Technical Appraisal 8.4: Borrow Pit Appraisal

Vale of Leven Wind Farm

Vale of Leven Wind Farm Ltd

Prepared by:

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SLR Project No.: 405.13034.00001

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Basis of Report

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1.0 Introduction

SLR Consulting Ltd (SLR) was commissioned by Vale of Leven Wind Farm Ltd to undertake a Borrow Pit Appraisal (BPA) at the proposed Vale of Leven Wind Farm.

The proposed wind farm development (Proposed Development) is located approximately 2.5 km east of Bonhill with the larger settlements of Alexandria and Dumbarton located approximately 4km to the west and south-west of the Proposed Development. The Proposed Development is located on predominantly upland moorland that is managed as farmland grazing. The location and layout of the Proposed Development are detailed on **Figure 8.4.1**.

The Proposed Development comprises of 10 wind turbines, and associated infrastructure including:

- associated turbine formations and transformers;
- hardstanding areas for erecting cranes at each turbine location;
- series of on-site access tracks connecting each turbine;
- underground cables linking the turbines to the grid connection;
- on-site substation;
- temporary construction compound(s);
- turning heads;
- LiDAR unit; and
- 3 borrow pit(s).

In addition, felling of approximately XX trees would be required to accommodate access for the turbines.

Full details of the proposed Development are provided in Chapter 2: Proposed Development of the EIA Report.

1.1 Scope of Report

There has been substantial works undertaken to date at the Proposed Development to inform the proposed layout, including site reconnaissance and several phases of peat probing as detailed within **Technical Appendix 8.1: Peat Landslide and Hazard Risk Assessment (PLHRA).** The principal objective of this report is to provide an initial assessment of the aggregate requirements for the Proposed Development and identify potential borrow pits suitable for providing this aggregate.

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 three proposed borrow pit search areas reviewed within this report. Selected because of their morphology, accessibility from proposed tracks, orientation and the expected proximity to suitable rock close to the surface. The proposed borrow pits are in areas where peat coverage is anticipated to be minimal and where bedrock may outcrop and potential aggregate reserves are expected to occur near the surface.

1.2 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 by an experienced geologist and geotechnical engineer.

2.0 Geological Setting

2.1 Superficial Geology

Based on the available BGS data, the Proposed Development is largely underlain by peat, from the Quaternary Period, covers most of the Proposed Development, particularly in the North and the East. In addition, Diamicton (Glacial Till) from the Devensian stage and Hummocky Mound Glacial deposits from the Pleistocene Epoch are present in some areas. Deposits are lithologically diverse and complex, composed of rock debris, clayey till, sand and gravel.

Peat is recorded and generally confined to flatter lying ground and the valleys between the summits of hills. The Glacial Till and hummocky glacial deposits are present across many of the slopes of the hills. Bedrock is recorded at surface on hilltops and steeper slopes of hills. Slope gradients across the Proposed Development are generally shallow with steeper hillside and valley features.

Figure 8.4.2 contained within this report details the superficial geology BGS mapping overlaid across the Proposed Development.

2.2 Bedrock Geology

The published BGS data indicates that the bedrock geology underlying the Proposed Development is predominantly comprised of three major formations: Kinnesswood Sandstone Formation, Stockiemuir Sandstone Formation and Ballagan Formation. The Kinnesswood Sandstone Formation bedrock covers a large proportion of the Proposed Development, but is particularly dominant in the centre and east, and some areas in the south. This bedrock is present in the subsurface where most of the turbines have been proposed.The Kinnesswood Sandstone Formation is Late Devonian and is comprised of thick sandstone bed units with carbonate (limestone or dolomite) nodular pedogenic horizons ('cornstone'), thin conglomerate beds, and occasional mudstone and calcareous mudstone beds. The Stockiemuir Sandstone Formation is present in the North of the Proposed Development. The Stockiemuir Formation is Late Devonian and is comprised of sandstones with sporadic mudstone clasts and quartz pebbles, overlain by sandstones with sporadic cornstones and quartz pebbles. The Ballagan Formation is present in the centre, south and south-west of the Proposed Development. The Formation is carboniferous in age and is comprised of mudstones and siltstones, with nodules and beds of ferroan dolomite (cementstones). Thin sandstones are present in many areas and thick localised sandstones.

There are multiple minor bedrock formations present beneath the Proposed Development. Firstly, Saughen Braes Lava Member is present in the South-East of the Proposed Development, covering part of Doughnot Hill and just North of Darnycaip. The unit is composed of around five flows of plagioclase-macrophyric basalt. The Burncrooks Volcaniclastic Member is present in the South-East of the Proposed Development, covering part of Doughnot Hill. The unit is composed of volcaniclastic sedimentary rock, some

[1] British Geological Survey (BGS) Geoindex website. http://mapapps.bgs.ac.uk/geologyofbritain/home.html; http://www.bgs.ac.uk/geoindex/
[2] Scotland's Environment Website. www.environment.scotland.gov.uk

lacustrine sedimentary rocks, tuff and agglomerate. The Clyde Sandstone Formation is underlying areas on Doughnot Hill in the South-East of the Proposed Development and the unit is composed of Carboniferous sandstone, commonly pebbly with beds of red-brown or grey mudstone. The Clyde Plateau Agglomerate Subsuite is present in the centre and South-East of the Proposed Development area, with exposure at the peak of Meikle White Hill, Little White Hill and Doughnot Hill. The unit is composed of Lower Carboniferous Agglomerates. The Clyde Plateau Basaltic Subsuite is a very minor unit present and exposed in the South-East of the Proposed Development and the unit is composed of Lower Carboniferous basalt. Auchineden Lava Member is a very minor unit located in the South of the area, present just North of Darnycaip. There are two main dyke complexes present on the Proposed Development. Firstly, the Dinantian Basaltic Dykes are situated throughout the Proposed Development, predominantly in the centre and West of the Proposed Development, near Auchenreoch Muir, Murroch Glen. In addition, the Central Scotland Late Carboniferous Tholeiitic Basalt Dykes are located throughout the centre of the Proposed Development, near Pappert Hill and proposed turbines 8, 9 There are some linear features that pass beneath the Proposed Development. There are three large faults trending northeast to south west, each approximately 8km in length. In addition, there is a cluster of faults in the south of the Proposed Development, especially around Doughnot Hill.

Figure 8.4.3 contained within this report details the bedrock geology BGS mapping overlaid across the Proposed Development.

2.3 Mining and Quarrying

The BGS Geoindex indicates that there are three existing quarries located within the Site Boundary. The Auchenreoch Muir Quarry is located in the centre of the Proposed Development, adjacent to T8. The Finland Burn and Finland Burn Workings are located to the north of the Proposed Development.

2.4 Aerial Photography

The OS mapping and aerial photography do not indicate exposed bedrock. This is also confirmed by the site visit where exposed bedrock was recorded to be limited.

3.0 Borrow Pit Assessment

This section of the report provides an assessment of the potential borrow pit locations with an evaluation of their potential to meet the Proposed Development's aggregate requirements.

The assessment has been completed through a desk-based review of geological maps and memoirs and is supported by several site visits from SLR geologists and a geotechnical engineer. Potential borrow pit locations were inspected visually with a view to assess ground conditions and help determine the borrow pit's suitability for use during construction of the Proposed Development.

In exploring the three potential borrow pit locations, as defined on **Figure 8.4.1**, consideration has been given to the practical aspects of each borrow pit. The main aspects to consider are as follows:

- ease of access;
- rock type;
- overburden thickness;
- topography;
- current and historical uses;

- proximity to construction activities;
- visual impact; and
- impact on environmentally sensitive areas.

Steeper topography is preferable for quarrying, where peat and soils coverage will be limited. Careful consideration was given to landscape and visual impacts, and other considerations included proximity to watercourses and places of archaeological interest. The proposed borrow pits are in areas where the peat cover is typically thinner or vacant and aggregate reserves are expected to occur near the surface.

No intrusive site investigation works have been undertaken into the quality of rock that might be recovered at the time of preparing this BPA. However, it is anticipated that a full ground investigation will take place in advance of construction of the Proposed Development. The investigation will include the testing of material from within the proposed borrow pit areas to assess its suitability for re-use.

3.1 Aggregate Requirements

The proposed turbine locations and their 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 (SHW)[3].

As indicated above, a site investigation would be required to investigate each borrow pit location to confirm the material suitability and re-use potential of the bedrock with bedrock samples recovered from the borrow pits and subjected to detailed geotechnical testing.

The indicative volumes of rock required for site infrastructure are summarised in Table A and based on the materials calculator provided in **Annex A**.

Table A: Aggregate Requirement Summary

Infrastructure Element	Volume of Aggregate Required (m^3)
Excavated Access Track	26,238
Turning Heads	1,629
Turbine Bases - formation only	3,075
Fill above Turbine Bases	9,577
Hardstandings	39,000
Substation	7,500
Main Construction Compound	5,000
Satellite Construction Compound North	450
Satellite Construction Compound South	153
Total	92,622

It has been estimated that approximately 92,622 m^3 of suitable quality rock would be required to construct the Proposed Development. This includes SHW[3] classes 6F2, 6N/ 6P and concrete aggregate. If rock quality is not suitable for each of these engineered materials then there may be a requirement for imported materials.

[3] Highways Agency, Manual of Contract Documents for Highway Works Volume 1 Specification for Highway Works, Series 600 Earthworks, Published February 2017.

No account has been taken in the calculations for the fortuitous 'winning' of rock during the construction phase for example during infrastructure excavations. If such rock was available, the amount extracted from the borrow pits would be reduced.

3.2 Borrow Pit Appraisal

This section of the report provides an assessment of the three borrow pit search areas together with an evaluation of their potential to meet the Proposed Development's aggregate requirements.

A total of three search areas were selected as possible borrow pit locations, shown on **Figure 8.4.1**. Each location is reviewed in the sections below. Potential search areas have been highlighted with indicative excavation areas identified at each borrow pit location. All borrow pits could be extended or reduced in size depending on review of aggregate requirements and/or ground investigation data.

These rock types have been assumed for the borrow pits where there were no rock exposures at the surface. The geology encountered within the Proposed Development is supported by BGS geological maps for the site. Dimensions of the borrow pits, volume of superficial material to be removed and volumes of site won rock for each borrow pit have been estimated based on cross-sections developed through a digital terrain model. These are required to be confirmed by future intrusive ground investigation works.

3.2.1 Borrow Pit 1

Borrow Pit 1 (BP1) would be in the northeast of the Proposed Development, at approximately NGR NS 43749 80025, shown on **Figure 8.4.1** with further details in Table B.

Photo 1: View north from NGR NS 43756 79967 showing BP1

Table B: Borrow Pit 1

Borrow Pit 1	
Excavation Area	Approximately 7,200 m^2
Height of Excavation	Approximately 8.2 m
Gradient	Slope increasing gently towards the north
Details of Likely Extraction	Combination of digging, drilling and blasting
Likely Overburden Type and Depth	Peaty soils / glacial cover
Extent of Aggregate Extraction	Approximately 25,077 m^3
Aggregate Composition	(Northern half of the BP Area) Kinnesswood Formation - Sandstone (Southern half of the BP Area) Ballagan Formation - Argillaceous Rock, Dolostone and Sandstone

3.2.2 Borrow Pit 2

Borrow Pit 2 (BP2) would be in the northwest of the Proposed Development, at approximately NGR NS 43305 79833, shown on **Figure 8.4.1** with further details in Table C.

Photo 2: View south from NGR NS 43350 79895 showing BP2

Table C: Borrow Pit 2

Borrow Pit 2	
Excavation Area	Approximately 8,000 m^2
Height of Excavation	Approximately 11.1 m
Gradient	Slope increasing steeply towards the southeast
Details of Likely Extraction	Combination of digging, drilling and blasting
Likely Overburden Type and Depth	Peaty soils / glacial cover
Extent of Aggregate Extraction	Approximately 35,966 m^3
Aggregate Composition	(Majority of the BP Area) Ballagan Formation - Argillaceous Rock, Dolostone and Sandstone (Southern edge of the BP Area) Clyde Plateau Subsuite - Basalt, Olivine-Macrophyric

3.2.3 Borrow Pit 3

Borrow Pit 3 (BP3) would be in the southwest of the Proposed Development, at approximately NGR NS 41315 77779, shown on **Figure 8.4.1** with further details in Table D.

Photo 3: View north from NGR NS 41254 77758 showing BP3

Table D: Borrow Pit 3

Borrow Pit 3	
Excavation Area	Approximately 7,200 m^2
Height of Excavation	Approximately 11.7 m
Gradient	Slope increasing steeply towards the southeast
Details of Likely Extraction	Combination of digging, drilling and blasting
Likely Overburden Type and Depth	Peaty soils / glacial cover
Extent of Aggregate Extraction	Approximately 41,451 m^3
Aggregate Composition	Ballagan Formation - Argillaceous Rock, Dolostone and Sandstone

4.0 Proposed Borrow Pit Design

The indicative borrow pit volumes are presented in Table B to Table D. The design of the borrow pits anticipates extracting a net stone volume suitable for the requirements of the Proposed Development, excluding imported top surface dressing which would require importing. This target capacity has been determined based on the estimated requirements for construction materials together with additional allowances for overburden material. 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.

4.1 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 combination of crawler tractor dozers and backtrackers with the material loaded by loading shovels. The overburden (including surface vegetation turves) would be carefully stripped and stored as a series of separate turves, topsoil, subsoil and weathered rock storage mounds to be used for reinstatement purposes.

4.2 Excavations within Rock

Once overburden and weathered rock horizons have been stripped, and stored, a suitably qualified geotechnical engineer/blasting engineer would assess the nature of the underlying solid rock strata. 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[4] and Annex D PAN 50[5].

A combination of digging, ripping and blasting would be utilised to excavate rock (subject to the nature of the material encountered, depth of weathering and level of fracturing) which would be processed using a mobile crushing and screening plant, which would be sited within the base of the working borrow pit.

4.3 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 1.5m 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 5m, with maximum side-slope gradients of 1(Vertical (V)) in 2.5(Horizontal (H)) and be in full compliance with the Quarries Regulations 1999[4] and Quarries National Joint Advisory Committee (QNJAC) Guidelines[6]. This material would be used as part of the restoration profiling on the cut faces.

[4] Health and Safety Executive (2014), Health and Safety at Quarries, Quarries Regulations 1999, Approved Code of Practice and Guidance (Second Edition).
[5] Scottish Government (2000), PAN 50 Annex D: Controlling the Environmental Effects of Surface Mineral Works.
[6] Quarries National Joint Advisory Committee (2020), Available at: http://qnjac.co.uk/what-is-qnjac/. Last accessed April 2020.

4.4 Access Tracks/Haulage Routes

The proposed access to the borrow pit(s) would involve constructing access tracks from the main wind farm 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).

4.5 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.

4.6 Restoration

Upon completion of extraction at the borrow pit(s), surface profile restoration would be undertaken using the stockpiled overburden materials and other suitable materials excavated on-site (including peat) subject to review by the Environmental Clerk of Works (EnvCoW).

General fill material would be sourced from the stockpiles located within the borrow pit void. These would comprise of materials with unsuitable engineering properties for the Proposed Development construction such as 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 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 the Proposed Development. 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, which would be a maximum of 2m thick across the floor area and if suitable, some of these soils could be used to ‘dress’ shallower side slopes but not on the steeper faces.

An ECoW would be in place, to monitor the restoration and aftercare of the borrow pits.

4.7 Best Practice Guidance Documents

A number of general pollution prevention measures would be employed to minimise the risks to ground and surface waters during the creation and use of the borrow pits. Extraction operations would be carried out in accordance with relevant SEPA Guidance for Pollution

Prevention[7] and other codes of best practice, to ensure that both ground and surface waters are not contaminated. These would include relevant codes of best practice relevant to the site, including:

- European Commission (EC) Water Framework Directive (2000/60/EC);
- Planning Advice Note (PAN) 50, Controlling the Environmental Effects of Surface Mineral Workings Scottish Government (2000) ;
- 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);
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011;
- Guidance for Pollution Prevention (GPPs) (various dates and references), SEPA; and
- Environmental Good Practice on Site C692, CIRIA (2010).

5.0 Conclusion

In summary, three borrow pits have been assessed as being capable of supplying all the aggregate required for the Proposed Development, excluding the concrete for the turbine bases and a surface road dressing. The locations and methods of working would be managed to cause minimal impact to the ground conditions and water environment. The borrow pit design and recommended methods of operation are in line with the Quarries Regulations, Approved Code of Practice, 1999 (as amended)[8] to provide a safe working environment and minimise risk of instability.

An approximate volume of excavated materials has been calculated for each of the proposed borrow pit locations, these volumes are based on initial calculations based on assumptions for the Proposed Development. These calculations would be verified by detailed intrusive investigation at the proposed locations, post-consent. Calculations do not take into consideration the 'winning' of materials along the route. Each of the proposed borrow pits selected could be increased or decreased in size, depending on the aggregate requirements or following an assessment of the suitability of aggregate materials following detailed ground investigation.

The quality of rock anticipated on-site is inferred from a visual assessment of rock outcrops and published information. An intrusive ground investigation, sampling and material laboratory testing will be required to confirm ground condition.

Prior to the construction of the Proposed Development, design and best practices, and any required mitigation measures, would be set out in full within a Construction Environmental Management Plan (CEMP) and would be secured by an appropriately worded predevelopment condition of consent.

7 SEPA (2019), Guidance for Pollution Prevention (GPPs). Available at https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

8 Health and Safety Executive (2014), Health and Safety at Quarries, Quarries Regulations 1999, Approved Code of Practice and Guidance (Second Edition).

Figures

Technical Appraisal 8.4: Borrow Pit Appraisal

Vale of Leven Wind Farm

Vale of Leven Wind Farm Ltd

SLR Project No.: 405.13034.00001

27 September 2023

240000 241000 242000 243000 244000

681000 680000 679000 678000

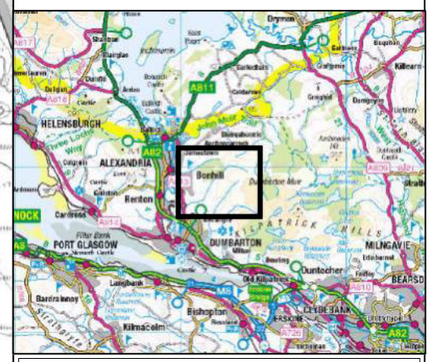
T01 T02 T03 T04 T05 T06 T07 T08 T09 T10

BP1 BP2 BP3

Application Boundary
Proposed Turbine Location
Proposed Access Track
Proposed Crane Pad
Proposed Substation
Proposed Construction Compound
Proposed Borrow Pit
Proposed LiDAR Unit Location

N

0 0.5 1 Kilometres



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VALE OF LEVEN WIND FARM

BORROW PIT REPORT

SITE LAYOUT

FIGURE 8.4.1

Scale 1:15,000 @ A3

Date JUNE 2023

13034.00001.0037.0 Site Layout

240000 241000 242000 243000 244000

681000 680000 679000 678000

T01 T02 T03 T04 T05 T06 T07 T08 T09 T10

Cairn (remains of)

Hill of Standing Stones

Knockshannoch

Auchenreoch Glen

Nobleston Wood

Pappert Hill 257

Meikle White Hill 353

Little White Hill

Glendonachy

Auchenreoch

Highdykes

Broomhill Wood

Beech Wood

Mains

Murroch

Murroch Glen

Hazel Glen

Grouse Butts

Black Craig

Black Wood

Round Wood

Quarry (dis)

Redburn

Bonhill

Braehead

Pappert

O'hare

Vale of Leven Golf Club

Maryland

Barr Wood

School

WEST DUNBARTONSHIRE

Waterfalls

Waterfall

Ford

Settling Ponds

Lang Dyke

Roughting Burn

Gallangad Burn

Doughnot 374 (375)

Black Linn Reservoir

N

0 0.5 1

Kilometres

LEGEND

- Application Boundary
- Proposed Turbine Location
- Proposed Access Track
- Proposed Crane Pad
- Proposed Substation
- Proposed Construction Compound
- Proposed Borrow Pit
- Proposed LiDAR Unit Location

Superficial Geology

- Alluvium - Clay, Silt, Sand and Gravel
- Glaciofluvial Deposits - Gravel, Sand and Silt
- Peat – Peat
- Raised Marine Deposits Of Holocene Age - Clay, Silt, Sand And Gravel
- Raised Marine Deposits, Devensian - Clay, Silt, Sand And Gravel
- Till, Devensian – Diamicton
- Bedrock at or Near Surface

VALE OF LEVEN WIND FARM

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VALE OF LEVEN WIND FARM

BORROW PIT REPORT

SUPERFICIAL GEOLOGY

FIGURE 8.4.2

Scale 1:15,000 @ A3

Date JUNE 2023

13034.00001.0038.0 Superficial Geology

240000 241000 242000 243000 244000

681000 680000 679000 678000

N

T01 T02 T03 T04 T05 T06 T07 T08 T09 T10

Cairn (remains of)

Hill of Standing Stones

Pappert Hill 257

Pappert Well

Lang Dyke

Nobleston Wood

Knockshannoch

Auchenreoch Muir

Hazel Glen

Auchenreoch Glen

Murroch Glen

Meikle White Hill 353

Little White Hill

Black Craig

Black Wood

Vale of Leven Golf Club

Woodside

Pappert

Bonhill

Braehead

Redburn

Highdykes

Glendonachy

Auchenreoch

Beech Wood

Broomhill Wood

Mains

Murroch

Maryland

Barr Wood

School

Round Wood Quarry (dis)

Black Linn Reservoir

Doughnot 374 (375)

WEST DUNBARTONSHIRE

0 0.5 1

Kilometres

LEGEND

- Application Boundary
- Proposed Turbine Location
- Proposed Access Track
- Proposed Crane Pad
- Proposed Substation
- Proposed Construction Compound
- Proposed Borrow Pit
- Proposed LiDAR Unit Location

Linear Features

- Back-Feature Marking Former Coastline, Arrowheads Denote Uphill Side
- Fault, Inferred, Crossmark On Downthrow Side, Throw In Metres

Solid Geology

CARBONIFEROUS

- Burncrooks Volcaniclastic Member - Tuff And Agglomerate
- Clyde Sandstone Formation - Sandstone
- Ballagan Formation - Argillaceous Rock, Dolostone And Sandstone

DEVONIAN

- Kinnesswood Formation - Limestone Nodular (Cornstone)
- Kinnesswood Formation – Sandstone
- Kinnesswood Formation - Silicate-Conglomerate - Calcite-Cemented (Calcrete)
- Stockiemuir Sandstone Formation – Sandstone

Igneous Geology

CARBONIFEROUS

- Central Scotland Late Carboniferous Tholeiitic Dyke Swarm - Quartz-Microgabbro
- Clyde Plateau Subsuite - Basaltic-Rock Plagioclase-Microphyric
- Clyde Plateau Subsuite - Basalt Olivine-Macrophyric
- Clyde Plateau Subsuite – Agglomerate
- Dinantian Dykes (Within Mcpad) - Basalt and Microgabbro
- Dinantian Dykes (Within Mcpad) - Basaltic-Rock Plagioclase-Microphyric
- Dinantian Dykes (Within Mcpad) - Basaltic-Rock - Plagioclase-Olivine-Clinopyroxene-M...

VALE OF LEVEN WIND FARM

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BORROW PIT REPORT

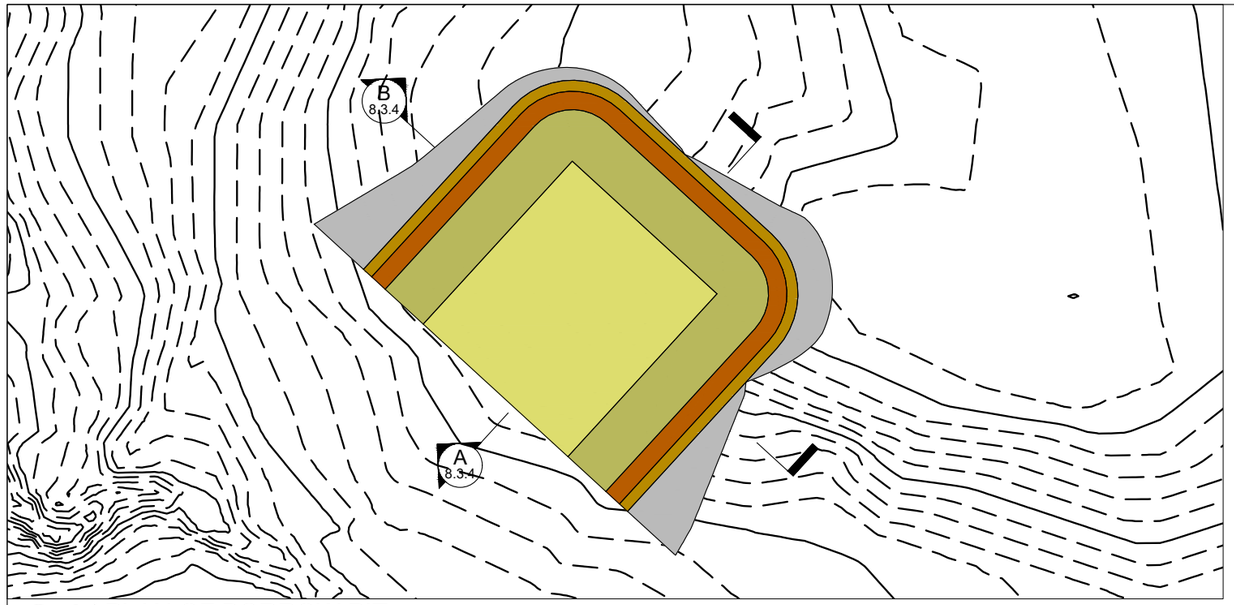
SOLID GEOLOGY

FIGURE 8.4.3

Scale 1:15,000 @ A3

Date JUNE 2023

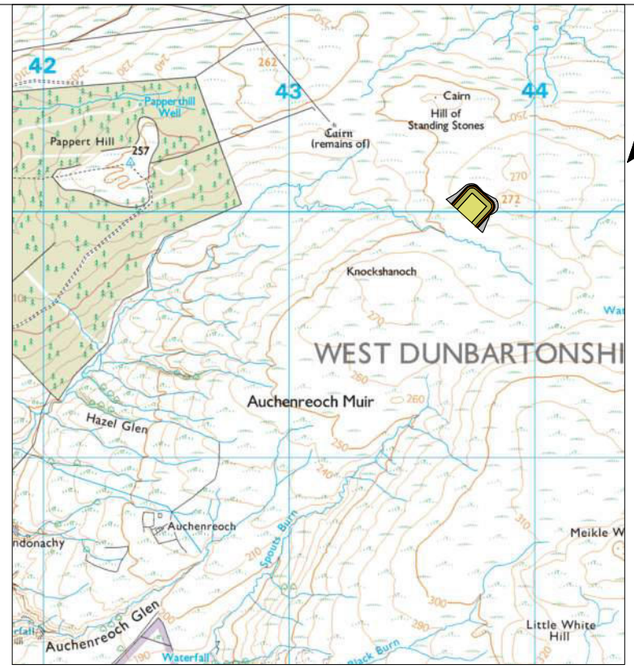
13034.00001.0039.0 Solid Geology



01 | PLAN OF BORROW PIT
SCALE: 1:2000

0 80m 200

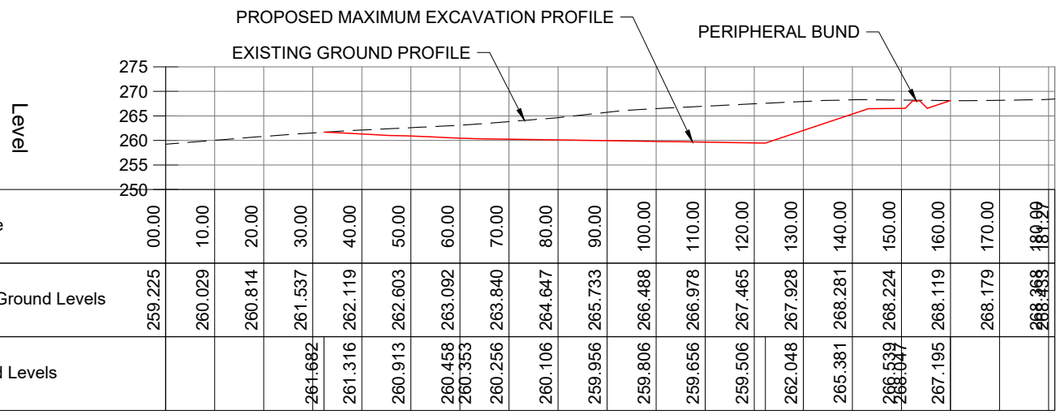
Metres 1:2500



02 | LOCATION PLAN
SCALE: 1:25000

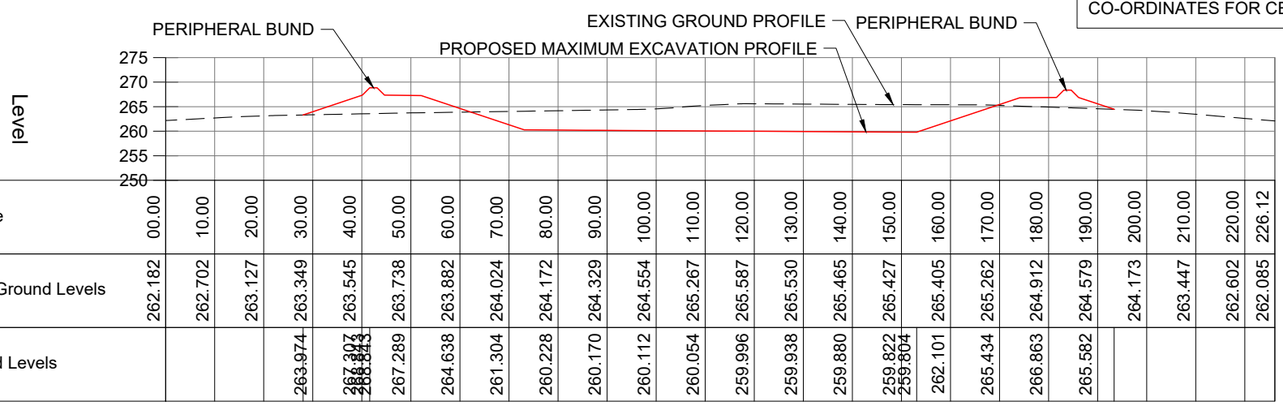
0 800m 2000

Metres 1:25,000



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	181.29
Existing Ground Levels	259.225	260.029	260.814	261.537	262.119	262.603	263.092	263.840	264.647	265.733	266.488	266.978	267.465	267.928	268.281	268.224	268.119	268.179	268.368	268.433
Proposed Levels				261.682	261.316	260.913	260.458	260.353	260.256	260.106	259.956	259.806	259.656	259.506	262.048	265.381	266.539	268.047	267.195	

SECTION A
Scale: H 1:1250,V 1:1250. Datum: 250.000



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	226.12
Existing Ground Levels	262.182	262.702	263.127	263.349	263.545	263.738	263.882	264.024	264.172	264.329	264.554	265.267	265.587	265.530	265.465	265.427	265.405	265.262	264.912	264.579	264.173	263.447	262.602	262.085
Proposed Levels				263.974	267.307	267.289	264.638	261.304	260.228	260.170	260.112	260.054	259.996	259.938	259.880	259.822	262.101	265.434	266.863	265.582				

SECTION B
Scale: H 1:1250,V 1:1250. Datum: 250.000

TOTAL EXCAVATION VOLUME	28,677m³
OVERBURDEN VOLUME	3,600m³
NET STONE VOLUME	25,077m³
PERIPHERAL BUND FILL	5,410m³
NET STONE TONNAGE	50,154T
EXCAVATION AREA	7,200m²
EXCAVATION METHOD REQUIRED	DIGGING, DRILLING AND BLASTING
INFERRED DESIGN PARAMETERS	63 DEGREE FACES THROUGH COMPETENT ROCK MAXIMUM FACE HEIGHT OF 8.2m FINAL BENCH WIDTH OF 7.5m 1.5m HIGH PERIPHERAL BUND
CO-ORDINATES FOR CENTRE OF BORROW PIT	E: 243737 N: 680019

0 10 20 30 40m 60 80 100

Metres 1:1250

NOTES

1. OVERBURDEN ASSUMED TO BE CIRCA 0.5m IN THICKNESS COMPRISING SOILS AND WEATHERED ROCK.
2. INITIAL STRIPPED OVERBURDEN TO BE PLACED IN PERIPHERAL BUND, WITH SUBSEQUENT OVERBURDEN AND WASTE MATERIALS TO BE STOCKPILED WITHIN FLAT BASAL AREA OF BORROW PIT PRIOR TO BEING USED IN RESTORATION.
3. DESIGN PARAMETERS ARE INDICATIVE AND SHOULD BE REFINED BASED UPON FINDINGS OF GROUND INVESTIGATIONS AND OR INITIAL EXCAVATIONS, TAKING INTO ACCOUNT GROUND CONDITIONS AND HYDROLOGICAL ISSUES.
4. ASSUMES INSITU CONVERSION FACTOR OF 2 TONNES PER m³.

LEGEND

- BENCH/BASE OF EXCAVATION
- EXCAVATION BATTER
- PERIPHERAL BUND
- BENCH
- EARTHWORK SLOPES

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VALE OF LEVEN WIND FARM

FOR INFORMATION

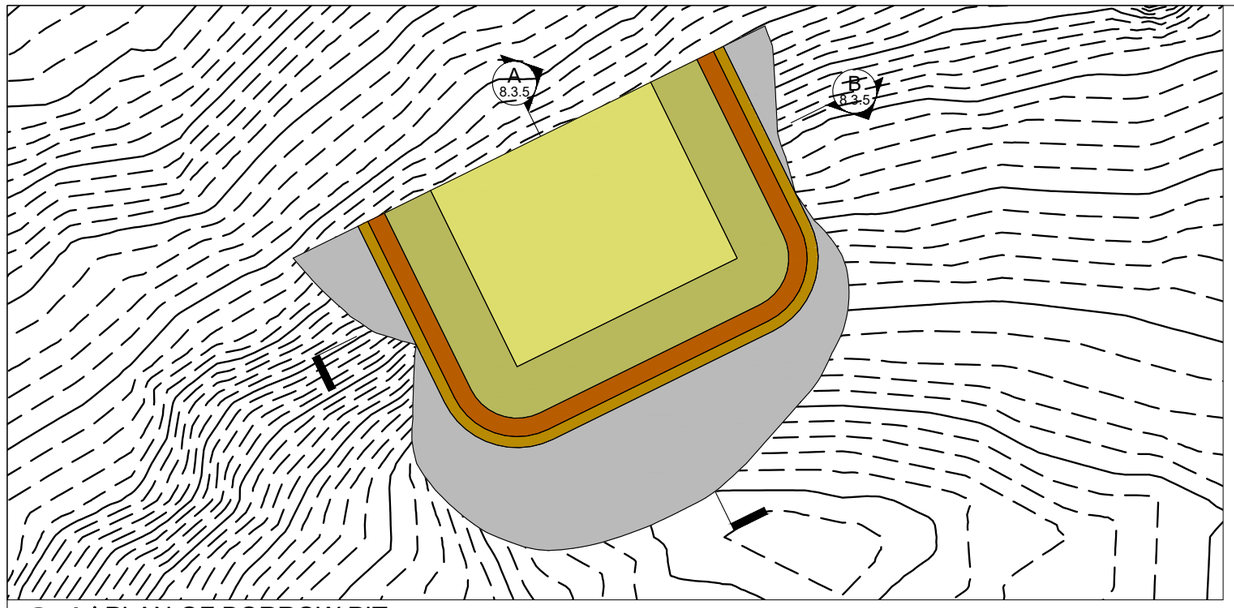
BORROW PIT 1

FIGURE 8.4.4

Scale: AS NOTED @ A3

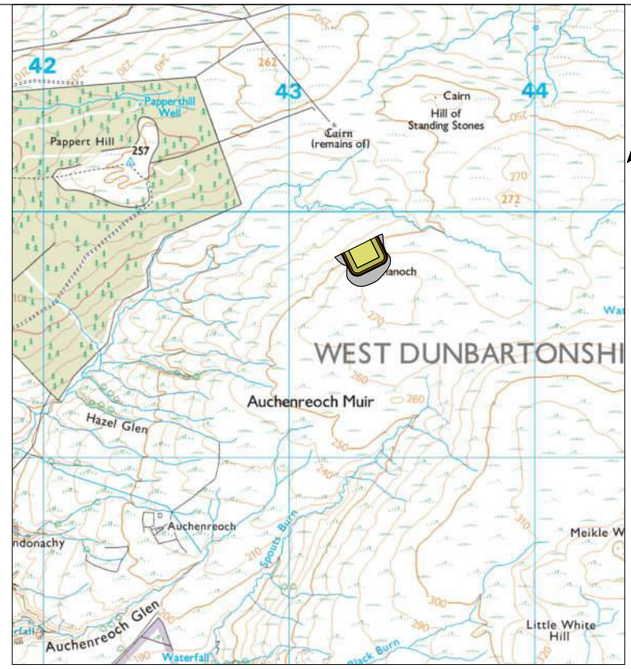
Date: JUNE 2023

8.3.4_Borrow_Pit_1.dwg



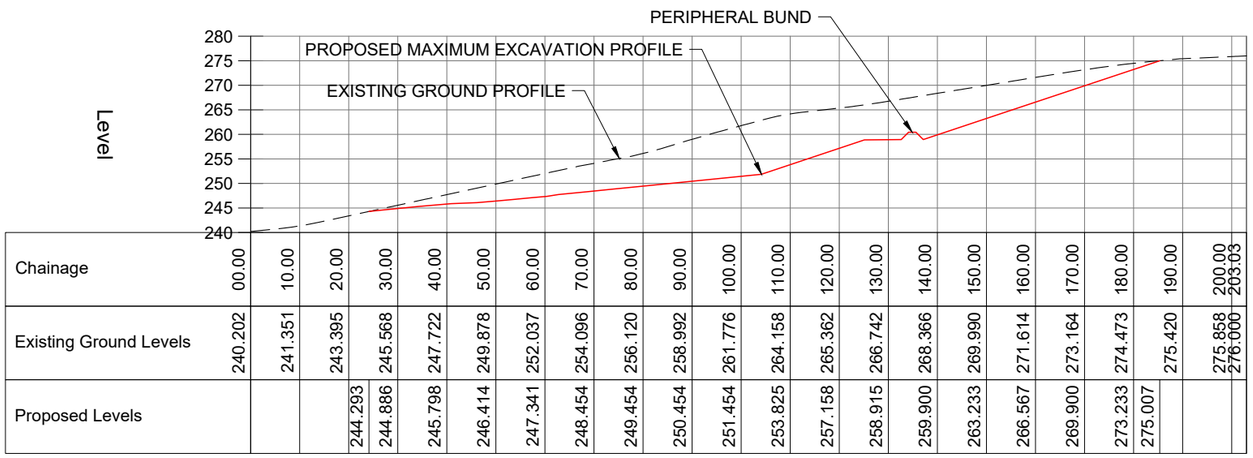
01 | PLAN OF BORROW PIT
SCALE: 1:2000

0 80m 200
Metres 1:2500



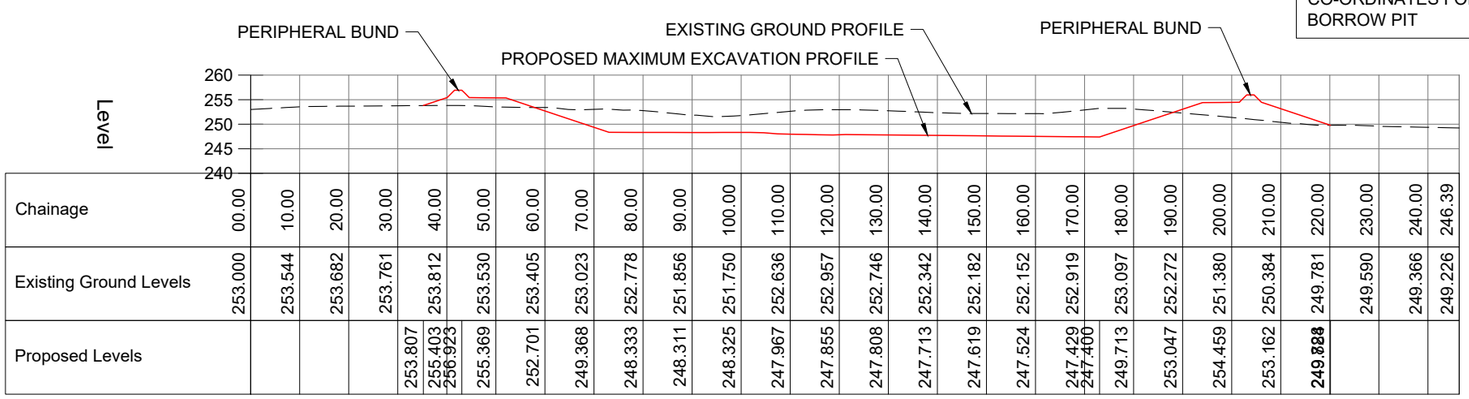
02 | LOCATION PLAN
SCALE: 1:25000

0 800m 2000
Metres 1:25,000



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	203.03
Existing Ground Levels	240.202	241.351	243.395	245.568	247.722	249.878	252.037	254.096	256.120	258.992	261.776	264.158	265.362	266.742	268.366	269.990	271.614	273.164	274.473	275.420	275.858	276.000
Proposed Levels				244.293	244.886	245.798	246.414	247.341	248.454	249.454	250.454	251.454	253.825	257.158	258.915	259.900	263.233	266.567	269.900	273.233	275.007	

SECTION A
Scale: H 1:1250,V 1:1250. Datum: 240.000



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	230.00	240.00	246.39
Existing Ground Levels	253.000	253.544	253.682	253.761	253.812	253.530	253.405	253.023	252.778	251.856	251.750	252.636	252.957	252.746	252.342	252.182	252.152	252.919	253.097	252.272	251.380	250.384	249.781	249.590	249.366	249.226
Proposed Levels					253.807 255.403 256.923	255.369	252.701	249.368	248.333	248.311	248.325	247.967	247.855	247.808	247.713	247.619	247.524	247.429 247.400	249.713	253.047	254.459	253.162	249.823			

SECTION B
Scale: H 1:1250,V 1:1250. Datum: 240.000

0 10 20 30 40m 60 80 100
Metres 1:1250

TOTAL EXCAVATION VOLUME	39,966m³
OVERBURDEN VOLUME	4,000m³
NET STONE VOLUME	35,966m³
PERIPHERAL BUND FILL	2,897m³
NET STONE TONNAGE	71,932T
EXCAVATION AREA	8,000m²
EXCAVATION METHOD REQUIRED	DIGGING, DRILLING AND BLASTING
INFERRED DESIGN PARAMETERS	63 DEGREE FACES THROUGH COMPETENT ROCK MAXIMUM FACE HEIGHT OF 11.1m FINAL BENCH WIDTH OF 7.5m 1.5m HIGH PERIPHERAL BUND
CO-ORDINATES FOR CENTRE OF BORROW PIT	E: 243296 N: 679832

NOTES

1. OVERBURDEN ASSUMED TO BE CIRCA 0.5m IN THICKNESS COMPRISING SOILS AND WEATHERED ROCK.
2. INITIAL STRIPPED OVERBURDEN TO BE PLACED IN PERIPHERAL BUND, WITH SUBSEQUENT OVERBURDEN AND WASTE MATERIALS TO BE STOCKPILED WITHIN FLAT BASAL AREA OF BORROW PIT PRIOR TO BEING USED IN RESTORATION.
3. DESIGN PARAMETERS ARE INDICATIVE AND SHOULD BE REFINED BASED UPON FINDINGS OF GROUND INVESTIGATIONS AND OR INITIAL EXCAVATIONS, TAKING INTO ACCOUNT GROUND CONDITIONS AND HYDROLOGICAL ISSUES.
4. ASSUMES INSITU CONVERSION FACTOR OF 2 TONNES PER m³.

LEGEND

- BENCH/BASE OF EXCAVATION
- EXCAVATION BATTER
- PERIPHERAL BUND
- BENCH
- EARTHWORK SLOPES

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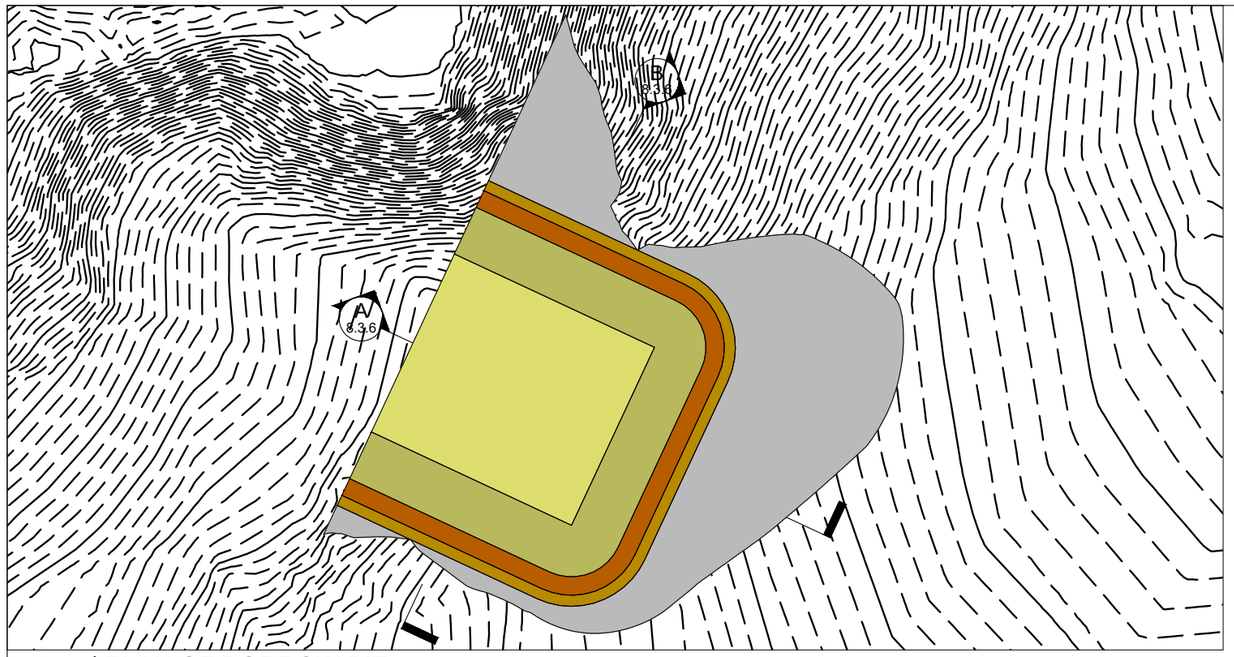
FOR INFORMATION

BORROW PIT 2

FIGURE 8.4.5

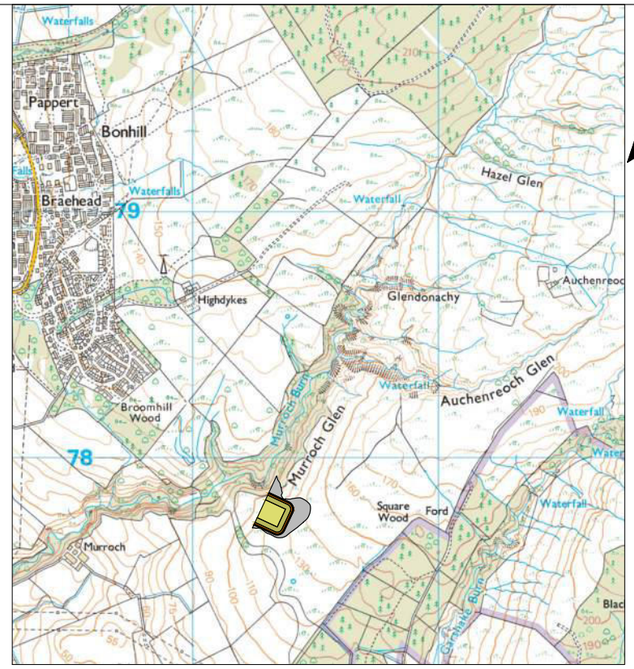
Scale: AS NOTED @ A3
Date: JUNE 2023

8.3.5_Borrow_Pit_2.dwg



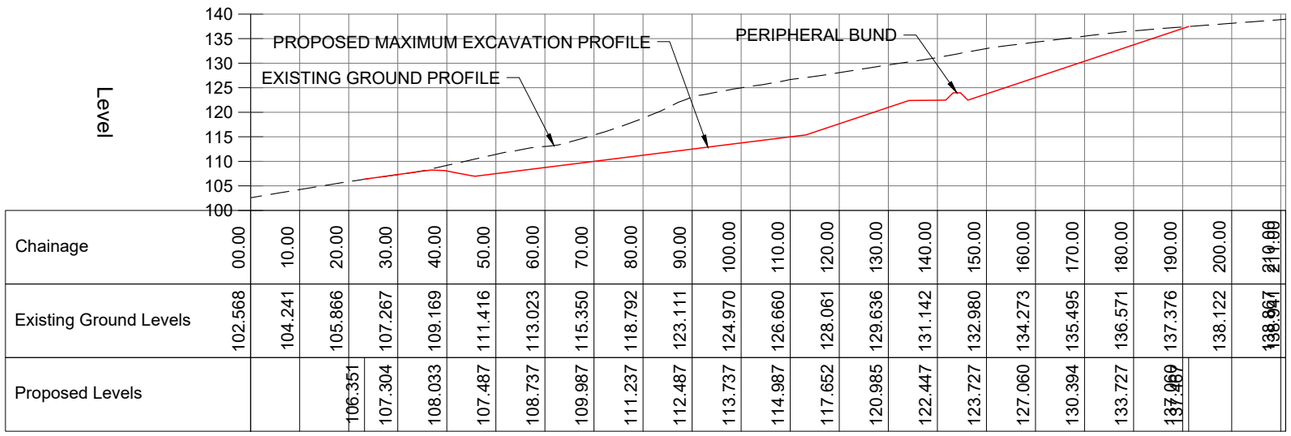
01 | PLAN OF BORROW PIT
SCALE: 1:2000

0 80m 200
Metres 1:2500



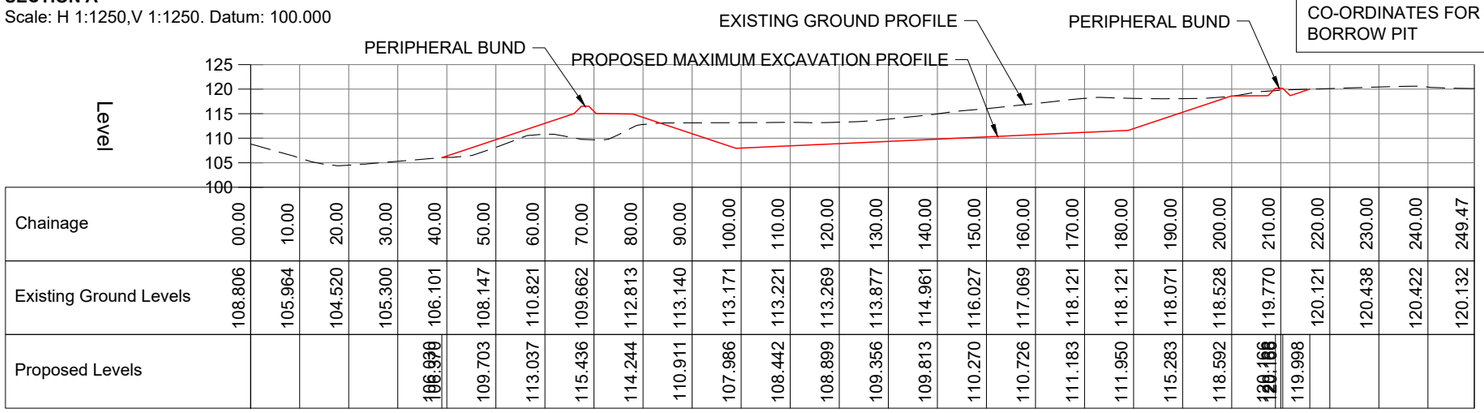
02 | LOCATION PLAN
SCALE: 1:25000

0 800m 2000
Metres 1:25,000



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00
Existing Ground Levels	102.568	104.241	105.866	107.267	109.169	111.416	113.023	115.350	118.792	123.111	124.970	126.660	128.061	129.636	131.142	132.980	134.273	135.495	136.571	137.376	138.122	138.867
Proposed Levels			106.351	107.304	108.033	107.487	108.737	109.987	111.237	112.487	113.737	114.987	117.652	120.985	122.447	123.727	127.060	130.394	133.727	137.060		

SECTION A
Scale: H 1:1250,V 1:1250. Datum: 100.000



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	230.00	240.00	249.47
Existing Ground Levels	108.806	105.964	104.520	105.300	106.101	108.147	110.821	109.662	112.813	113.140	113.171	113.221	113.269	113.877	114.961	116.027	117.069	118.121	118.121	118.071	118.528	119.770	120.121	120.438	120.422	120.132
Proposed Levels					106.930	109.703	113.037	115.436	114.244	110.911	107.986	108.442	108.899	109.356	109.813	110.270	110.726	111.183	111.950	115.283	118.592	120.166	119.998			

SECTION B
Scale: H 1:1250,V 1:1250. Datum: 100.000

0 10 20 30 40m 60 80 100
Metres 1:1250

TOTAL EXCAVATION VOLUME	45,051m³
OVERBURDEN VOLUME	3,600m³
NET STONE VOLUME	41,451m³
PERIPHERAL BUND FILL	3,685m³
NET STONE TONNAGE	82,902T
EXCAVATION AREA	7,200m²
EXCAVATION METHOD REQUIRED	DIGGING, DRILLING AND BLASTING
INFERRED DESIGN PARAMETERS	63 DEGREE FACES THROUGH COMPETENT ROCK MAXIMUM FACE HEIGHT OF 11.7m FINAL BENCH WIDTH OF 7.5m 1.5m HIGH PERIPHERAL BUND
CO-ORDINATES FOR CENTRE OF BORROW PIT	E: 241322 N: 677772

NOTES

1. OVERBURDEN ASSUMED TO BE CIRCA 0.5m IN THICKNESS COMPRISING SOILS AND WEATHERED ROCK.
2. INITIAL STRIPPED OVERBURDEN TO BE PLACED IN PERIPHERAL BUND, WITH SUBSEQUENT OVERBURDEN AND WASTE MATERIALS TO BE STOCKPILED WITHIN FLAT BASAL AREA OF BORROW PIT PRIOR TO BEING USED IN RESTORATION.
3. DESIGN PARAMETERS ARE INDICATIVE AND SHOULD BE REFINED BASED UPON FINDINGS OF GROUND INVESTIGATIONS AND OR INITIAL EXCAVATIONS, TAKING INTO ACCOUNT GROUND CONDITIONS AND HYDROLOGICAL ISSUES.
4. ASSUMES INSITU CONVERSION FACTOR OF 2 TONNES PER m³.

LEGEND

- BENCH/BASE OF EXCAVATION
- EXCAVATION BATTER
- PERIPHERAL BUND
- BENCH
- EARTHWORK SLOPES

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VALE OF LEVEN WIND FARM

FOR INFORMATION

BORROW PIT 3

FIGURE 8.4.6

Scale: AS NOTED @ A3
Date: JUNE 2023

8.3.6_Borrow_Pit_3.dwg

Annex A. Materials Calculator

Technical Appraisal 8.4: Borrow Pit Appraisal

Vale of Leven Wind Farm

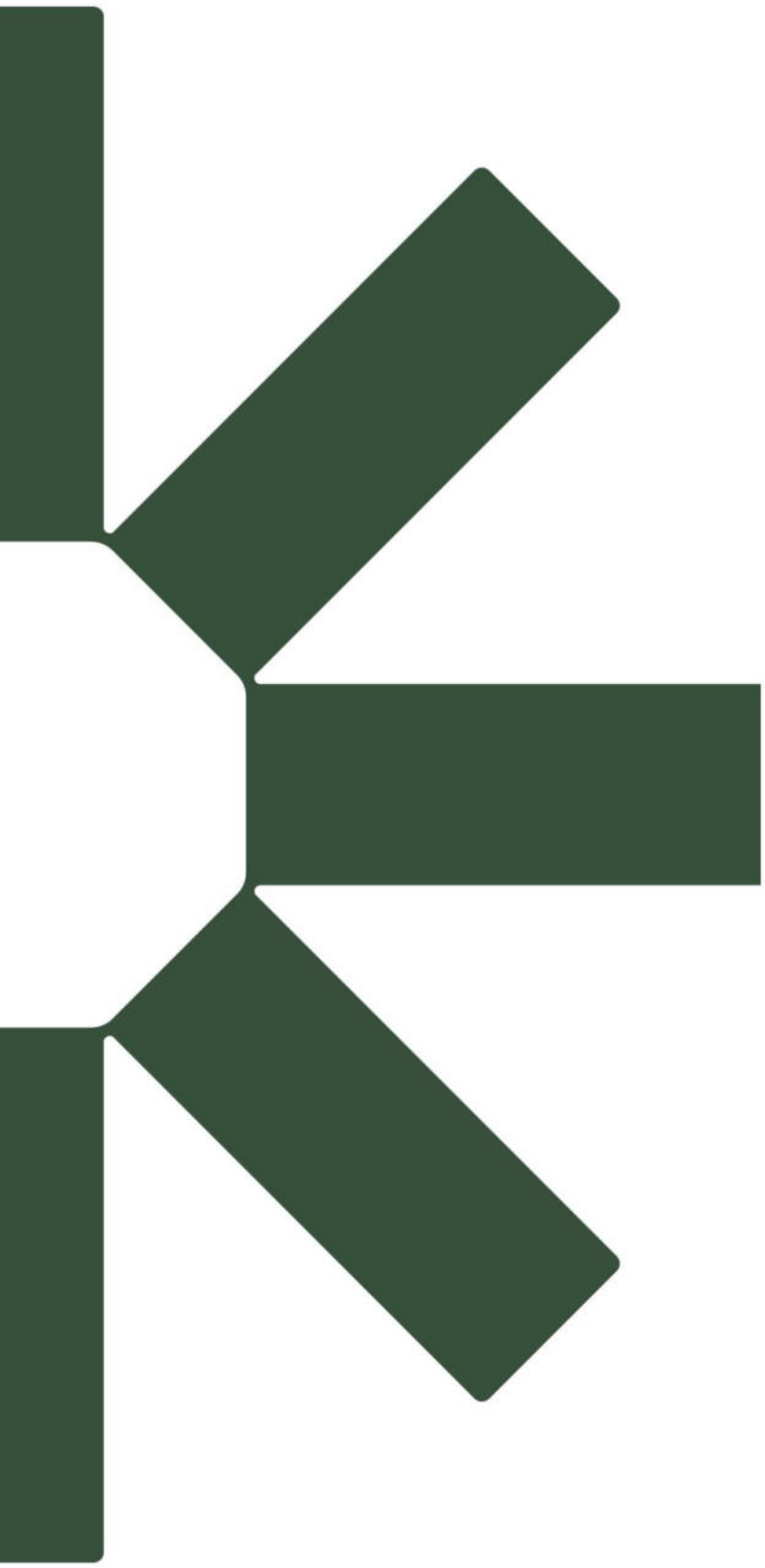
Vale of Leven Wind Farm Ltd

SLR Project No.: 405.13034.00001

27 September 2023

Infrastructure	Length (m)	Width (m)	Area (m^2)	Thickness m	Number	Volume m3	Final Volume m3	Notes:
Site Track (Excavated)	8746	6	52476	0.5	1	26238	26238	Assumes average 6m width
Turning Heads	-	-	543	0.5	6	1629	1629	
Turbine Bases - formation only	-	-	615	0.5	10	3075	3075	
Fill above Turbine Bases	-	-	804	2	10	16077	9577	Less volume of bases 10*650m3 =6500m3
Hardstandings	-	-	7800	0.5	10	39000	39000	
Substation	100	75	7500	1	1	7500	7500	
Main Construction Compound	100	100	10000	0.5	1	5000	5000	
Satellite Construction Compound North	30	30	900	0.5	1	450	450	
Satellite Construction Compound South	17	18	306	0.5	1	153	153	
TOTAL REQUIREMENT						99122	92622	All volume measurements in m^3

Potential Volume of Rock to be sourced on site	
BP1	25,077
BP2	35,966
BP3	41,451
Total Volume from Site	102,494
Import requirements (shortfall)	-9872
Total import	-9872
plus 10% contingency	-10859



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