SHEIRDRIM RENEWABLE ENERGY DEVELOPMENT

Technical Appendix 10.5: Borrow Pit Assessment
Prepared for: ScottishPower Renewables UK Ltd

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BASIS OF REPORT

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1.0 Introduction

SLR Consulting Ltd (SLR) was commissioned by ScottishPower Renewables (SPR) (UK) Ltd to undertake a Borrow Pit Assessment at the proposed Sheirdrim Renewable Energy Development (proposed Development), located approximately 11 km south west of Tarbert, 2 km to the east of Clachan and 2.6 km south west of Whitehouse at the northern end of the Kintyre Peninsula.

It is anticipated that the proposed Development would comprise up to 19 wind turbines generating 114 MW of energy and 20 MW of solar development, with associated infrastructure including external transformers, crane hardstandings, access tracks, cabling, borrow pits and a single substation including 38 MW of battery storage and a control building. It is proposed that the blade tip height for 16 wind turbines would be up to 149.9 m. Three of the wind turbines would have a tip height of 135 m.

The Site is currently accessed via the existing timber haul road which is also used for access to Cour Windfarm, south off the A83.

1.1 Methodology

This report provides details of the proposed borrow pits, which would be necessary to provide the aggregates required to construct the proposed Development.

There are five proposed borrow pit locations that have been selected because of their morphology, accessibility from proposed tracks, orientation and the expected proximity of suitable rock close to surface. The borrow pits are in areas where the peat coverage is minimal and where bedrock outcrops and potential aggregate reserves are known to occur near the surface.

This report is based on a desk based assessment of five potential borrow pits, supported by a site visit by an experienced engineering geologist. The desk based assessment has involved review of all geological plans, including historic geological plans, topographic and slope plans and review of available memoirs. The site visit was used to confirm peat coverage and identify bedrock outcrops. Prior to construction, site investigations would be carried out to determine the suitability of the geology and rock at the proposed borrow pits locations.

1.1.1 Sources of Information

The following sources of information have been reviewed and assessed:

- British Geological Survey (BGS) online map viewer and Geoindex[1];
- Scotland's Environment website[2]; and
- Information gathered during site visits.

1.2 Site Location and Description

The western part of the Site comprises commercial plantation forestry and existing forestry tracks around Sheirdrim Hill (186 m AOD). Upland moorland/wet grassland is dominant within the eastern and south eastern extent of the site. Topography generally rises to the south from circa 70 m AOD at the Site entrance to circa 270 m AOD in the south east, particularly around Cruach nam Fiadh. There are two lochs within the Site (Loch Chorra-riabhaich and Loch Lurach) and several others in the immediate vicinity, including Loch Freasdail (north east), Loch Cruinn (north east) and Loch Ciaran (south west). Other large hills include Cnoc Creagach (215 m AOD), Cnoc an t-Seallaidh Bhig (248 m AOD), Cruach Achaidh Ghlais (244 m AOD) and Cruach Tamalabh (242 m AOD).

To the north of the Site is the operational Freasdail Windfarm comprising 11 turbines of 100 m tip height. Eascairt Windfarm to the south east has been consented and will comprise 13 turbines also with a tip height of 100 m.

Approximately half of the site is Class 1 peatland which is described as nationally important carbon-rich soils, deep peat and priority peatland habitat, however, detailed assessment of the site has confirmed the extent of Class 1 Peatland is reduced based on extent of modified bog habitat due to artificial drainage and grazing and areas of shallow bedrock. This is outlined in the **Chapter 8 Ecology**.

A general view of the site conditions is shown within **Photos 1-1, 1-2** and **1-3**.

Photo 1-1
View north east from NGR NR 82123 57221

[1] British Geological Survey (BGS) Online Viewer/Geoindex website http://mapapps.bgs.ac.uk/geologyofbritain/home.html; http://www.bgs.ac.uk/geoindex/ Last accessed April 2019

[2] Scotland's Environment Website www.environment.scotland.gov.uk (last accessed April 2019)

Photo 1-2
View towards south east from NGR NR 81645 57808

Photo 1-3
View west towards proposed Turbines 17 – 19 from NGR NR 83358 56373

2.0 Geological Setting

This assessment has been completed through a largely desk based review of soil and geological maps and OS contour data. No intrusive investigation has been undertaken on site.

2.1 Superficial Geology

The superficial geology on site comprises glacial till with the majority of the Site mapped as containing no superficial deposits. No peat is mapped within the Survey Area.

The Superficial geology of the Site is detailed in in **Figure 10.5.2 – Superficial Geology**.

2.2 Solid Geology

The geology of the Site comprises predominately Dalradian age metasedimentary rocks of the Beinn Bheula Schist Formation. The unit shows a strong linear alignment trending roughly south west north east. The solid geology of the site comprises Palaeogene age extrusive igneous rocks of mafic (predominately basaltic composition) lava/tuff.

No faults are recorded to pass beneath the Site.

The solid geology of the site is shown in **Figure 10.5.3 – Solid Geology**. A summary of the solid geology onsite is shown in **Table 2-1**.

Table 2-1
Solid Geology Summary

Age	Stratigraphic Group	Unit	Description
IGNEOUS ROCKS			
Palaeogene (66 – 23 Ma)	Hebridean Province (North Atlantic Igneous Superprovince)	North Britain Palaeogene Dyke Suite	Olivine-microgabbro.
META-IGNEOUS ROCKS			
Neoproterozoic (1000 – 541 Ma)	N/A	Basic Minor Intrusion Suite	Amphibolite and Hornblende Schist
META-SEDIMENTARY ROCKS			
Neoproterozoic (1000 – 541 Ma)	Southern Highland Group (Dalradian Supergroup)	Beinn Bheula Schist Formation	Gritty psammite and Pelite
		Green Beds Formation	Metavolcaniclastic sedimentary rocks.
	Argyll Group (Dalradian Supergroup)	Loch Tay Limestone Formation	Schistose calcareous psammite and semipelite with units of blue-grey, crystalline meta-carbonate rock up to 10m thick.

Age	Stratigraphic Group	Unit	Description
		Ben Lui Schist Formation	Dominantly schistose to gneissose semipelite. Psammite locally developed in lower parts and pebbly psammite locally developed at top.

2.2.1 Mining and Quarrying

Following review of publicly available records, there is no evidence of mining or quarrying within the application boundary or immediate surrounds, except for small forestry borrow pits used for track construction.

2.2.2 Hydrological Setting

The solid geology underlying the Site is classified as a Low Productivity Aquifer, where flow is virtually all through fractures and other discontinuities.

The Site is drained by four main surface water catchments; the Clachan Burn, Claonaig Water, Whitehouse Burn and Alltan Fhearachair. The Clachan Burn drains the majority of the Site whilst the proposed infrastructure within the eastern and northern extent of the Site is drained by Claonaig Water, Whitehouse Burn and Alltan Fhearachair.

The Clachan Burn has an overall catchment size of 28.8 km^2 (of which 6.6 km^2 lies within the application boundary) and discharges at Dunskeig Bay, 3.5 km west of the Site. The catchment is drained by two main watercourses, the Clachan Burn and a tributary, the Allt Mòr.

Within the study area, the Clachan Burn has many unnamed watercourses, as well as, a watercourse named Allt a'Chreagain and waterbodies named Lochan a'Chreimh, Lochan Fraoich, Loch Chorra-riabhaich and Loch nan Gad. The catchment is composed of approximately 50 % commercial conifer forestry, with an extensive drainage network, and 50 % open moorland.

3.0 Aggregate Requirements

The proposed Development and its subsequent maintenance would require the construction of a purpose built network of access tracks. These tracks would be single track with occasional passing places, un-metalled and would be constructed to the turbine suppliers' specifications conforming to the Specification for Highway Works.

The total length of permanent new access track is estimated to be approximately 13.6 km. The typical cross sectional area of track with respect to imported construction materials has been estimated to be 3.5 m^2 per linear metre, which is based upon an estimated carriage width of 5-7 m and an average thickness of 0.5-1.0 m.

The indicative volumes of rock required for site infrastructure are summarised in **Table 3-1** and based on a materials calculator (**Appendix A**).

Table 3-1
Aggregate Requirements

Proposed Infrastructure	Volume of Aggregate Required
Access Tracks (new)	76,496 m^3
Existing Access Tracks for Upgrade	4,420 m^3
Floating Track	7,896 m^3
Track to Solar Arrays	6,496 m^3
Recreational Access Track	2,680 m^3
Access Track to Met Mast	32 m^3
Access Track to Borrow Pit (temporary)	240 m^3
Passing Places	4,200 m^3
Turbine Bases – formation only	2,759 m^3
Fill Above Turbine Bases	35,568 m^3
Crane Pads	37,240 m^3
Crane Pad Boom Support	1,862 m^3
Blade laydown and ancillaries	760 m^3
Turning Heads	2,730 m^3
Substation	7,500 m^3
Met Mast Working Area	1,250 m^3
Laydown Area	3,750 m^3
Construction Compound	3,750 m^3
Total	**199,629 m^3**

4.0 Aggregate Quality

The primary use of aggregate arising from working of the selected borrow pits would be for the construction of the tracks using unbound aggregate to the turbine suppliers' specifications and conforming to the Specification for Highway Works.

A site investigation would be required to establish that aggregate within the proposed borrow pits would comprise suitable aggregate material; it is at this stage still subject to geotechnical testing.

5.0 Borrow Pits

5.1 Introduction

It is anticipated that the proposed Development would be sited on glacial soils or shallow bedrock, composed of *in-situ* extrusive igneous rock types. The solid geology, either at surface or beneath superficial deposits across site ranges from Dalradian age metasedimentary rocks comprising of pelites, psammites and metavolcaniclastic sedimentary rocks.

Following review of publicly available records, there is no evidence of mining or quarrying within the application boundary or immediate surrounds.

The assessment has been completed through a desk-based review of geological maps and memoirs and is supported by several walkovers completed between May 2019 and September 2019.

This section of the report provides an assessment of the potential borrow pits with an evaluation of its potential to meet the proposed Development's aggregate requirements.

The proposed borrow pit locations have been predominantly selected due to their geological setting. Other factors included environmental impacts, morphology, accessibility from the site or proposed roads, orientation and the expected proximity of rock to the surface. The proposed locations are in areas where the superficial coverage is limited and where bedrock is anticipated to have aggregate reserves near to surface.

No account has been taken in the calculations for the fortuitous 'winning' of rock during the construction phase for example during infrastructure excavations. The calculations provided in this report assume a worst case scenario where no other rock or materials would be found on site during construction. In the event that such rock was available the amount extracted from the borrow pits would be reduced.

5.2 Borrow Pit Selection

A total of five potential search areas have been selected as possible borrow pit locations. Each location will be reviewed in the sections below.

5.3 Borrow Pit BP1

Borrow pit BP1 is located to the south of the proposed access track at approximately NGR NR 179744, 658637 shown on **Figure 10.5.4a** with further details in **Table 5-1** and **Photo 5.1**.

The underlying geology in this area comprises of Dalradian age psammites and semipelites.

It is anticipated that the borrow pit would comprise a layer of weathered granular material, broken rock and rock close to surface, which would offer significant volume of material for much of the site. This borrow pit would not provide sufficient rock for the proposed Development on its own but could have the capacity to do so.

Table 5-1
Borrow Pit BP1

Borrow Pit 1	
Site Dimensions	Approximately 100 x 70 m
Excavation Area	Approximately 7,000 m^2
Height of Excavation	Approximately 20 m
Gradient	Slope increasing steeply towards the south east
Details of Extraction	Combination of drilling and blasting
Overburden Type and Depth	Soil/weathered rock
Extent of Aggregate Extraction	Approximately 56,000 m^3
Aggregate Composition	Metasedimentary rock psammites and semipelites

Photo 5-1
Proposed Borrow Pit BP1 (Direction of View – South)

5.4 Borrow Pit BP2

Borrow pit BP2 is located on the southern edge of the access track at approximately NGR NR 180151, 658697 shown on **Figure 10.5.4b** with further details in **Table 5-2** and **Photo 5.2**.

The underlying geology in this area comprises of Dalradian metavolcaniclastic sedimentary rocks.

It is anticipated that the borrow pit would comprise a layer of weathered granular material, broken rock and rock close to surface, which would offer significant volume of material for much of the site. This borrow pit would not provide sufficient rock for the proposed Development on its own.

Table 5-2
Borrow Pit BP2

Borrow Pit 2	
Site Dimensions	Approximately 80 x 80 m
Excavation Area	Approximately 6,400 m^2
Height of Excavation	Approximately 22 m
Gradient	Slope increasing steeply towards the south
Details of Extraction	Combination of drilling and blasting
Overburden Type and Depth	Soil/weathered rock
Extent of Aggregate Extraction	Approximately 56,320 m^3
Aggregate Composition	Metavolcaniclastic sedimentary rocks

Photo 5-2
Proposed Borrow Pit BP2 (Direction of View – East)

5.5 Borrow Pit BP3

Borrow pit BP3 is located to the east of the proposed access track at approximately NGR NR 180478, 657583 shown on **Figure 10.5.4c** with further details in **Table 5-3** and **Photo 5.3.**

The underlying geology in this area comprises Dalradian metavolcaniclastic sedimentary rocks.

It is anticipated that the borrow pit would comprise a layer of weathered granular material, broken rock and rock close to surface, which would offer significant volume of material for much of the site. This borrow pit could provide much of the rock for the proposed Development.

Table 5-3
Borrow Pit BP3

Borrow Pit 3	
Site Dimensions	Approximately 90 x 90 m
Excavation Area	Approximately 8,100m^2
Height of Excavation	Approximately 18 m
Gradient	Slope increasing steeply towards the east
Details of Extraction	Combination of drilling and blasting
Overburden Type and Depth	Soil/weathered rock
Extent of Aggregate Extraction	Approximately 58,320 m^3
Aggregate Composition	Metavolcaniclastic sedimentary rocks

Photo 5-3
Proposed Borrow Pit BP3 (Direction of View – South)

5.6 Borrow Pit BP4

Borrow pit BP4 is located to the south of a proposed new access track at approximately NGR NR 180167, 657242 shown on **Figure 10.5.4d** with further details in **Table 5-4** and **Photo 5.4**.

The underlying geology in this area comprises Dalradian metavolcaniclastic sedimentary rocks.

It is anticipated that the borrow pit would comprise a layer of weathered granular material, broken rock and rock close to surface, which would offer significant volume of material for much of the site. This borrow pit is unlikely to be utilised due to its proximity to water courses. If additional localised supplies were needed then the borrow pit could be developed.

Table 5-4
Borrow Pit BP4

Borrow Pit 4	
Site Dimensions	Approximately 106 x 95 m
Excavation Area (limited)	Approximately 1500 m^2
Height of Excavation	Approximately 10 m
Gradient	Slope increasing steeply towards the north east
Details of Extraction	Combination of drilling and blasting
Overburden Type and Depth	Soil/weathered rock
Extent of Aggregate Extraction	Approximately 7,500 m^3
Aggregate Composition	Metavolcaniclastic sedimentary rocks

Photo 5-4
Proposed Borrow Pit BP3 (Direction of View –North)

5.7 Borrow Pit BP5

Borrow pit BP5 is located to the east of the site on the eastern edge of a proposed new access track at approximately NGR NR 181766, 657611 shown on **Figure 10.5.4e** with further details in **Table 5-5** and **Photo 5.5**.

The underlying geology in this area comprises Dalradian psammite and pelite.

It is anticipated that the borrow pit would comprise a layer of weathered granular material, broken rock and rock close to surface, which would offer significant volume of material for much of the site. This borrow pit could provide much of the rock for the proposed Development.

Table 5-5
Borrow Pit BP5

Borrow Pit 5	
Site Dimensions	Approximately 100 x 97 m
Excavation Area	Approximately 9,700 m^2
Height of Excavation	Approximately 12 m
Gradient	Slope increasing steeply towards the east
Details of Extraction	Combination of drilling and blasting
Overburden Type and Depth	Soil/weathered rock
Extent of Aggregate Extraction	Approximately 46,560 m^3
Aggregate Composition	Metasedimentary rock

Photo 5-5
Proposed Borrow Pit BP5 (Direction of View – North west from NGR: NR 82136 57246)

6.0 Proposed Borrow Pit Design

The indicative borrow pit volumes are indicated in **Tables 5-1** to **5-5**. The design of the borrow pits anticipates extracting a net stone volume suitable for the requirements onsite, excluding top surface dressing which will require importing. This target capacity has been determined on the basis of the estimated requirements for construction materials together with additional allowances for overburden and processing waste. It is envisaged that overburden/soils together with processing waste would be carefully stored adjacent to the excavation void for eventual use in the restoration process.

6.1 Marking Out and Overburden Stripping

The permitted extents of the borrow pit would be marked out with pegs, and overburden, including topsoil, subsoil and weathered rock horizons, would be stripped from within this delineated area.

The overburden and weathered rock horizons would be stripped using a backhoe excavator and loading shovels. The overburden would be carefully stripped and stored as a series of separate topsoil, subsoil and weathered rock storage mounds.

6.2 Excavations within Rock

Once overburden and weathered rock horizons have been stripped, and stored, the nature of the underlying solid rock strata would be assessed by a suitably qualified geotechnical engineer/blasting engineer. The engineer would provide advice on suitable extraction techniques including; extraction method, bench and cut face design parameters, and blasting design (if required).

If blasting is required, blasting would be undertaken in accordance with the Quarries Regulations 1999 and Annex D PAN 50.

The blasted/excavated rock materials would be processed using a mobile crushing and screening plant, which would be sited within the base of the working borrow pit.

6.3 Stockpiling of Materials

The initial overburden strip would be stored within temporary screening mounds around the perimeter of the borrow pit. The Screening mounds would be at least 1.5 m in height.

The remaining unsuitable materials (weathered/unsuitable rock horizons) would be stockpiled within the base of the working borrow pit. The Stockpiles would have a maximum height of 5 m, with maximum side-slope gradients of 1(V) in 2.5(H) and be in full compliance with the Quarries Regulations 1999 and QNJAC Guidelines. This material would be used as part of the restoration profiling on the cut faces.

6.4 Access Tracks/Haulage Routes

The proposed access to the borrow pit(s) would involve constructing access tracks from the main site access track. The access tracks would include suitable roadside drainage ditches, with soakaways located where appropriate.

The tracks (haulage routes) within the borrow pit would have a gradient of no steeper than 1(V) in 10(H).

6.5 Water Management/Drainage

The borrow pit(s) would feature a perimeter surface drain, which would aim to prevent water in-flow into the borrow pit. The water collected within the surface drains would be discharged either into the surrounding vegetation, or into suitably located settlement lagoons.

Where necessary surface settlement lagoons would be constructed within the borrow pit. These would be constructed with the aim of containing any surface water collection within the excavation voids, and from collection of water from the perimeter surface drains. The lagoons would be contained within a bunded area at the base of the borrow pit, with suitable pumping systems installed allowing water to be pumped to soakaways as required.

6.6 Restoration

Upon completion of extraction at the borrow pit(s), the sites would be restored as far as possible back to their ‘natural state’.

General fill material would be sourced from the stockpiles located within the borrow pit void. These comprise of unsuitable materials which consist of weathered rock and unsuitable/ poor quality rock horizons, and unsuitable materials arising from the crusher/blasting operations. This material would be utilised to provide the basis of the restoration profile.

The fill materials would be used as general fill to soften the benched profile of the excavations and to provide a gentler sloping gradient than near vertical working face slope designs. The fill materials would also be used to provide a suitable gradient on the borrow pit floor to prevent ponding.

The stripped soils, and subsoil horizons which would be stored within perimeter screening mounds would be utilised as the surface dressing layer in which to provide a suitable medium for seeding and planting as appropriate.

The restoration of the borrow pit sites would not involve importing any material onto site. Only materials arising from the excavations would be utilised as part of the restoration scheme. The base of the borrow pit would re-use existing stockpiled materials/soils generated from the site excavations to create a habitat on the floor of the borrow pit, this would be to a maximum of 2 m thick across the floor area, if suitable some of these soils may be used to ‘dress’ shallower side slopes but not on the steeper faces.

An Ecological Clerk of Works (ECoW) would be in place, in order to monitor the restoration and aftercare of the borrow pits.

6.7 Good Practice Guidance Documents

A number of general pollution prevention measures would be employed to minimise the risks to ground and surface waters during creation and use of the borrow pits. Extraction operations would be carried out in accordance with relevant Pollution Prevention Guidelines and other codes of best practice, to ensure that both ground and surface waters are not contaminated. These would include relevant codes of good practice relevant to the site include:

- Scottish Planning Policy (SPP), Scottish Executive, June 2014;
- EC Water Framework Directive (2000/60/EC);
- Planning Advice Note (PAN) 50, Controlling the Environmental Effects of Surface Mineral Workings,

Scottish Executive, 1996;

- Good Practice on Controlling the Effects of Surface Mineral Working on the Water Environment, Department of the Communities and Local Government and Mineral Industry Research Organisation, 2008;
- Pollution Prevention Guidance (various dates and references), SEPA; and
- Environmental Good Practice on Site C692, CIRIA, 2010.

7.0 Conclusion

In summary, the proposed borrow pits have been assessed as being capable of supplying all of the aggregate required for the proposed Development. The locations and methods of working would cause minimal impact to the ground conditions and water environment. Additional aggregate for the turbine bases and the initial tracks to access the borrow pits would be sourced off-site.

An approximate volume of excavated materials has been calculated for each of the proposed borrow pit locations, these volumes are based on initial calculations and would be verified by detailed intrusive investigation at the proposed locations. Each of the five proposed borrow pits has the potential to be extended beyond its proposed dimensions to achieve a greater volume of material. Calculations do not take into consideration the 'winning' of material along the route.

FIGURES

Legend

- Application Boundary
- Turbine Location (135m Tip Height)
- Turbine Location (149.9m Tip Height)
- Proposed Watercourse Crossing Location
- Existing Watercourse Crossing Location
- Existing Passing Place
- Proposed Passing Place
- Proposed Access Track
- Existing Track
- Proposed Turning Head
- Proposed Substation
- Proposed Construction Compound
- Proposed Laydown Area
- Borrow Pit Search Area
- Proposed Crane Pad
- Proposed Solar Control Building
- Proposed Solar Area Access
- Proposed Solar Area
- Proposed Shelter Location
- Proposed Hide Location
- Cultural Heritage Feature
- Proposed Recreational Viewing Point on top of Cruach Nam Fiadh
- Proposed Recreational Route

177000 178000 179000 180000 181000 182000 183000 184000

659000 658000 657000 656000 655000

N

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14 T15 T16 T17 T18 T19

WX01 WX02 WX03 WX04 WX05 WX06 WX07 WX08 WX09 WX10 WX11

BP01 BP02 BP03 BP04 BP05

SA1 SA2

Freasdail Sheepfold Loch Cruinn Loch Lurach Cairn Sheepfold Sheirdrim Hill Monyliadh Achavraid Sheirdrum Ailt a' Chreagain Cruach nam Fiadh Dubh Loch Loch Chorra-riabhaich Lochan Fraoich Old Shielings Waterfalls Waterfall Cnoc Creagach Druimnaleck Achadunan Achaglass Mullach Dubh Kintyre Way Larachmor Burn

59 58 57 56 55

SCOTTISHPOWER RENEWABLES					1:20,000 Scale @ A3	0 0.5 1 Km	**Sheirdrim Renewable Energy Development - EIAR**
							Borrow Pit Report
							Site Location
A	16/10/19	JRS	First Issue.		© Crown Copyright 2019. All rights reserved. Ordnance Survey Licence 0100031673.		**Drg No** 00481.00051.08.10.5.1.0
Rev	**Date**	**By**	**Comment**				**Rev** A
							Date 16/10/19
							Figure 10.5.1
							Datum: OSGB36 Projection: TM