Pell Frischmann

# Lynemore Wind Farm

## Technical Appendix 8.8: Borrow Pit Assessment

March 2025

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|---|---|---|---|---|---|---|
| **Report Ref.** | | **10109815 Lynemore Borrow Pit Assessment (GG Checked)** | | | | |
| **File Path** | | **https://pellf-my.sharepoint.com/personal/mevans_pellfrischmann_com/Documents/Desktop/Lynemore Borrow Pit/10109815 Lynemore Borrow Pit Assessment (GG checked).docx** | | | | |
| **Rev** | **Suit** | **Description** | **Date** | **Originator** | **Checker** | **Approver** |
| 01 | | Initial Issue | 20/03/2025 | S McLeod | S McLeod | S McGarva |
| 02 | | Second Issue | 24/03/2025 | S McLeod | S McLeod | S McGarva |
| Ref. reference. Rev revision. Suit suitability. | | | | | | |

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# 1 Introduction

## 1.1 Purpose of the Report

Pell Frischmann (PF) has been commissioned by the Applicant to undertake a Borrow Pit Assessment associated with the construction and development of Lynemore Wind Farm (the Proposed Development), located southeast of Inverness.

This Borrow Pit Assessment forms an appendix to the Environmental Impact Assessment (EIA) Report for the Proposed Development. The report is intended to identify potential areas of material extraction and summarise the good practice measures that will be implemented during the extraction of materials from the Site.

Detailed proposals for such measures will be documented prior to construction and will provide the same or greater provision in terms of protecting the water environment as those described in this document. The measures are proportionate to the risk and, where greater risk is highlighted at specific locations prior to construction, specific measures would be agreed at that time.

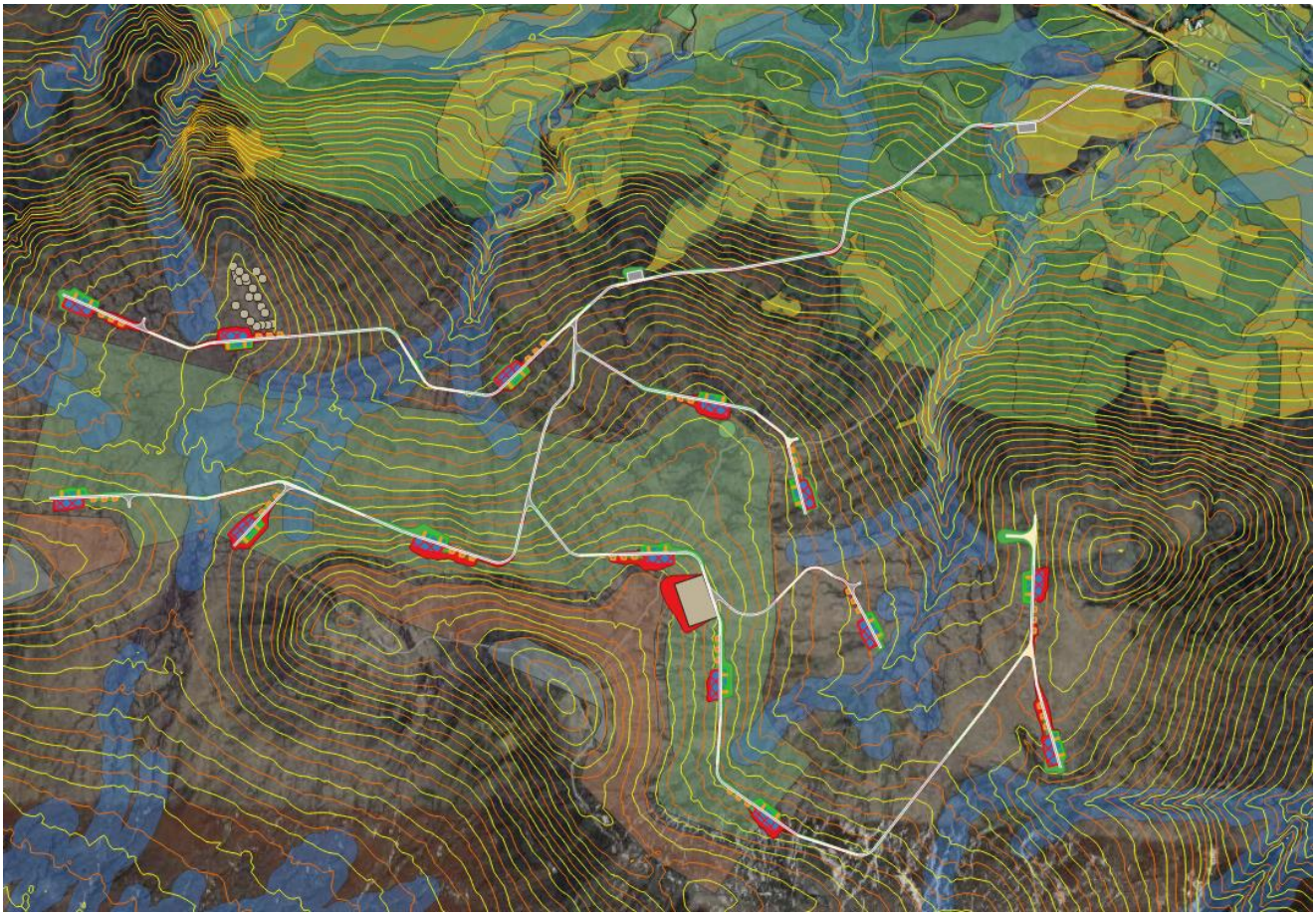
It should be noted that no intrusive geotechnical investigation or testing has been carried out at this stage.

# 2 Site Location and Overview

This report addresses the borrow pit requirement for construction of the Proposed Development. The Site is approximately centred on National Grid Reference NH 74632 32773.

A full description of the Site components is provided in Chapter 2: Proposed Development of the EIA Report whilst the Site layout is presented in image 1 below.

**Image 1: Site Layout**



The topography is variable with undulating terrain across most of the Site which include several steep slopes, generally located in the vicinity of watercourses.

Ordnance Survey mapping indicates the levels increase across the site from 300m above ordnance datum (AOD) at the site entrance to a high of 550m AOD in the southeast of the wind farm.

The Proposed Development comprises of 14 wind turbines, a substation, a battery storage facility, two temporary construction compounds, approximately 13.1km of proposed site tracks and other ancillary infrastructure.

The proposed infrastructure requires a large quantity of graded crushed rock fill material that will be sourced from borrow pits on the Site rather than being imported, thus reducing HGV movements on the public road network.

This borrow pit assessment is based on both Superficial and Bedrock 1:50k mapping available from the British Geological Survey (BGS).

# 3 Geology and Hydrogeology

This section summarises the geological and hydrogeological conditions on Site and should be read in conjunction with *Chapter 8: Geology, Hydrology, Hydrogeology and Peat* of the EIA Report for more detail.

## 3.1 Superficial

Review of the 1:50,000 scale British Geological Survey (BGS) map indicates the dominant superficial deposits within the red line boundary to be Devensian to Diamicton Glacial Till at lower level to the north and Quaternary Peat at higher level to the south of the boundary extents.

In the wider area, Quaternary Alluvium, Alluvial Fan and River Terrace deposits, Pleistocene Glacial Head Deposits, Pleistocene Glaciofluvial Ice Contact Deposits, Pleistocene Glaciofluvial Sheet Deposits and Pleistocene Hummocky (Moundy) Glacial Deposits are also all shown. These deposits (and a trend towards increased complexity of superficial deposition) are generally focused around the valley floor to the northeast and various tributary valleys on the surrounding hill sides.

Based on stratigraphic sequence, it is considered that the widely present Glacial Till was first deposited during an earlier phase of glaciation and generally other localised glacial deposits were then deposited during a later phase of glaciation. The Peat and Alluvial deposits are post glacial and not yet subject to glacial loading and unloading (i.e. normally consolidated).

At the borrow pit location (towards the summit of Carn na h-Easgainn/broadly on the summit plateau and away from the hill sides), the superficial deposits are shown to be predominantly Quaternary Peat with underlying Glacial Till deposits that are also shown where Peat is locally not present.

It is therefore considered likely that, at the location of the borrow pit, Peat will be encountered from surface underlain by Glacial Till deposits. It is not known if the Glacial Till deposits in this area are typically granular or cohesive, although BGS historic boreholes present in the valley to the northeast on areas recorded on the BGS mapping as being underlain by Glacial Till typically indicate these deposits to be granular.

The thickness and composition of these deposits is unconfirmed although, based on the site's relatively elevated location towards the summit of Carn na h-Easgainn (where bedrock is shown to be present from surface) and likely greater exposure to erosion rather than depositional processes, substantial thicknesses superficial deposits are not anticipated bedrock.

Review of the 1:50,000 scale British Geological Survey (BGS) map indicates the superificial deposits to be underlain by solid metamorphic deposits of the Tonian Dava Subgroup of the Badenoch Group. The BGS lithological description describes the Badenoch Group as including:

> *'.. metasedimentary rocks, mainly psammites and semipelites (Dava and Glen Banchor subgroups) that are generally gneissose and migmatitic or locally non-migmatitic, some gneissose quartzites and garnetiferous semipelitic gneiss with associated minor metamafic rocks. Major rock type(s): gneissose psammite and semipelite, migmatitic psammite and semipelite. Subsidiary rock type(s): schistose semipelite, micaceous psammite, quartzite. Trace rock type(s): garnetiferous migmatitic semipelite, feldspathic psammite, metadolerite, metagabbro'.*

The BGS lithological description describes the Tonian Dava Subgroup as a:

> *'Heterogenous succession of predominantly gneissose psammite, semipelite and subordinate quartzite.'*

## 3.2 Suitability of Bedrock as Aggregate

The primary use of the aggregate extracted from borrow pits will be for the construction of tracks using unbound aggregate, with further aggregate required for construction of hardstandings, crane pads, substation, BESS and construction compounds.

The thickness of Peat deposits across the identified borrow pit has an average depth of 0.9m, although it is considered highly likely that any of these deposits won from excavations will be unsuitable for reuse. The thickness and composition of any underlying Glacial Till deposits is also not known although, as discussed in the previous section, the Till is typically granular further down the valley to the northeast. Glacial Tills are commonly suitable for reuse as general earthwork material and, if granular and subject to processing, potentially also suitable as capping material.

It is considered that any underlying solid deposits of Psammite (a metasedimentary/metamorphic sandstone) may be suitable for processing to an aggregate for hardstanding subject to testing and confirmation of low mica content/lack of argillaceous properties.

It is also considered that any underlying deposits of Semi-pelite (a metasedimentary/metamorphic siltstone or mudstone) may also be suitable for reuse, although because of a greater potential for the material to be argillaceous/micaceous, the material may potentially be considered suitable as general earthwork fill but not capping material.

Geotechnical investigation and testing will be required to establish that material won from the proposed borrow pit would be suitable for its intended purpose as an aggregate to form areas of unbound pavement.

## 3.3 Hydrogeology

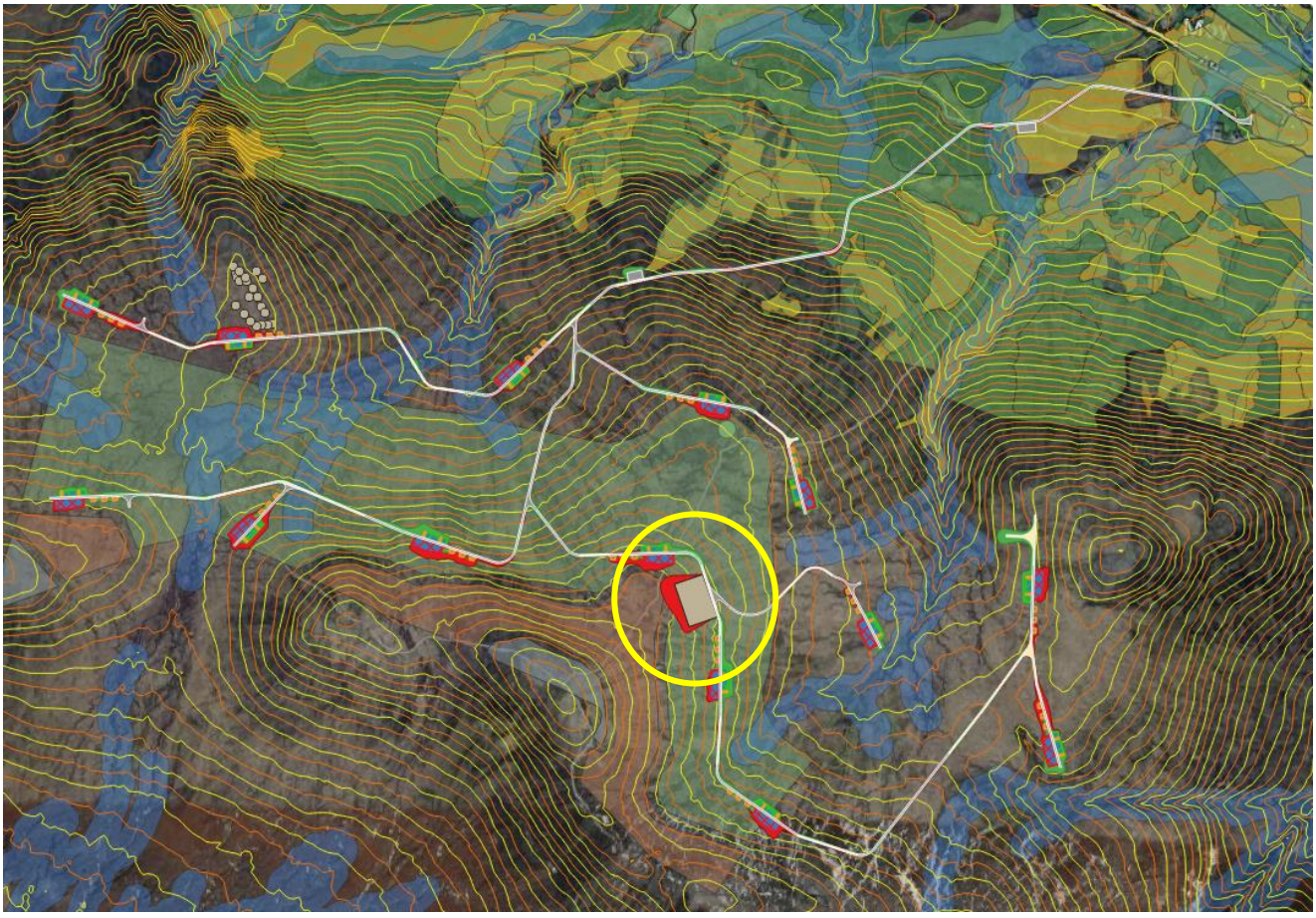
Bedrock underlying the Site is classified as a low productivity aquifer with small amounts of groundwater in the near surface weathered zone and secondary features.

# 4 Borrow Pit Design

## 4.1 Borrow Pit Siting

1No. borrow pit is proposed for the development. The location of the proposed borrow pit is shown in Image 2 below.

**Image 2: Proposed Borrow Pit Location**



The proposed borrow pit location has been selected taking due consideration of the known environmental constraints within the Site.

The proposed borrow pit general arrangement and cross sections can be found in Appendix A.

## 4.2 Material Requirement Calculations

Due to the length of the proposed access track network (13.1km), combined with the proposed ancillary infrastructure, a large volume of material is required. As indicated in Section 3, the geology of the Site indicates that the material extracted should be suitable for use in construction of the infrastructure required.

The estimated calculations, summarised in Table 1 below take into account the proposed access tracks, turbine hardstandings, substation extension and construction compounds.

**Table 1 Estimated Material Requirements**

| Design Element | Proposed Construction Thickness (m) | Total Area ($m^2$) | Volume ($m^3$) |
|---|---|---|---|
| Cut track | 0.5 | 57,820 | 28,910 |
| Floating track | 0.8 | 23,801 | 19,041 |

| | | | |
|---|---|---|---|
| Turbine hardstanding | 0.7 | 77,742 | 54,419 |
| Substation & BESS | 0.7 | 15,000 | 10,500 |
| Construction compound 1 & 2 | 0.5 | 3,300 | 1,650 |
| | | **TOTAL VOLUME:** | **116,520** |

## 4.3 Borrow Pit Calculations

An estimate of the material generation from each of the borrow pits is presented in Table 2 below.

**Table 2 Borrow Pit Material Generation**

| **Parameter** | **Borrow Pit 1** |
|---|---|
| Approximate coordinates | *NH 74831 32414* |
| Total footprint ($m^2$) | 25,208 |
| Cut volume (from Civil3D) ($m^3$) | 192,000 |
| **-25% volume reduction coefficient** | **144,000$m^3$** |

The calculated material volume extracted from each borrow pit has been reduced by a factor of 0.75 in order to account for poor recovery, dilution, increased superficial cover and areas of unsuitable/poor strata as well as cut/fill inaccuracies and the conceptual status of design.

Further detailed design will allow track and hardstanding level variations to be designed for and the true cut & fill quantities to be calculated.

The high-level calculations in Table 2 indicate that the proposed borrow pit will provide the volume of material required to construct the on-site infrastructure (as per Table 1). A summary of the calculations is included in Appendix A.

## 4.4 Borrow Pit Reinstatement

Once excavated the borrow pit will become the onsite substation and BESS platform. An indicative layout of the substation and BESS is shown in Appendix B. Scottish Environment Protection Agency (SEPA) guidelines[1] state that complete infilling of borrow pits should not be undertaken as loose or unstable infill can pose a risk to walkers and animal life.

## 4.5 Borrow Pit Drainage

A Sustainable Drainage System (SuDS) scheme will be designed and installed for the borrow pits. The SuDS system should follow the SuDS management train as defined in The SuDS Manual[2].

It is anticipated the arrangements will include a high-level clean water cut-off drain at the crest of the excavation slope to divert existing runoff around the excavation area and maintain hydraulic continuity. The borrow pit will also be graded to allow positive drainage within the excavation area. Runoff from this area will be conveyed to SuDS features to allow removal of sediment and silt prior to discharge to match pre-development arrangements.

[1] *Restoration Techniques Using Peat Spoil From Construction Works*
[2] *CIRIA C753, The SuDS Manual, Version 6, 2018*

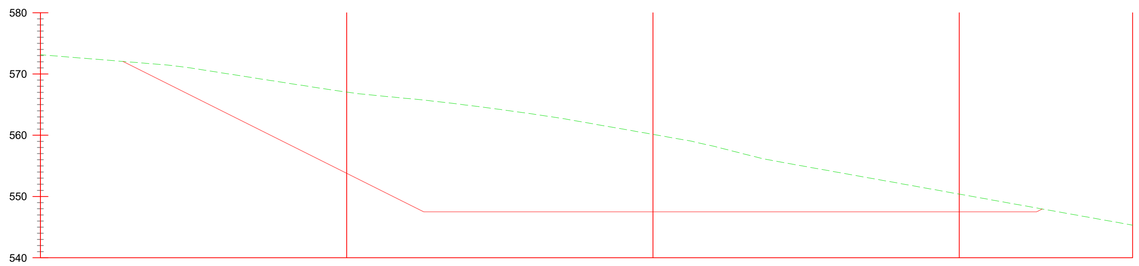
# 5 Conclusion

The borrow pit identified has been sited with due considerations of environmental constraints and designations. Approximate borrow pit dimensions and potential material extraction volumes have been estimated alongside material requirements for construction of infrastructure. It is estimated that a total material volume of approximately 144,000m$^3$ could be extracted, with an estimated 116,520m$^3$ required for construction, meaning it is likely that no material import will be required to construct the Proposed Development.

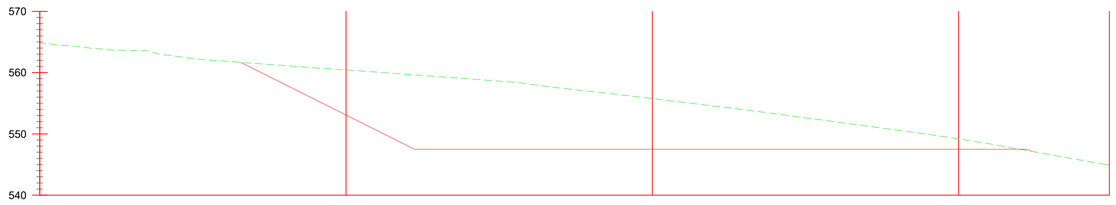
Detailed ground investigations, slope stability assessments and geotechnical testing will be required to inform the detailed design of the borrow pits.

A detailed Borrow Pit Assessment will then be prepared post consent, this document will provide further detail on working methods and environmental management measures.

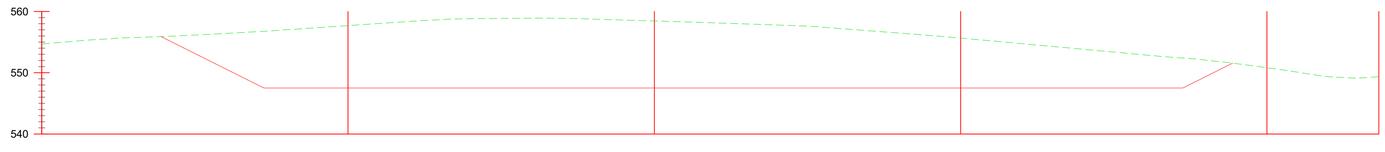
# Appendix A


SECTION A-A




SECTION B-B




SECTION C-C



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Client

GALILEO EMPOWER

RSK

Project

TYPICAL CONSTRUCTION COMPOUND

Drawing Title

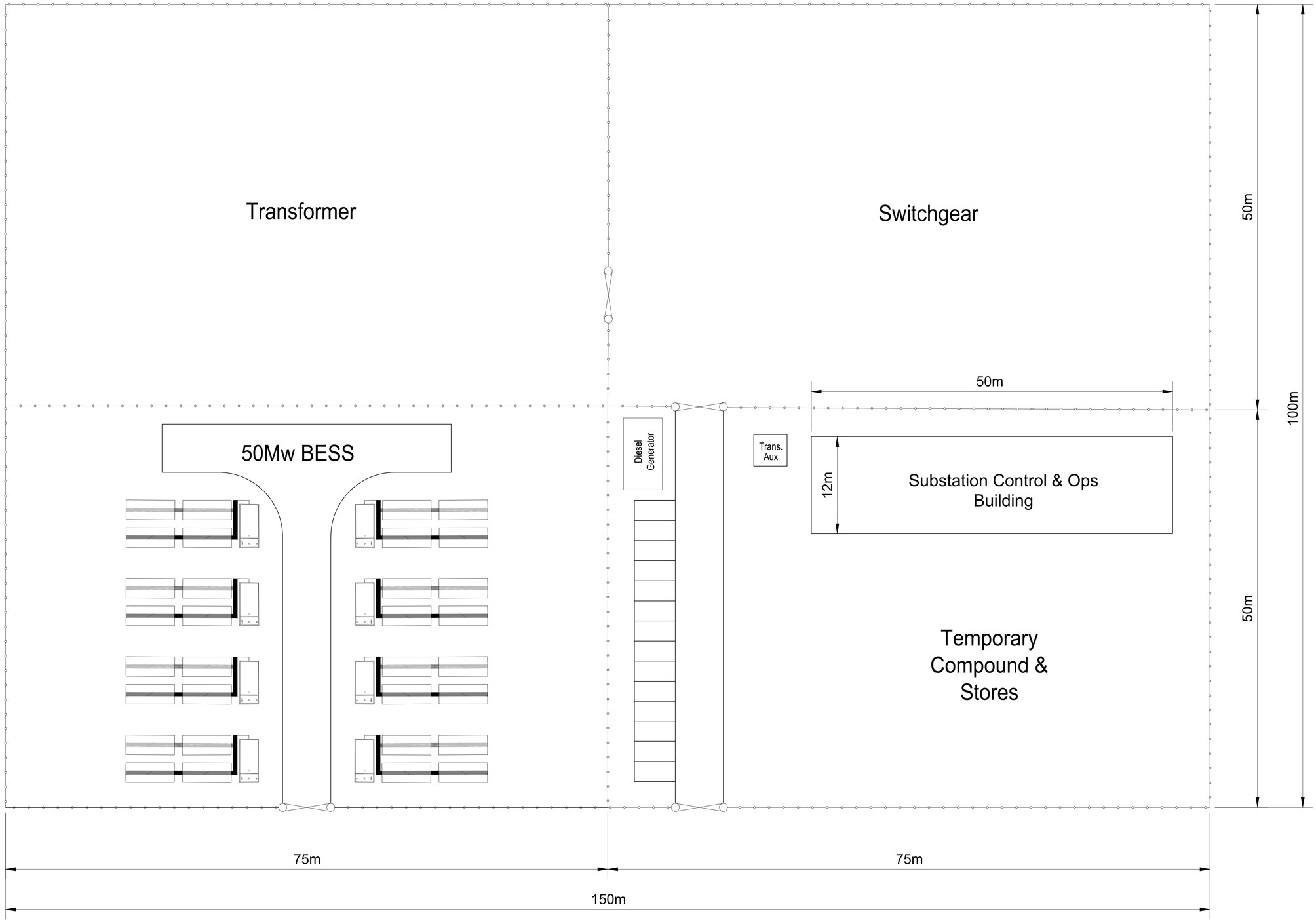
PROPOSED BORROW PIT
GENERAL ARRANGEMENT AND
CROSS SECTIONS

| | Name | Date | |
|---|---|---|---|
| Designed | SMcL | 18.03.2025 | Scale 1:500 |
| Checked | SMcL | 18.03.2025 | File Lynemore Borrow Pit |
| | | | Drawing Status DRAFT |

Drawing No. SK_0001

Revision P01

# Appendix B




NOTE:

1. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION FOR HIGHWAY WORKS AND THE TURBINE MANUFACTURERS STANDARDS AND ALL RELEVANT DRAWINGS WITHIN THE PROJECT DESIGN PACKAGE.
2. ALL WORKS TO BE EXECUTED IN ACCORDANCE WITH THE DMRB, THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, DESIGN MANUAL FOR ROADS AND BRIDGES, AND TRAFFIC SIGNS MANUAL.
3. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE. ALL LEVELS ARE IN METRES AND RELATE TO ORDNANCE DATUM.
4. DO NOT SCALE FROM ANY DRAWING. WORK TO FIGURED DIMENSIONS ONLY. ANY DISCREPANCIES IN DIMENSIONS ARE TO BE REFERRED TO THE DESIGNER BEFORE WORK IS PUT TO HAND.
5. ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO PREPARING ANY WORKING DRAWINGS OR COMMENCING ON SITE.
6. ALL WORKS BY THE CONTRACTOR MUST BE CARRIED OUT IS SUCH A WAY THAT ALL REQUIREMENTS UNDER THE HEALTH AND SAFETY AT WORK ACT ARE SATISFIED.
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KEY:

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Client

GALILEO EMPOWER RSK

Project

LYNEMORE WIND FARM

Drawing Title

TYPICAL ONSITE SUBSTATION & BESS LAYOUT

| | Name | Date |
|---|---|---|
| Designed | JS | 16.01.2025 |
| Checked | SM | 16.01.2025 |

Scale: NTS @ A1
File: Lynemore Construction Details
Drawing Status: DRAFT
Drawing No.: FIGURE 2.13
Revision: P1