CRUACH CLENAMACRIE WIND FARM

APPENDIX 9.5 BORROW PIT ASSESSMENT

Voltalia

Cruach Clenamacrie: Borrow Pit Assessment

Technical Appendix 9.5

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WRc GENERAL NOTES

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1 INTRODUCTION

1.1 This report provides a Borrow Pit Assessment for Cruach Clenamacrie Wind Farm and associated infrastructure and ancillary features (hereafter referred to as the Proposed Development).

1.2 This report forms a Technical Appendix to the Environmental Impact Assessment Report (EIA Report) for the Proposed Development and should be read in conjunction with the EIA Report. It has been produced to address the requirement for aggregate for the Proposed Development to supply the construction needs for new and upgraded access tracks and hardstanding areas, including ongoing supply for track maintenance during the operation of the Proposed Development.

1.3 This report quantifies the aggregate requirement, appropriate locations within the Application Boundary from which this material can be sourced and addresses the suitability of the material for the required purpose. Potential impacts from aggregate extraction, processing, and transportation are considered and assessed. Design and mitigation measures to avoid or minimise these impacts are set out, along with a number of good construction practices that would be employed during all construction works.

1.4 Within this Technical Appendix, the following definitions will be used. The 'Application Boundary' refers to the extent of the area relating to the application for which consent will be sought. The 'Proposed Development' refers to infrastructure within the Application Boundary. 'Site' refers to the area within the Application Boundary within which the Proposed Development lies. 'Access track to the turbine area' refers to the route from the A85 to the 'turbine area', which is the area of the Site in which the Proposed Development turbines are located.

Site Description

1.5 The Proposed Development is located approximately 7km east of Oban and 5km south of Connel, within the Argyll and Bute Council area. This area falls within the UK meteorological (Met) Office's Western Scotland climatic region. The Application Boundary is bordered by private land to the north, all other sides are bound by Fearnoch Forest managed by Forestry and Land Scotland. Current land use in the area includes rough grazing and commercial forestry. The Site comprises areas of unimproved grassland, upland moorland and blanket bog.

Development Proposals

1.6 The Proposed Development infrastructure would include:

- New Access tracks, passing places, and turning heads;
- Site entrance from the A85;
- Access route through Fearnoch Forest;
- Turbine foundations;
- Hardstanding areas for cranes at each turbine location;

- Blade laydown areas;
- Temporary construction compound, including parking, and welfare facilities;
- Watercourse crossings;
- Drainage works;
- Power cables, linking the wind turbines, laid in trenches underground, including cable markers;
- An on-site electrical substation, parking, and a small storage compound;
-
- Borrow Pits; and
- Aviation obstacle lighting fitted to turbines.

1.7 Full details of the Proposed Development design are provided in **EIA Report Chapter 5**: **Project Description**.

Aims

1.8 This report aims to undertake a review of available relevant site information, including all track design specifications, to produce borrow pit designs and development plans in order to address the aggregate need for the Proposed Development construction and operational maintenance. Recommendations are made for mitigation measures and reinstatement to minimise potential landscape, visual, hydrological and hydrogeological impacts from the excavations. Potential impacts from noise, dust and vibration are also considered.

Assessment Method

1.9 The assessment has involved the following stages:

- Desk study;
- Site reconnaissance;
- Borrow pit design;
- Environmental review.

2 DESK STUDY

Information Sources

2.1 The desk study involved a review of available relevant information sources on the ground conditions in and around the Site. Information sources included:

- Ordnance Survey (OS) mapping at 1:50,000, 1:25,000 and VectorMap Local raster mapping, Terrain 5 digital terrain model and OS OpenData mapping;
- Historical OS mapping as available to view online;
- High-resolution orthorectified aerial imagery;
- British Geological Survey (BGS) online and digital geological mapping, 1:50,000 scale;
- Scotland's Soils digital soil mapping, 1:250,000 scale;
- Data provided by the applicant, including turbine foundation and track design specifications;
- Site data for the Proposed Development held by WRc.

Geology

2.2 Geological information is derived from the BGS GeoIndex online geological mapping at a 1:50,000 scale and the BGS Lexicon of Named Rock Units (BGS, 2024a,b).

Bedrock Geology

2.3 The Site is situated on bedrock of the Lorn Plateau Volcanic Formation, mainly comprising extrusive basalts and andesites, of late Silurian to early Devonian age.

2.4 Some north-east to south-west trending microdiorite and appinitic diorite dykes are present within the Site, which form part of the North Britain Siluro-Devonian Calc-Alkaline Dyke Suite. Some lenses of tuff and agglomerate of the Lorn Plateau Volcanic Formation are found in the far west of the Site.

2.5 There is one minor displacement fault trending north-east to south-west, in the south-west of the Site.

2.6 Borrow Pit 1 is underlain by microdiorite and appinitic diorite dykes of the North Britian Siluro-Devonian Calc-Alkaline Dyke Suite, and extrusive basalts and andesites of the Lorn Plateau Volcanic Formation. Borrow Pit 2 is underlain by extrusive basalts and andesites of the Lorn Plateau Volcanic Formation.

Superficial Geology

2.7 There is very little mapped superficial geology (BGS, 2024a) within the Planning Application Boundary. BGS GeoIndex identifies some small areas of peat north of turbine T5 and the construction compound, as well as to the north-west of watercourse crossing WC6.

2.8 No areas of artificial ground are identified within the Application Boundary.

Mineral Extraction

2.9 The Coal Authority and BGS GeoIndex (Coal Authority, 2024; BGS, 2024a) show no records of active or historic mining within the Application Boundary.

Soil

2.10 The Soil Survey of Scotland (1981) digital soils mapping indicates that the soil coverage within the Application Boundary is predominantly peaty gleys and peaty gleyed podzols of the Sourhope Association. Peaty gleys are described as poorly drained acidic soils which support wet heathland and rough grassland communities. Areas of brown earth soil and a small area of humus-iron podzols with peaty gleys are present along the upper section of the access track.

2.11 NatureScot's Carbon and Peatland Map (NatureScot 2016) classifies soils into five carbon classes, as well as three classes for mineral soils, non-soil or unknown. The map was consulted to understand where the carbon-rich soils, deep peat and priority peatland habitat are located within the Application Boundary. The map indicates that much of the Site is underlain by Class 2 peatland, considered to be nationally important carbon-rich soils, deep peat and priority peatland habitat. Smaller areas of Class 5 peatland, described as carbon-rich soils and deep peat, are present near the south and south-western parts of the Site and underly the majority of the Site access. A section of Class 0 is present underlying the northern end of the Site access. Class 0 is described as mineral soils where peatland habitats are not typically found.

2.12 Additional peat deposits have been identified during the Phase 1 and 2 peat depth surveys, and are detailed in **Figure 9.4.**

Rock Volumes

2.13 Calculation of aggregate requirement was undertaken by the applicant's design team, and a total required volume was provided for the purpose of borrow pit design and assessment. A contingency of 20% was added to the estimated total, to allow for under-estimation in the requirements and for some of the excavated material being unsuitable for construction use.

2.14 The provided total aggregate volume required is approximately **40,000 m^3**. Including 20% contingency, this amounts to a total of **48,000 m^3** .

2.15 Two borrow pit areas have been identified to provide suitable rock for use as aggregate in turbine bases, hardstanding areas and access tracks. The volumes of material that could be supplied from each borrow pit are provided in **Table 9.5.1.**

Table 9.5.1: Aggregate Volumes

Aggregate Source	Required Volume (m^3)	Design Volume (m^3)
BP1	38,000	50,000
BP2	10,000	13,000
Total (m^3):	**48,000**	**63,000**

Design Optimisation

2.16 Design optimisation considers alternative directions and modes of working. The optimised borrow pit designs provide in the first instance for the rock requirement whilst also considering, in line with PAN 50 (Scottish Government, 1996), potential impacts on:

- Landscape;
- Ecology;
- Hydrology;
- Hydrogeology.

2.17 Potential impacts on human beings relate principally to operational factors and include:

- Noise;
- Vibration;
- Dust;
- Visibility.

2.18 The physical constraints of rock suitability and topography, and the requirement to plan for a suitable restoration scheme, have been primary considerations in the borrow pit design. The preferred option has been to open up to two borrow pits to supply rock aggregate for the Proposed Development.

2.19 The rock within the Application Boundary has been assessed visually by an experienced geotechnical specialist as potentially suitable for track and hardstanding construction; however, rock exposure within parts of the Application Boundary is relatively limited and there may be local variations that restrict suitability of some of the aggregate, particularly for track running surfaces.

3 BORROW PIT METHOD OF WORKING

The Quarries Regulations 1999

3.1 The principles of the Quarries Regulations 1999, as set out in the Health & Safety Executive's document "Health and Safety at Quarries: The Quarries Regulations 1999 Approved Code of Practice" (HSE, 2013), would be followed by the appointed Contractor to provide a safe working environment during the development of the Proposed Development's borrow pits. The excavation designs must, in the first instance, provide safe and stable slopes which encompass the principle of '*design for closure*'. Haul and access roads should be of adequate width for the plant to be used on site and allow for the provision of edge protection in all locations where applicable.

The Water Environment (Controlled Activities) (Scotland) Regulations 2011

3.2 The *Water Environment (Controlled Activities) (Scotland) Regulations 2011* as amended provide a regulatory framework to prevent pollution of the groundwater environment. Related to these, the Scottish Environment Protection Agency's (SEPA) publication *The Water Environment (Controlled Activities) (Scotland) Regulations (as amended): A Practical Guide)* (2022) sets out good practice guidelines to prevent pollution of the groundwater environment. These guidelines reflect good operational practices and would be implemented at the Proposed Development .

3.3 Where authorisations are required for process plant operation or consents to discharge (under the *Water Environment Controlled Activities (Scotland) Regulations 2011* as amended and the *Pollution Prevention and Control (Scotland) Regulations 2012*) these would be obtained in advance from SEPA

Borrow Pit 1: Development

3.4 The proposed Borrow Pit 1 (BP1) is located on the outskirts of the Fearnoch Forest, roughly 500 m north-west of Creag Ruisgte, where the access track to the turbine area meets the Site. The borrow pit has not been previously excavated and is located in an area of former clearfell that has been replanted with young conifers (**Photograph 9.5.1)**.

3.5 The existing topography of the proposed borrow pit area, the borrow pit development plan and the borrow pit cross-section are illustrated on **Figure 9.5.1.**

Photograph 9.5.1: View across the proposed borrow pit area, looking south from 19559, 73068.

Topsoil Stripping and Storage

3.6 The Phase 1 and 2 peat depth surveys indicate that the proposed borrow pit area has limited peat cover. Soil depth records within the borrow pit footprint were found to be between 0.1 and 0.7m; surrounding this area, depths range from 0.05 to 0.4m. It has been estimated based on survey measurements that the average depth of soil across the borrow pit footprint is 0.29m. The borrow pit is located on a north-facing slope.

3.7 The borrow pit would be worked in strips, to ensure that only enough aggregate for the Proposed Development is obtained and to limit the impacts of the borrow pit to as confined an area as possible.

3.8 Topsoil would be removed in strips from the initial excavation area and would be stored in a temporary storage area. Topsoil would be stored in mounds which would not exceed 2m in height, to minimise compaction of the soil. Additionally, the mounds would be shaped to promote shedding of water. Some limited blading would be undertaken on the soil mound surface to assist in the shedding of water and to minimise surface erosion in wet conditions. Mounds would not be compacted.

3.9 As the borrow pit excavation develops, the topsoil would be removed in advance of the active excavation and would be retained for use in borrow pit area reinstatement. Removed topsoil, plus rock material unsuitable for use as aggregate or fill, would be used in the final restoration of the borrow pit.

Extraction of Rock

3.10 The predominantly basalt bedrock would be obtained by blasting. The blast techniques to be used would depend on the depth of rock to the borrow pit floor level at 168m above Ordnance Datum (AOD). Pattern blasting is recommended for the initial opening-up of

the borrow pit, blasting at shallow depths initially at the borrow pit entrance and gradually increasing in depth as the land rises to the south.

3.11 Pattern blasting involves the drilling of blast holes on a grid layout, normally to a depth of up to 6 m, and is mostly used where no pre-existing natural face is present. Once the fragmented rock is removed, blasting can continue from the rock faces created, using continued pattern blasting or face blasting as appropriate. Face blasting typically involves one or two rows of blast holes drilled to the target depth parallel to and behind an existing face.

3.12 The proposed location of the borrow pit is near the eastern Site boundary, on a north-facing slope. It would be accessed from the north-east via the access track to the turbine area and an existing forestry track.

3.13 The borrow pit has been designed to have two working faces and four subsidiary faces, with a gently sloping floor level at 168 m AOD. The working faces would be up to 15 m in height, blasted at an angle of 75° from the horizontal. The general direction of working would be to the south, with blasted rock removed and transported to the relevant area of construction.

3.14 Effects during rock extraction from noise and dust would be minimised by keeping the use of processing plant to a minimum. The blast pattern would be kept tight to maximise fragmentation, although some processing is likely to be required to produce aggregate of suitable grade for track construction. Blast design, including charge weights and delays, is the responsibility of the Contractor. Processing plant would be operated only for short periods of time, as necessary to provide the aggregate requirement for construction works.

Drainage

3.15 Drainage would be directed to the northern side, where water treatment would be provided for the borrow pit. The borrow pit floor would have a gentle slope during rock extraction, to allow for free drainage out of the borrow pit.

3.16 Natural surface runoff would be diverted around the active excavation area by construction of a low soil bund (0.5 m high) around the outer edge of the excavation, to ensure that runoff is prevented from flowing directly into the excavation. Blind ditches would be created as necessary to control water flow.

3.17 During blasting operations, joints and fractures in the sub-drill zone below the target extraction level are opened up by the expansion of gases generated by the explosives. In consequence, incident rainfall into the operational area would mostly infiltrate into the borrow pit floor. Any excess runoff would be diverted towards a constructed water collection sump, from where collected water would be allowed to discharge slowly into the trackside drainage system.

Restoration

3.18 Restoration for Borrow Pit BP1 would involve softening excavation edges with respect to the immediately adjacent hillside by ripping, earthworks and/or restoration blasting as appropriate. Any unusable material from the excavation would be used to create slopes and shallow areas, and in restoration of the borrow pit. Restored faces would have a

maximum slope of 27° and stored topsoil would be replaced over the restored faces to facilitate re-vegetation and the final restoration of the borrow pit.

3.19 The borrow pit floor would be ripped or routed to break up the surface; soils and turf material would then be replaced over the area. The soils would contain a natural seedbank and it is anticipated that natural vegetation would re-establish over time. Additional seeding may be required; this would be assessed by the Environmental Clerk of Works (ECoW) at the point of restoration and a suitable seed mix would be identified for this process.

Borrow Pit 2: Development

3.20 The proposed Borrow Pit 2 (BP2) is located in Fearnoch Forest, just south-west of Dailnamac, along the access track to the turbine area. The borrow pit has not been previously excavated and is located in an area of recent clearfell with conifer plantation at the southern margin (**Photograph 9.5.2** and **Photograph 9.5.3).**

3.21 The existing topography of the proposed borrow pit area, the borrow pit development plan and the borrow pit cross-section are illustrated on **Figure 9.5.2.**

Photograph 9.5.2: View south-west from the top of the proposed borrow pit area looking towards the existing forestry track, at 19721, 73204.

Photograph 9.5.3: View south-east from the existing forest track across the proposed borrow pit area, 19716, 73205.

Topsoil Stripping and Storage

3.22 The Phase 1 and 2 peat depth surveys indicate that the proposed borrow pit area has limited peat cover. Soil depth records within the borrow pit footprint were found to be between 0.1 and 0.9m; surrounding this area, depths range from 0.1 to 0.25m. It has been estimated based on survey measurements that the average depth of soil across the borrow pit footprint is 0.27. The borrow pit is located on a north-west-facing slope.

3.23 The borrow pit would be worked in strips, to ensure that only enough aggregate for the Proposed Development is obtained and to limit the impacts of the borrow pit to as confined an area as possible

3.24 Topsoil would be removed in strips from the initial excavation area and would be stored in a temporary storage area. Topsoil would be stored in mounds which would not exceed 2m in height, to minimise compaction of the soil. Additionally, the mounds would be shaped to promote shedding of water. Some limited blading would be undertaken on the soil mound surface to assist in the shedding of water and to minimise surface erosion in wet conditions. Mounds would not be compacted.

3.25 As the borrow pit excavation develops, the topsoil would be removed in advance of the active excavation and would be retained for use in borrow pit area reinstatement. Removed topsoil, plus rock material unsuitable for use as aggregate or fill, would be used in the final restoration of the borrow pit.

Extraction of Rock

3.26 The predominantly basalt bedrock would be obtained by blasting. The blast techniques to be used depends on the depth of rock to the borrow pit floor level at 40m AOD. The

blasting process is described fully under **Section 3 (Borrow Pit 1: Development, Extraction of rock).**

3.27 The proposed location of the borrow pit is 500 m along the access track to the turbine area from the A85, in Fearnoch Forest on a north-west-facing slope. It would be accessed from the east via the access track to the turbine area.

3.28 The borrow pit has been designed to have one main working face and two subsidiary faces, with a gently sloping floor level at 40m AOD. The working face would be up to 15m in height, blasted at an angle of 75° from the horizontal. The general direction of working would be to the south-east, with blasted rock removed and transported to the relevant area of construction.

3.29 Effects during rock extraction from noise and dust would be minimised by keeping the use of processing plant to a minimum. The blast pattern would be kept tight to maximise fragmentation, although some processing is likely to be required to produce aggregate of suitable grade for track construction. Blast design, including charge weights and delays, is the responsibility of the Contractor. Processing plant would be operated only for short periods of time, as necessary to provide the aggregate requirement for construction works. It is anticipated that Borrow Pit 2 would be used only for track upgrading and new track to provide the access to the turbine area, and that Borrow Pit 1 would provide aggregate for the turbine area infrastructure.

Drainage

3.30 Drainage would be directed to the north-west, where water treatment would be provided for the borrow pit. The borrow pit floor would have a gentle slope during rock extraction, to allow for free drainage out of the borrow pit.

3.31 Natural surface runoff would be diverted around the active excavation area by the construction of a low soil bund (0.5m high) around the outer edge of the excavation, to ensure that runoff is prevented from flowing directly into the excavation. Blind ditches would be created as necessary to control water flow.

3.32 During blasting operations, joints and fractures in the sub-drill zone below the target extraction level are opened up by the expansion of gases generated by the explosives. In consequence, incident rainfall into the operational area would mostly infiltrate into the borrow pit floor. Any excess runoff would be diverted towards a constructed water collection sump, from where collected water would be allowed to discharge slowly into the trackside drainage system.

Restoration

3.33 Restoration for Borrow Pit BP2 would involve softening excavation edges with respect to the immediately adjacent hillside by ripping, earthworks and/or restoration blasting as appropriate. Any unusable material from the excavation would be used to create slopes and shallow areas, and in restoration of the borrow pit. Restored faces would have a maximum slope of 27° and stored topsoil would be replaced over the restored faces to facilitate re-vegetation and the final restoration of the borrow pit.

3.34 The borrow pit floor would be ripped or routed to break up the surface; soils and turf material would then be replaced over the area. The soils would contain a natural

seedbank and it is anticipated that natural vegetation would re-establish over time. Additional seeding may be required; this would be assessed by the ECoW at the point of restoration and a suitable seed mix would be identified for this process.

4 ENVIRONMENTAL REVIEW

4.1 Most potential environmental effects associated with borrow pit development have been considered within the relevant EIA chapters including Chapter 7: Cultural Heritage and Archaeology and Chapter 8: Noise . As a result, this section provides a brief review of environmental issues not addressed elsewhere.

4.2 Borrow pit operations are relatively small-scale, owing to the small aggregate volume requirement for the new and upgraded access tracks and hardstanding areas.

Dust

4.3 Dust emissions can arise from blasting, processing, loading-out and stockpiled material. They are sensitive to weather conditions, typically being worst in dry and windy weather. Water sprays would be available at the borrow pit areas for use in dust suppression in dry and windy conditions, to control and minimise dust emissions. Any processing plant brought to the Proposed Development would have integral dust suppression systems to control dust emissions during processing. Effects from dust would be limited to active excavation at the borrow pits, notably during blasting, processing and loading-out of oversized and processed material. With appropriate controls in place, effects from dust emissions would be negligible.

Lighting

4.4 Any lighting associated with the borrow pits should have a clearly defined purpose and be directed to where it is required in order to provide a safe working environment. Lighting would only be used when necessary and would be switched off when not required.

Site Stability

4.5 Site stability has been assessed as part of the survey and design work for the borrow pits and has been incorporated into the design as part of a safe working environment. The proposed restoration scheme takes into consideration the requirement for long-term safety with respect to future land use.

5 CONCLUSIONS

5.1 This report sets out details with respect to the operational design for the borrow pits for the Proposed Development, in order to supply the need for the proposed access track, turbine foundations and hardstanding requirements. The borrow pit design and recommended methods of operation are in line with the *Quarries Regulations, Approved Code of Practice, 1999* (as amended) to provide a safe working environment and minimise risk of instability.

5.2 An Environmental Review of potential effects from the borrow pit operation has been undertaken. Use of best practice working methods and other mitigation methods as appropriate would be put in place during all borrow pit operations. It is concluded that residual effects would be minor, long-term and adverse during borrow pit operation.

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