Figure 4.3).** Each foundation will have a central pedestal approximately 5 m diameter where it meets the turbine tower.

4.20 Construction of the turbine foundations will involve the excavation of soil / peat / rock, prior to the in situ casting of the steel-reinforced concrete slab. Surplus soil / peat will be stored separately and used to create a batter on the edges of the tracks and hardstandings or to reinstate areas local to each turbine. Any turf with vegetation removed will be carefully stacked on the surrounding ground to preserve vegetation, until required for re-turfing.

4.21 The depth of the excavation will depend on the need to reach suitable substrate but will typically be 3.5 m. The sides will be 'battered' back to ensure that they remain stable during construction. Therefore, the excavation for each foundation will be greater, and in the order of 28 m. It is estimated each foundation will require approximately 700 m^3 of concrete and around 65 tonnes of steel reinforcing. The final amount of concrete and steel will be specified by manufacturer of the turbine that is selected.

4.22 The concrete pedestal will be cast on top of the main slab of the individual turbine foundations, to which the turbine tower will later be bolted, and the excavated area will be back-filled with compacted layers of graded material from the original excavation. This will be capped with approximately 150 mm of soil or peat, which will either be flush with the existing ground surface or will form a raised mound between 300 and 500 mm above the existing ground level, depending on the depth of the foundation at each specific turbine location. The turbine foundations will be covered and reinstated as appropriate, leaving only a narrow area of concrete at the base of each turbine tower and a stoned access path around the base. The turbine foundation area will be allowed to re-vegetate and will permit the natural infiltration of surface water.

4.23 Turbine foundations will be constructed using concrete appropriate to the chemical conditions encountered in the turbine locations. This will ensure that the concrete will not degrade when in contact with acidic water.

4.24 The turbines and their foundations will be designed with containment systems to prevent accidental releases of, for example, lubricating oil, from leaving the turbine tower.

Crane Hardstandings

4.25 Hardstanding areas will be required adjacent to each turbine base to accommodate cranes and their outriggers. These will be of similar construction to the tracks (see below) but covering a rectangular area adjacent to the turbine foundation. Two additional 'tail crane' hardstandings may also be required, depending on the local topography and the type of crane ultimately used for construction. A typical hardstanding layout with an estimated area of 1812 m² for the main hardstanding and two auxiliary pads is presented in **Variation Figure 4.4.** This compares with 3940 m² required in the consented development. The final detailed design and layout will be determined by the turbine supplier.

4.26 The crane hardstandings will be excavated and backfilled with stone to a suitable depth. Surplus soil and peat will be used to batter the edges of the tracks and hardstandings or landscaped local to each turbine.

4.27 The orientation of the crane hardstandings will be optimised to make best use of the existing topography, prevailing wind conditions (to enable safe lifting) and the erection procedure. The locations of the hardstandings shown in **Variation Figure 4.1A** have taken account of known constraints identified as part of the EIA. In the event that further constraints are identified during the construction phase, the crane hardstanding will be re-orientated where possible.

4.28 The crane hardstanding will remain in situ throughout the operational phase.

Wind Turbine Transformers

4.29 An electrical transformer will be located within a housing outside and adjacent to the turbine base. The dimensions of the transformer housing will be around 4 m x 6 m x 3 m (high). The external finishes will typically be rendered masonry or moulded plastic, the colour of which will be agreed with East Ayrshire Council. The configuration of a typical transformer housing is shown in **Variation Figure 4.5.**

Access Tracks

Site Access

4.30 A new bell mouth junction arrangement is proposed from the Afton Road into the Application site for use by construction vehicles, including abnormal load vehicles and also for use throughout the operational and decommissioning phases of the proposed development.

4.31 The location and form of the Application site access junction have been agreed in principle with Ayrshire Roads Authority. Visibility splays of 4.5 m x 160 m to the north and south will be achieved. Given the nature of Afton Road, where traffic speeds are likely to be low due to its width and alignment, the achievable visibility splays are deemed to be sufficient. The first 7.5 m of the bell mouth apron will be metalled and finished with a blacktop (macadam) surface and tied into the existing carriageway. Behind the bell mouth the track will be finished with a compacted granular surface.

Internal Access Tracks

4.32 The layout of internal access tracks is shown on **Variation Figure 4.1A.** A breakdown of different track types and estimated lengths is shown in **Table 4.4.**

Table 4.4 – Track Types and Estimated Lengths

Type	Length (m) (approximate)
New excavated track 5 m wide for turbine delivery vehicles	9,295
New excavated track 4 m wide for construction vehicles	190
New 4 m wide forestry track for future felling	788
Existing 3 m wide track to be widened to 5 m for turbine delivery vehicles	2,132
Existing 3 m wide track to be widened to 4 m for general construction vehicles	3,458
TOTAL	**15,863**

4.33 Tracks for the turbine delivery vehicles will have a running width of 5 m. Local widening will be required on corners, with the amount of land required depending upon the angle of slope and the severity of the bend on plan. Passing places will be required along the length of the track with track junctions utilised where possible. Where the existing track is used it will require some upgrades including widening, re-alignment and re-grading to make it suitable for the construction and delivery traffic.

4.34 The overall track length has been kept to a minimum to reduce environmental effects, construction time and material quantities. The following issues have been carefully considered and avoided where practicable:

- archaeological and hydrological features;
- Groundwater Dependent Terrestrial Ecosystems (GWDTEs);
- deeper areas of peat; and
- protected species and habitats.

4.35 The gradients of tracks have been kept to less than the recommended gradients from the turbine supplier, generally shallower than 1 vertical: 10 horizontal to facilitate access by the large specialist vehicles for both construction and transport of the turbine components and also to allow construction plant to move safely round the site; and the layout has been optimised to align with appropriate orientation of crane hardstandings.

4.36 Tracks will be constructed on the cut track principle where soil (including turves), and peat, or other sub-soils are excavated down to the underlying strata. The excavated track is then backfilled with approximately 0.75 m depth of compacted stone and stripped turves and excavated peat or top-soil / sub-soil is used appropriately to dress and landscape the side slopes and verges. Typical track cross sections for excavated track are shown in **Variation Figure 4.6.** The site layout has been designed to avoid where possible areas where deeper peat is identified from the peat probing survey. As such there are no significant lengths of the tracks which would require a floating road construction, however, during construction should

localised areas require a floating road then this will be constructed in line with the details shown in **Variation Figure 4.6.**

4.37 At bends, the tracks will widen as appropriate depending on bend radius required. The edges of the tracks will be encouraged to re-vegetate after construction, while maintaining a suitable width of approximately 4.5 m for maintenance vehicles throughout the operational period. All new tracks will be unpaved and constructed from material sourced from the onsite borrow pits. Temporary passing places (up to 35 m x 5 m) would also be provided at intervals to facilitate traffic movements. It is currently anticipated that 12 passing places will be required, and track junctions will also be utilised as passing places where required.

Drainage Management around Access Tracks

4.38 The need for drainage will be established onsite during construction by observation. Tracks will be designed with a slight camber to encourage runoff to adjacent trackside drains. Trackside drains will be provided to control runoff from construction areas especially during heavy rainfall. Trackside drainage will comprise infiltration trenches with check dams which will be unlined to allow the standing water to infiltrate back into the ground.

4.39 Maintenance of existing drainage is important, therefore identified existing drainage routes including, if present, 'peat pipes' which have formed naturally will be maintained and, where necessary, channelled below the proposed track construction. Upslope side drainage ditches to the track will be required on side-long ground; the ditches would be constructed with small dams and cross drains where necessary so that:

- Water can pass below the track at regular intervals; and
- Scour and erosion is avoided in the side ditches due the limited volume and velocity. Concentrated discharges to the peat on the down slope side of the track are avoided.

4.40 The track drainage design will ensure that runoff rates are not increased and will be sized to be able to accommodate runoff flows for the life of the proposed development. The final drainage design will take into account predicted increases in rainfall intensity due to climate change and will be subject to approval by East Ayrshire Council and SEPA. Drainage provisions beneath access tracks that run perpendicular to slopes will ensure continuity of surface water flows to downslope catchments.

Water crossings (access tracks)

4.41 There will be a requirement for permanent crossings of a number of watercourses or drainage channels to accommodate the new access tracks. The location of each of the crossings is provided in **Table 4.5** and also shown on **Variation Figure 4.1A.**

Table 4.5: Access Track Crossings

Name	Reference	Easting (NGR)	Northing (NGR)	Description
Unnamed tributary of Glenshalloch Burn	Crossing 1	260954	608279	Existing crossing, needs upgrading
Glenshalloch Burn	Crossing 2	260859	607363	Existing crossing, needs upgrading
West Strand, tributary of Water of Deugh	Crossing 3	259632	605590	Additional crossing will be a minor crossing (probably culvert)
Unnamed tributary of Afton River	Crossing 4	261811	609623	Existing crossing, needs upgrading
Unnamed tributary of Afton River (likely ephemeral flow)	Crossing 5	261909	609726	Existing crossing, needs upgrading
Unnamed tributary of Afton River (likely ephemeral flow)	Crossing 6	261943	609764	Existing crossing, needs upgrading
Unnamed tributary of Sandy Syke	Crossing 7	260182	605443	Additional will be a minor crossing (probably culvert)

4.42 The crossings will be constructed in accordance with the SEPA and CIRIA good practice guidance and will be agreed in advance with SEPA and Forestry and Land Scotland. It is proposed that the crossings are made by pre-cast circular or semi-circular piped culverts, and these will be generally adopted with culvert sizes based on ensuring conveyance of the 0.5% Annual Exceedance Probability (AEP) flow, including an allowance for climate change on future rainfall intensities. Design of these crossings will take into consideration overland flow routing in the event of a blockage and crossings will be designed to direct flow back into the watercourse downstream of any obstruction. Culverts will be embedded so that the base is at grade with the streambed, or lower to maintain bed form processes and minimise disruption to wildlife migration. The need for ledges to enable the movement of mammals through the pipe will be assessed at the design stage and incorporated if necessary. An indicative drawing of a typical culvert is shown in **Variation Figure 4.7**.

4.43 The construction of all watercourse crossings will be bound by the protocols of a Construction Environmental Management Plan (CEMP) to avoid polluting watercourses with soil or sediment.

Anemometry Masts

Permanent Masts

4.44 It is expected that up to three permanent self-supporting anemometry masts, up to 85 m tall, will be installed to inform the operation of the proposed development and performance monitoring, see **Variation Figure 4.8**. The proposed mast locations are shown on **Variation Figure 4.1A**. Temporary 60 m and 80 m anemometry masts are currently located onsite.

4.45 Each mast will require a concrete foundation, measuring approximately 6 m x 6 m and 2.5 m deep and a crane hardstanding measuring approximately 25 m x 25 m. The masts will be erected using a small crane. Access to the masts will be along a 5 m wide track connected to the main network of access tracks.

Temporary Mast

4.46 It may be necessary to erect a temporary anemometry mast during the construction period in order to allow calibration between wind conditions at the location of the permanent anemometry masts and the positions of the turbine locations. This will be the same height as the permanent anemometry masts (up to 85 m) and will be moved from turbine location to turbine location as construction progresses. The temporary mast will be removed prior to the final turbine being erected.

Control Building and Substation Compound

4.47 The cables from each of the turbine circuits will be collected at the control building within the substation compound. The location of the compound has been selected due to the grid connection being routed to the Blackhill collector substation immediately south of the site and is shown on **Variation Figure 4.1A**.

4.48 The indicative layout of the compound is shown in **Variation Figure 4.9**. The control building will comprise a single storey control building measuring approximately 34.0 m x 5.8 m with a pitched roof and an external compound (anticipated to be 5 m x 5.8 m) for external electrical equipment. The building will contain switch-gear, stores, site communications (i.e. SCADA), an office and welfare facilities, while the external compound will house the auxiliary supply transformer. An indicative design for the building is shown in **Variation Figure 4.10**.

4.49 The compound will measure approximately 50 m x 75 m and will contain car parking facilities and a storage yard. The compound will be surrounded by stock fencing.

4.50 It is expected that the small quantity of sewage arising from the infrequent visits of maintenance staff will be removed from site by a licensed operator. A rainwater collection system will be installed to provide water for flushing which, if necessary, will be topped up with water brought to site by tanker delivery in dry periods. Excess rainwater falling on the roof of the building will be discharged to an infiltration drain or other Sustainable Drainage System (SUDS) around the compound.

4.51 The building will be constructed in keeping with the local built environment. The final designs for the building and compound will incorporate sustainable design features and will be agreed with East Ayrshire Council.

Cabling

4.52 The wind turbines will be linked together with underground cabling, and it is currently expected three 33 kV, three-phase cable circuits will be required to export electricity from the wind turbines to the control building and substation compound. The type and design of cabling has yet to be confirmed and cross sections of a number of cable trench options are shown in **Variation Figure 4.11**.

4.53 The construction of the cable route will minimise disturbance to drainage by taking the route alongside the access track and around the turbines adjacent to the access tracks shown in **Variation Figure 4.1A**. Cables will be laid directly into trenches and a sand surround applied prior to the overburden being replaced in the trench. To prevent water tracking along trenches, clay plugs or similar plugging material will replace the backfill in short (typically 1 m) sections, with the distance between plugs dependent on the track slope.

4.54 The position of trenches will be marked out and the line stripped of turfs and soils and set aside for reinstatement. If the cable route is on rock this may require excavation of rock or alternatively laying cable in a mounded strip to minimise excavation of rock.

4.55 In areas of trenching, the vegetation layer and pea / soil will be removed and segregated from the removed subsoil for use in reinstatement. If necessary where depth allows, further segregation of the vegetation layer and peat / soil will be undertaken to prevent burying of the upper vegetation layers in deeper soil upon replacement. To mark the location of cable, markers will be placed at regular intervals along the track edge.

Grid Connection

4.56 The proposed development is one of several wind farm projects enabled by Scottish Power's South West Scotland Connections. The Pencloe Wind Farm project will connect into the new local (Blackhill) 132 kV 'collector' substation (developed by SPEN), located immediately south of the Application site as shown in **Variation Figure 4.1A**, where electricity generated from the wind farm will enter the transmission network.

4.57 The route for the short connection is currently being evaluated by SPEN. The connection to this new substation will be subject to a separate planning application by SPEN (if not permitted under general development rights), and an appropriate level of environmental assessment will be undertaken.

Temporary Works

Construction Compound

4.58 During the construction phase, two temporary construction compounds will be required, one in the north of the site close to where the existing track running south from Pencloe Farm enters the forest and a second on the track between turbines 9 and 16. Grid coordinates for these compounds are presented in **Table 4.2**, and their locations are shown on **Variation Figure 4.1A**.

4.59 An indicative layout for the construction compounds is shown in **Variation Figure 4.12**. The dimensions will be approximately 100 m x 50 m. The areas will be prepared by stripping peat / soil, laying down a geotextile material and then a working surface of stone. The stripped material will be stored adjacent to the working area for subsequent use in reinstatement and screening. It is anticipated that the construction compounds will include:

- Temporary portacabin type structures to be used for the security and site offices;
- Welfare facilities, including portacabin toilet with provision for sealed waste storage and removal;
- Parking for construction staff, visitors and construction vehicles;
- Laydown areas for the storage of large items;
- Secure storage for tools, small parts and oils;
- Waste storage facilities; and
- A receiving area for incoming vehicles.

4.60 In addition, a temporary wheel-wash facility will be located close to the access from the public road to reduce the amount of mud deposited on local roads before vehicles exit the Application site.

Borrow Pits

4.61 To minimise the volume of imported material brought to site and any consequent environmental impact, it is preferred that borrow pits located within the Application site will be used to source the necessary aggregate required for track upgrade and construction, turbine base backfill, crane hardstandings, compounds and other hardstanding areas. A borrow pit assessment (**see Appendix 1 of the September 2015 FEI submission**) has been undertaken to identify the

optimal locations within the Application site, such that suitable controls and methodologies can be implemented during the design and construction phases.

4.62 Five borrow pits are proposed which PWEL aim to use to source an estimated 94,623 m^3 of aggregate for construction of the proposed development. An updated calculation for the stone required for the variation layout is presented below in **Table 4.6**. Of the five identified areas, as shown on **Variation Figure 4.1A**, four have previously been used for the excavation of stone and are estimated to have reserves sufficient to supply in excess of the required amount of aggregate. The proposed locations have been selected because of their morphology, accessibility from existing or proposed new access tracks, orientation and their previous use.

Table 4.6: Proposed Scheme Stone Volume Requirement for Wind Farm Infrastructure

Infrastructure	Infrastructure dimensions footprint (m)	Excavated area footprint (m^2)	Infrastructure footprint requiring stone (m^2)	Stone requirement (m^3)
Construction Compound 1	Rectangle 100 x 50	5,000	5,000	3,750
Construction Compound 2	Rectangle 100 x 50	5,000	5,000	3,750
Substation	Rectangle 75 x 50	3,750	3,750	2,813
Turbine Foundation (19)	Diameter of 24 m	8,588	7815	5,861
Main Crane Pads Section A (19)	Irregular Shape	29,678	29,678	22,259
Aux Crane Pads and 159 m link track Section B (38)	Irregular Shape	19,865	19,865	14,899
Borrow Pit 1	Irregular Shape	1,658	-	-
Borrow Pit 2	Irregular Shape	22,565	-	-
Borrow Pit 3	Irregular Shape	18,883	-	-
Borrow Pit 4	Irregular Shape	1,225	-	-
Borrow Pit 5	Irregular Shape	4,985	-	-
Met Mast and Hardstanding 1	Rectangle 25 x 25	625	625	469

Infrastructure	Infrastructure dimensions footprint (m)	Excavated area footprint (m^2)	Infrastructure footprint requiring stone (m^2)	Stone requirement (m^3)
Met Mast and Hardstanding 2	Rectangle 25 x 25	625	625	469
Met Mast and Hardstanding 3	Rectangle 25 x 25	625	625	469
Excavated (new) 5 m track	Irregular Shape	54,452	39,750	29,812
Excavated (new) 4 m track	Irregular Shape	760	555	416
Existing 3 m track widened to 5 m for WTG vehicles	Irregular Shape	10,656	3,552	2,664
Existing 3 m track widened to 4 m for general construction vehicles	Irregular Shape	13,832	4,611	3,458
New 4 m Wide Forestry Track for future felling	Irregular Shape	3,250	2,373	1,780
Turning Area (8)	Irregular Shape	2,000	2,000	1,755
		208,362	126,163	94,623

4.63 The rock would be extracted using standard quarrying techniques and crushed to provide the required road stone properties. Rock from the borrow pits would be checked to ensure it is compatible with its intended place of use.

4.64 Prior to the excavation and where required, soil/peat will be removed and stockpiled for use in reinstatement. The majority of the rock will be ripped using an excavator, however it is anticipated that some blasting may be required in certain instances.

4.65 The borrow pits would be restored following extraction of stone, and indicative plans for each pit are shown in **Appendix 1 of the September 2015 FEI submission**. It is currently anticipated that the floor of the pits will be built up with surplus soil / peat excavated during the construction of the wind farm. The side slopes of the borrow pits will be graded to a safe angle to prevent collapse and to provide a landform shape that integrates the feature, as far as practicable, with the adjacent landscape. The soil / peat will be replaced and prepared to create suitable ground conditions for seeding or re-turfing. Any seeding would be carried out in accordance with

techniques and seed mixes approved by East Ayrshire Council. Detailed methodologies regarding removal of topsoil and reinstatement methods and approaches would also be agreed with the Council.

Security Office

4.66 During the construction period, a temporary security office will be located on the access track, close to the access from Afton Road.

Felling and Forestry Management

4.67 Given the predominant commercial forestry cover over the Application site, a plan has been prepared to address the implications for forestry management in the event of the proposed development being approved and constructed and is provided within **Variation Appendix 4.1** of this EIAR**.** This represents an update of the plan submitted as **Original Appendix 4.1** of the Pencloe Wind farm Environmental Statement 2015. The key information from the updated plan is summarised below.

Existing Woodland

4.68 Pencloe Forest consists of commercial conifer plantations, it extends to 825.89 ha and was planted in the early 1970s. Species diversity is low and the principal species is Sitka spruce, which accounts for over 80% of the crops. The woodlands have been managed and maintained by Forestry and Land Scotland since planting. They have been managed on non-thin basis and no thinning, felling or replanting has been carried out to date. Some of the coupes have suffered extensive windblow in recent years.

4.69 Pencloe Forest is adjacent to existing forests on the west, east and southern boundaries, which form part of the extensive Carsphairn Forest Complex.

Current Management

4.70 The woodlands onsite are now mature and into the production phase and are managed under an approved Forest Design Plan (2018). Felling is due to commence in 2019.

Felling for the Wind Farm Development

4.71 A Felling Design Plan for the wind farm development is included in **Variation Appendix 4.1.**

Restocking Plans for the Wind Farm Development

4.72 Following commissioning of the wind turbines, the forest will be restocked to incorporate the proposed development into the forest structure. The majority of the areas felled will be replanted except for areas required for the proposed development infrastructure. The species composition of the forest will change. In particular, species diversity will increase and the areas of conifer crops and open ground decrease, balanced by an increase in broadleaf woodland and woodland fringe. Overall there will be a net increase in the area of stocked woodland of about 2.3 ha.

Construction

4.73 Construction of the wind farm will comprise the following main tasks. These are listed below in sequence, however some will overlap and some activities undertaken in parallel:

- Removal of forestry where required within the Application site (**see Variation Appendix 4.1);**
- Construct the bell mouth access from the Afton Road;
- Establish temporary construction compound at entrance to forest and install the Application site accommodation;
- Erect temporary anemometry mast for calibration;
  Construct an estimated 15.83 km of access tracks (of which about 5.59 km is an upgrade to existing forestry track), water crossings and crane hardstandings;
- Excavate the wind turbine foundations and construct the turbine bases;
- Construct control building and substation compound;
- Excavate cable trenches and lay the power and instrumentation cables;
- Install the grid connection (subject to separate consent process);
- Erect and commission the permanent anemometry masts;
- Erect and commission the wind turbines;
- Carry out reinstatement works; and
- Remove temporary accommodation and compounds and clear the Application site.

4.74 The construction period for the proposed development is expected to be approximately 19 months and will follow completion of the felling phase.

4.75 An indicative programme for construction is provided in **Table 4.7**. Note the construction programme does not include any provision for potential winter down time due to adverse weather.

Table 4.7: Indicative Construction Programme

	Activity	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Site Establishment																				
1	Forestry Clearance	■	■	■	■	■														
2	Install Site Entrance		■																	■
3	Plant Offices delivery / removal		■																	
4	Construct First Compound		■																	
5	Install Welfare		■																	
Access Tracks																				
6	Construct Access Tracks / Second Compound		■	■	■	■	■	■	■	■	■	■								
7	Water Crossings							■												
Turbine Foundations / Crane Hardstandings																				
8	Construct Hardstandings				■	■	■	■	■	■	■	■								
9	Construct Turbine Foundations							■	■	■	■	■	■	■	■					
Substation																				

	Activity	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
10	Construct Building																			
11	Internal Fit Out																			
Electrical																				
12	Install Wind Farm Cabling																			
Wind Turbine Generators (WTGs)																				
13	Erect WTGs																			
14	Commission WTGs																			
15	WTg / Wind Farm Reliability Run & Final Works																			

Personnel

4.76 It is estimated that over the 19 month period the onsite construction workforce will average 40 individuals (with a likely maximum of approximately 90 individuals) to undertake the various activities, split between civil engineering, turbine installation, electrical and commissioning contractors. The levels of manning will vary according to the phase of the project, with the highest levels at the point where civil works are nearing completion and turbines and electrical systems are being installed, followed by the initial testing of turbines for commissioning.

4.77 Where feasible and subject to procurement rules, local contractors or sub-contractors will be invited to tender. Prior to construction, PWEL intend holding a meeting in the local area to introduce and discuss any aspects of the proposal to regional and local contractors.

Materials

4.78 The wind turbines will all be delivered to site in component form and will require up to 9 loads per turbine (consisting of tower sections, blades, hub and nacelle).

4.79 The majority of the aggregate required for the construction of the access tracks, crane hardstandings and other construction activities (including temporary construction compounds and substation) will be won from the identified on site borrow pits. However, of this total, about 5,400 m^3 of aggregate will be required to be brought to site in order to construct the first 1.4 km of access track needed to reach the most northerly borrow pit (assuming that no material is won along the way) and also to provide the higher grade aggregate needed for the production of concrete for the turbine foundations.

4.80 It is estimated that about 94,623 m^3 of aggregate will be required for use in access roads, crane hardstandings and other construction activities (including temporary construction compound and control building construction).

4.81 It is anticipated that concrete will be batched onsite.

4.82 Steel reinforcement for the turbine foundations will be imported to Application site and will number 3-4 deliveries per foundation.

4.83 Sand for the cable trenches will normally be imported to the Application site. It is estimated around 5200 m^3 will be required. The potential to use fine material from crushing as a substitute for sand would be subject to appropriate testing.

4.84 Cables will be imported to the Application site in ready cut lengths. Typically, up to four cable drums can be loaded onto one delivery vehicle; and therefore, it is estimated that around 15 deliveries will be required. This will include the delivery of optical cable.

4.85 Transformers, switch gear, panels, batteries, steelwork, main building and other ancillaries will be required for the substation, as well as concrete and steel re-bar for the footings. It is estimated that approximately 50 deliveries associated with the substation will be required.

4.86 The construction delivery programme is discussed in more detail in **Variation Chapter 13: Traffic and Transport.**

Construction Traffic Routes

4.87 It is anticipated that the Turbine Delivery Vehicles (TDVs) will be transported by road from the Port of Ayr, which is the closest port in the region capable of handling wind turbine equipment. The Port of Ayr has been used regularly for the delivery of wind turbine components for wind farm developments in this region and was the selected port of entry for turbine components for

the proposed Afton Wind Farm, now operational adjacent to the proposed development. The proposed TDV access route from Port of Ayr to the proposed development access is as follows**:**

- Exit Griffen Dock in Port of Ayr;
- East on Waggon Road;
- South on A79 Allison Street;
- East on A719;
- Northeast on the A77;
- Southeast on A76;
- Southwest on B741 Mossmark;
- South on Afton Road; and
- Proposed site access off Afton Road, approximately 3.5 km south of the B741 Mossmark / Afton Road priority junction.

4.88 The delivery route of all other imported materials will depend on the location of the supplier, which will not be finalised until the tender process has been completed. An assessment of the traffic impacts are considered in **Variation Chapter 13: Traffic and Transport.**

Construction Hours

4.89 Hours of construction will be from 7am to 7pm on weekdays and 7am to 1pm on Saturdays unless otherwise agreed with East Ayrshire Council. This restriction will also apply to the delivery of the majority of materials to Application site. Delivery of the towers, nacelles and blades will require the use of abnormal sized and slow-moving loads and may require to be escorted. It is possible that abnormal deliveries will be made at night to avoid disruption to road users, but this will be done in agreement with the council. The erection of the wind turbines may also be necessary outside of these core hours.

4.90 Twenty-four-hour security may be required onsite during the construction phase.

Reinstatement

4.91 After each element of the proposed development is constructed there will be a requirement to reinstate the ground surface. Details of reinstatement methods will be provided in the detailed CEMP, (**see outline CEMP, Original Appendix 10.7**).

Waste

4.92 The construction phase is likely to generate waste from the following activities:

- felling;
- site clearance;
- site preparation;
- earthworks (including soil / peat removal);
- establishment of the site and construction compounds, and access tracks; and
- construction and erection of the wind turbines, control building and substation compound, and underground cables.

4.93 There are currently no buildings on the Application site, so no demolition waste is anticipated.

4.94 The main waste types anticipated to be generated from materials imported onto the Application site would be inert and metal related.

4.95 The size of the borrow pits have been determined on the basis of the estimated requirements for construction materials together with additional allowances for overburden and processing waste. Excavated materials from the borrow pits are assumed to have 0% wastage rate, as any excess materials will be used onsite. It is envisaged that overburden / soils would be carefully

stored adjacent to the excavation void for eventual use in the restoration process. It has been assumed that there would be no aggregate wastage due to the predicted volumes required and that there are a number of reuse outlets onsite for the aggregate.

4.96 It is estimated that peat excavated for the proposed development will total approximately 65,300 m^3, primarily as a result of preparation for track, hardstanding and foundation areas. Where peat is excavated this will be managed in accordance with the Outline PMP **(Variation Appendix 10.2)** which will be developed further prior to construction commencing. The PMP proposes prevention and re-use as the primary means of managing peat excavated during construction. The PMP demonstrates any peat that is excavated onsite will be reused onsite.

4.97 Material such as steel will be used in the building of the wind farm and cement and aggregates will be used in the foundations of the wind turbines. There is the possibility for waste to be generated during construction from material brought onsite and the wastage that occurs from this.

4.98 It is acknowledged that not all waste arising during the construction phase may be suitable for management and/or reuse onsite. Any waste removed from the Application site will be taken to permitted facilities for recovery or disposal and any hazardous waste that is generated will also be appropriately managed.

4.99 A Site Waste Management Plan (SWMP) will be developed for the construction phase which will help confirm the types and quantities of wastes arising and how best to manage them. An outline SWMP for the construction phase has been prepared and included as **Original Appendix 4.2**.

4.100 The objective of the SWMP will be to ensure that there is the safe management of waste during the construction process from production to final disposal, thus minimising any potential impacts. During the construction phase every attempt will be made to implement best practice with respect to waste management and construction management practises.

4.101 With the design and construction methods and mitigations proposed (and in particular the PMP) the amount of waste that will require removal from the Application site will be minimised. Given the relatively low tonnages arising during the construction and operational phases of the development, this will have a negligible effect on the existing waste treatment capacity in East Ayrshire and the associated environmental effects.

Operation

4.102 The proposed development has a planned operational life of up to 27 years. On a day to day basis the wind turbines will operate automatically, responding by means of anemometry equipment and control systems to changes in wind speed and direction. The operation of the turbines will be remotely monitored.

4.103 When operating, the rotational speed of the turbine blades will be geared up through the gearbox, which drives the generator. This produces an output which is transferred from the generator to the transformer. Buried inter-array cables then transmit the power output to the substation at 33 kv where it is then exported offsite to the transmission network.

4.104 The proposed development will support some limited direct employment during the operational phase. In comparison to the temporary jobs created during the construction phase the level of employment is expected to be relatively small but permanent and is estimated to be around 2 permanent staff (based on experience of similar developments). There will be a further

requirement for temporary contractors and remote support staff probably resulting in 3 to 7 local jobs in total.

Traffic

4.105 The predicted levels of traffic associated with the operation and maintenance of the proposed development are unknown at this point. However, previous experience allows the following assumptions to be made:

- standard turbine servicing, typically twice per year (allow for 2 turbines / day / team);
- unscheduled servicing (allow 2 visits per turbine annually);
- repairs to turbines approximately 30 times annually;
- access track maintenance (allow for a team 1 week / year);
- substation maintenance approximately 1 inspection annually; and
- routine site inspections once a fortnight.

Shadow Flicker

4.106 Under certain combinations of geographical position and time of day, the sun may pass behind the rotors of a wind turbine and cast a shadow over neighbouring properties. When the blades rotate, the shadow flicks on and off resulting in an effect known as 'shadow flicker'. This effect only occurs inside buildings and under a limited set of circumstances, e.g. when meteorological conditions are clear, the sun is low in the sky and the moving shadow of a turbine is cast onto a narrow window.

4.107 The impact of shadow flicker on the local community is discussed in the Scottish Government's web based renewable advice note on onshore wind turbines (which replaces the relevant aspects of Planning Advice Note 45). The renewable advice note states that *"In most cases, where separation is provided between wind turbines and nearby dwellings (as a general rule 10 rotor diameters), "shadow flicker" should not be a problem."* In the case of the proposed development, this would be a radius of up to 1,360 m, depending on turbine / rotor size. As shown in **Table 4.1**, the two nearest properties to a turbine at Lynn View and Craig an Dhu are just over 1,300 m away to the East and at the very limit of where shadow flicker effects might be experienced. The properties are also below the Application Site in the Afton Valley, with very limited visibility of blade tips. An initial modelling exercise has concluded that shadow flicker will not occur as a result of the proposed development. An assessment of the effects of shadow flicker has therefore been scoped out (see **Section 5.3 of Variation Chapter 5: Scoping and Consultation**).

Waste

4.108 The proposed development will not be manned during the operational phase and, therefore, waste generation will be minimal and restricted to waste from maintenance works in the main. It will be disposed of in line with normal waste disposal practices and the SWMP (**outline provided in Original Appendix 4.2**).

4.109 Based on the existing waste disposal capacity in the region the additional waste would have no significant effects.

Decommissioning

4.110 At the end of the operational life, either planning permission will be sought to repower the development or the development will be decommissioned. It is assumed for the purposes of the EIA that the proposed development will be decommissioned at the end of its operational life. The decommissioning process will comprise the following:

- Wind turbines will be dismantled, removed from the Application site and disposed of appropriately;
- Foundations will be left in situ although the top metre of the base will be removed and disposed of appropriately. The area will be re-surfaced with soil or peat and restored;
- Underground cabling will be left in situ or removed for recycling;
- Access tracks and hard standings will be left in situ to be used by the landowner or will be soiled and seeded over should they no longer be required;
- The anemometry masts will be dismantled, removed from the Application site and disposed of appropriately. The foundations will remain in situ. The top metre of the base will be removed, disposed of appropriately, then covered with topsoil or peat and restored;
- The site access (i.e. the bell mouth) will be left in situ; and
- The equipment will be removed from the substation and disposed of appropriately. The buildings will be demolished, and the material removed from the Application site. The top one metre of the foundations will be removed then covered over with topsoil or peat and reinstated appropriately.

Environmental Management

4.111 In order to ensure that environmental considerations are addressed, construction, operation and decommissioning activities will be carried out in accordance with the management commitments made in the **Original ES**, plus any additional legislative and contractual requirements and updated good practice guidance in place at the time. These commitments include mitigation measures, management measures and / or monitoring requirements. Measures that will be taken to manage environmental issues during all three phases of the proposed development are presented in **Chapters 6 to 16** of this EIAR and summarised in **Original Chapter 17: Summary of Mitigation Measures**.

4.112 To facilitate this, Environmental Management Plans (EMPs) will be prepared for the construction, operation and decommissioning phases of the proposed development. The EMPs will describe the environmental risks and potential impacts of site activities and outline how the proposed mitigation measures and procedures will be implemented to manage these risks and impacts. A draft Construction EMP (CEMP) is included as **Original Appendix 10.7**.

4.113 If planning permission is granted, then prior to commencement of development, PWEL and / or its appointed Principal Contractor will finalise the CEMP and a detailed Construction Method Statement (CMS) outlining the methods and procedures which will be implemented during construction. It is anticipated that PWEL will present the CMS and CEMP to East Ayrshire Council for approval, in consultation with SNH and SEPA, at least two months prior to work commencing.

4.114 An Ecological / Environmental Clerk of Works (ECoW) will be appointed for the construction phase and will work, along with a nominated Environmental Manager to ensure that methods and good working practice detailed in the CEMP are adhered to and that any unforeseen risks to the environment encountered during construction are managed appropriately. The ECoW and Environmental Manager will be supported by specialists, for example with respect to water quality monitoring.

4.115 The EMPs for the operational and decommissioning phases will be prepared in advance of the start of each phase. It is anticipated that these will also be presented to East Ayrshire Council for approval, in consultation with SNH and SEPA.

4.116 In addition to the EMPs, the SWMP, and the PMP, a Habitat Management Plan (HMP) will also be prepared.

Habitat Management Plan

4.117 Separate to the EMPs outlined above, a Habitat Management Plan (HMP) will be developed to compensate for the loss of habitats during the construction phase. The content of the HMP will be agreed with East Ayrshire Council, in consultation with SNH and SEPA at least two months prior to work commencing.

4.118 The HMP is discussed in more detail in **Original Chapter 8 Non-Avian Ecology** and an Outline HMP is included as **Original Appendix 8.5**. The broad aims and objectives of the Outline HMP are to compensate the permanent loss of habitats and the disturbance of habitats, as follows:

- The greatest potential for compensation involves restoration of moorland habitat, notably heath and blanket bog, in drained and afforested areas of shallow (<50 cm) or deeper peat. There is no set rule on the scale of compensation being required, but it is acknowledged that habitat restoration is unlikely to provide equivalent value to intact habitat on a unit-for-unit basis, e.g. because the full range of soil microorganisms, higher and lower plants, associated fauna, and physical structure typical of intact habitat are unlikely to be restored in the short to medium term. The measures proposed provide compensation on a 2:1 basis.
- Enhancement measures are included that comprise widening of river corridors and replacing sections of conifer plantation with mixed broadleaved woodland.
- In addition to the value inherent in creating new areas of open habitat within the site, creating corridors of open habitat within the plantation and diversifying the woodland is predicted to benefit biodiversity by both providing a greater range of habitats on site and by facilitating the movement through the site of plants and animals, including species associated with moorland.