Technical Appendix

Lairdmannoch Energy Park

Technical Appendix 3-1: Borrow Pit Appraisal

Lairdmannoch Energy Park Limited

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GDG
GAVIN & DOHERTY
GEOSOLUTIONS

Lairdmannoch Energy Park Preliminary Borrow Pit Appraisal

atmos
CONSULTING

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DISCLAIMER

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1 INTRODUCTION

1.1 GENERAL

Gavin and Doherty Geosolutions UK Ltd. (GDG) was commissioned to undertake an assessment of potential locations for the rock extraction associated with the proposed energy park at Lairdmannoch, Dumfries and Galloway. The proposed development (the Site) is located 10km west of Castle Douglas from the centre of the Site and is at the approximate National Grid Reference. The Site Location Plan is shown in Figure 1-1.

The proposed development comprises up to 9 wind turbines, ground-mounted solar panels and battery storage. The development will have a total installed capacity of approximately 100MW. The development will also comprise the construction of associated services and access infrastructure.

Scottish Planning Policy (paragraph 243) states that *"borrow pits should only be permitted if there are significant environmental or economic benefits compared to obtaining material from local quarries, they are time-limited, tied to a specific project, and appropriate reclamation measures are in place."* In the case of the Proposed Development, onsite borrowing of rock provides significant environmental benefits, as the traffic volume on local roads would be significantly decreased due to the reduction in demand for imported materials.

The purpose of the assessment is to identify suitable locations for borrow pits that are proposed to supply aggregate material necessary for the proposed development.

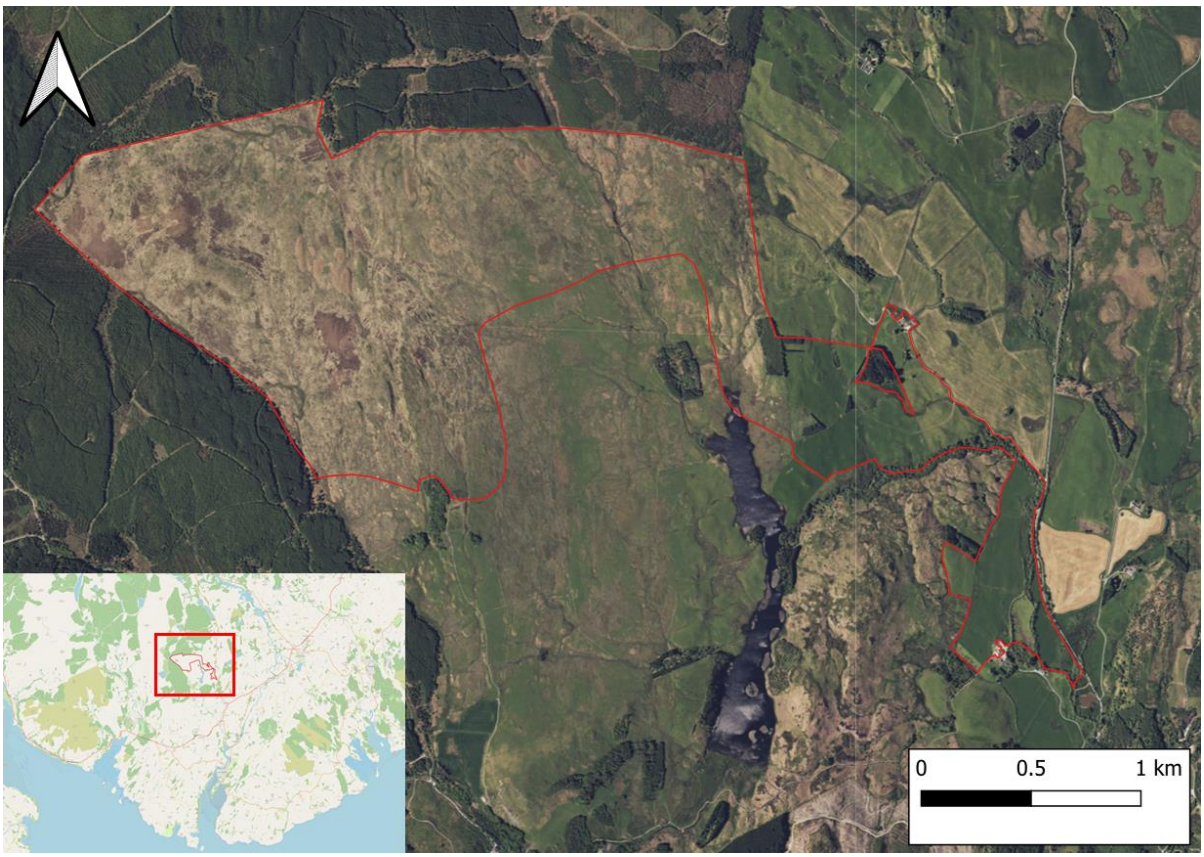


Figure 1-1: Site Location Plan and Boundary

1.2 SCOPE OF REPORT

The Preliminary Borrow Pit Appraisal (BPA) for the proposed development has been prepared to identify potential rock source areas within the Site required for the construction of the energy park.

The objectives of the appraisal are to:

- Assess a potential area for the extraction of rock;
- Identify overlying potential superficial soils;
- Identify underlying rock types; and,
- Provide an estimate of the available aggregate from the source location.

The criteria used to identify Borrow Pit Search Areas include anticipated rock quality, and environmental and physical constraints and discussed in detail in Section 3.2. No site investigation data is currently available for the bedrock geology and superficial soils, so intrusive investigations and earthworks testing will be required to confirm the suitability of the borrow pit locations.

The anticipated rock quality at these locations has been assessed based on available literature and knowledge of typical rock characteristics found on the Site. The final extent and volume of material to be extracted from each location will be determined following an intrusive ground investigation, which will be required if the Proposed Development is granted planning consent.

The borrow pit assessment does not take into consideration peat stability, and for details of this reference should be made to EIA Appendix 8-1, Peat Landslide Hazard Risk Assessment.

2 SITE DESCRIPTION

2.1 GEOGRAPHY, TOPOGRAPHY AND LAND USE

The Proposed Development is located on land northeast of Gatehouse of Fleet and approximately 10km west of Castle Douglas (the 'Proposed Development Site'). The Proposed Development Site lies entirely within the Dumfries and Galloway Council (DGC). The Site is shown in Figure 1-1.

The topography reflects a typical upland landscape, characterised by relatively steep slopes dissected by small streams. The highest elevation of the Site is situated in the west, at approximately 250 mAOD.

The Proposed Development Site features numerous watercourses.

Outside the boundary of the Proposed Development Site, the area to the south and southeast contains several watercourses and lochans, the most notable of which is Loch Mannoch which receives the Anstool Burn from the north and the Glengap Burn from the south.

The predominant land cover within the Site consists of upland bog and wet heath, grazed by sheep and cattle.

2.2 GEOLOGY

2.2.1 SUPERFICIAL DEPOSITS

A review of the British Geological Survey (BGS) indicates minimal superficial deposits in the area, with isolated pockets of silt, sand, gravel, and some peat, as shown in Drawing 20181-GDG-ZZ-XX-DR-C-0003 in Appendix C. The lack of significant mapped superficial deposits may suggest that bedrock is close to or exposed at the surface.

Two phases of peat probing have been undertaken by Atmos Consulting and the interpolated peat depths are shown on Drawing 20181-GDG-ZZ-XX-DR-C-0002 in Appendix C. The majority of the Site shows peat depths of less than 0.5m, although deeper pockets, ranging from 0.5m to over 3.0m, are located primarily in the central and northwestern parts of the Site. These thicker peat deposits correspond with flatter areas of the topography.

Further investigation and testing will be required to verify these initial observations. This will determine the variability, presence, depth, and extent of overburden across the Site, particularly at the proposed borrow pit locations.

2.2.2 SOLID GEOLOGY

A review of the British Geological Survey (BGS) indicates that the Site is underlain by Wacke of the Cairnharrow and Kirkmaiden Formation, characterised by thin to medium-bedded greywacke with varying proportions of interbedded silty greywackes and mudstone, shown in Drawing 20181-GDG-ZZ-XX-DR-C-0004 in Appendix C.

For engineering geology purposes, the BGS further classifies the formation as strong sandstone (greywacke). A review of the 1:1M Bedrock Engineering Geology dataset from the BGS outlined that highly weathered sections of sandstone may be excavated through hard digging, whereas less

weathered, fresher material would generally require blasting or ripping, depending on the spacing and orientation of discontinuities.

Additionally, the BGS indicates that strong sandstone has potential for use as engineering fill. Sandstone (greywackes) could be suitable, but its selection and extraction must be carried out carefully, taking into account the extent of the interbedded mudstone layer. Before the material can be used as granular fill in borrow pits, a detailed assessment of bedrock characteristics and rock durability is required.

Furthermore, the BGS recommends that during the ground investigation, it is important to assess intact rock strength, the spacing and orientation of discontinuities (including cleavage planes and potential water flow), as well as the depth and properties of weathered zones.

3 BORROW PIT LOCATIONS

3.1 GENERAL

Multiple locations were identified as potentially suitable for use as a borrow pit, of which only one was required to be selected. The selected location is shown on the Site plan in Drawing 20181-GDG-ZZ-XX-DR-C-0001. A General Arrangement and Cross Section for the borrow pit is included in Drawing 20181-GDG-ZZ-XX-DR-C-0005 in Appendix C.

3.2 CRITERIA FOR SELECTION OF BORROW PIT SEARCH AREA

Information provided by Atmos Consulting Ltd. in August 2024 and January 2025 has been used to select the optimum Borrow Pit location considering the following criteria.

- Avoiding peat depths >0.5m
- Watercourses (min. 50m buffer): the risks associated with polluting adjacent watercourses from both silt runoff and fuel and hydraulic oils.
- Quality of bedrock: the Site is underlain by greywacke and interbedded mudstone which is expected to provide adequate aggregate for general construction purposes. However, testing is required as part of future site investigation works to confirm the physical properties of the rock.
- Haul distances: Anticipated haul distances were considered during the borrow pits' selection process. Reducing haul distances between borrow pits and final placement has the following benefits:
    - Reduces the volume of site traffic/number of haul vehicles and hence reduces air pollution;
    - Reduces Health and Safety Risks; and
    - Reduces tracking of vehicles in periods of wet weather when plant movements should be kept to a minimum.
- Other: avoiding exclusion zones and other buffers provided by Atmos Consulting.

3.3 SITE WALKOVER

A Site walkover was undertaken by a GDG Engineer on 6th September 2024. Representative photographs and associated comments are provided in Appendix A. The purpose of the walkover was to assess ground surface conditions at the preliminary borrow pit area to support selection of the preferred location, with key findings summarised in Table 3-1 below.

The Site is characteristic of a post-glacial landscape, featuring gently sloping areas, undulations, and occasional steeper, craggy slopes. Vegetation is predominantly thick grasses, heather, and bracken, with wet, boggy ground in the low-lying areas and watercourses dissecting the Site. Grazing was observed in the central and eastern parts of the site.

Exposed rock, where present, appeared slightly weathered and covered in lichen-like vegetation. Rock exposure frequently coincided with areas of shallower peat depth.

Table 3-1 Preliminary Borrow Pit Area Descriptions

Preliminary Borrow Pit	Photograph Reference Numbers (Appendix A)	Location Description
Proposed BP (Previously BP3)	1-14	The preliminary area of the borrow pit (previously referred to as BP3) was observed to dip moderately towards the east, with localised undulations and steeper slopes. Exposed rock and shallow bedrock were recorded on the eastern slope. In some areas, the exposed bedrock appeared slightly weathered and covered with lichen-like vegetation. Shorter grasses on the eastern slope indicated areas with possible shallow rock, often these areas had occasional small outcrops visible. The proposed borrow pit area showed signs of grazing activity.

4 CONSTRUCTION REQUIREMENTS

4.1 ROCK VOLUME ESTIMATES

A summary of the indicative volumes of rock required is, as provided by Atmos, within the document 'Lairdmannoch – Materials Calculator' (provided in Appendix B). Based on these calculations, the total estimated volume of required aggregate from the stone extraction areas would be in the order of 107,000m^3.

The potential engineering properties of aggregate from the bedrock (Cairnharrow Formation), consisting of greywacke and interbedded mudstone, are expected to vary slightly. These properties may range from General Fill (Class 1/2) to Select Engineered Fill (Class 6), as specified in the Specification for Highway Works. The strength of greywacke may be variable, and the interbedded mudstone layers could contain argillaceous material. Additionally, when required, the extraction process should consider variations in rock quality, and ensure measures are in place to separate unsuitable or low-quality material from acceptable aggregate.

Table 4-1 provides a preliminary indication of the potential aggregate extraction volume from the borrow pit area. Estimate assumes a conservative yield of 80% recovery rate to account for any unsuitable material, an average overburden thickness of 0.5m to be stripped, and a maximum excavation depth of 8.5m. A tiered construction approach has been applied to the borrow pit locations.

Based on the above assumption, the maximum recovery volume from the assessed borrow pit areas is 147,421m^3, with an estimated aggregate yield volume of 118,000m^3 as detailed in Table 4-1. While the rock on Site is likely suitable for general fill, provisions should be made for the potential need to import materials for wind turbine foundations and other structures that require select materials to meet performance criteria. Import requirements may vary based on the results of Site investigations and the confirmed properties of the rock and aggregate potential.

Note, intrusive Site Investigation required to confirm anticipated ground conditions, including but not limited to confirmation of quality aggregate yield rate, and overburden depth prior to commencement of works.

Table 4-1: Indicative Borrow Pit Volumes

Borrow Pit	Estimated Overall Aggregate Volume (m^3)	Estimated Aggregate Yield Volume (m^3)	Footprint Area (m^2)
Proposed BP Location (Previously BP3)	**147,421**	**118,000**	**35,964**

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSION

The purpose of this Preliminary Borrow Pit Appraisal is to assess potential locations for the temporary extraction of rock for the proposed energy park development at Lairdmannoch.

This report outlines the preliminary assessment of the proposed borrow pit location (as shown in Drawing 20181-GDG-ZZ-XX-DR-C-0001), with associated drawings provided in Appendix C. The identified borrow pit location was selected based on environmental and engineering constraints, as well as observations from a Site walkover.

The proposed borrow pit location is underlain by the greywacke of the Cairnharrow and Kirkmaiden Formation. As outlined in Section 2.2.2, this bedrock unit is considered potentially suitable for material reuse, pending detailed Site investigations, including geotechnical and geochemical testing. During the Site walkover, bedrock was observed near the surface in proposed borrow pit location, evidenced by rock outcrops.

It is anticipated an estimated aggregate yield volume of 118,000m^3 may be produced from the proposed borrow pit. Therefore, the estimated volumes suggest that the proposed borrow pit area can provide the required stone of 107,000m^3, as provided by Atmos, for the proposed development. The estimated aggregate yield volume assume applying reasonable contingencies to higher stone requirements than anticipated and potential volume loss during borrow pit material excavation and processing. Refer to estimated stone volumes and estimated borrow pit generated stone material volumes as outlined in Appendix B and Table 4-1 in Section 4.

Typically, it is anticipated that the bedrock could be processed to provide General Fill (Class 1/2 in accordance with the Specification for Highway Works), and Select Granular Fill (Class 6) for specific engineering requirements.

Further assessment of rock volume will be necessary during the construction phase, following detailed design and additional geotechnical and geochemical evaluations of the bedrock.

5.2 RECOMMENDATIONS

The preliminary borrow pit assessment has considered the available Site information, with ground investigation to date limited to peat probes only.

Further assessment will be required to characterise the overburden (superficial deposits) and bedrock, and the suitability for reuse as an engineered fill material, combined with a preliminary earthworks assessment to inform planning requirements.

Further ground investigations at the borrow pit areas should include:

- Rotary boreholes with core recovery, for rock mass rating and discontinuity assessment,
- Rotary borehole standpipes, for groundwater monitoring,
- Trial pits, for assessment of overburden materials,

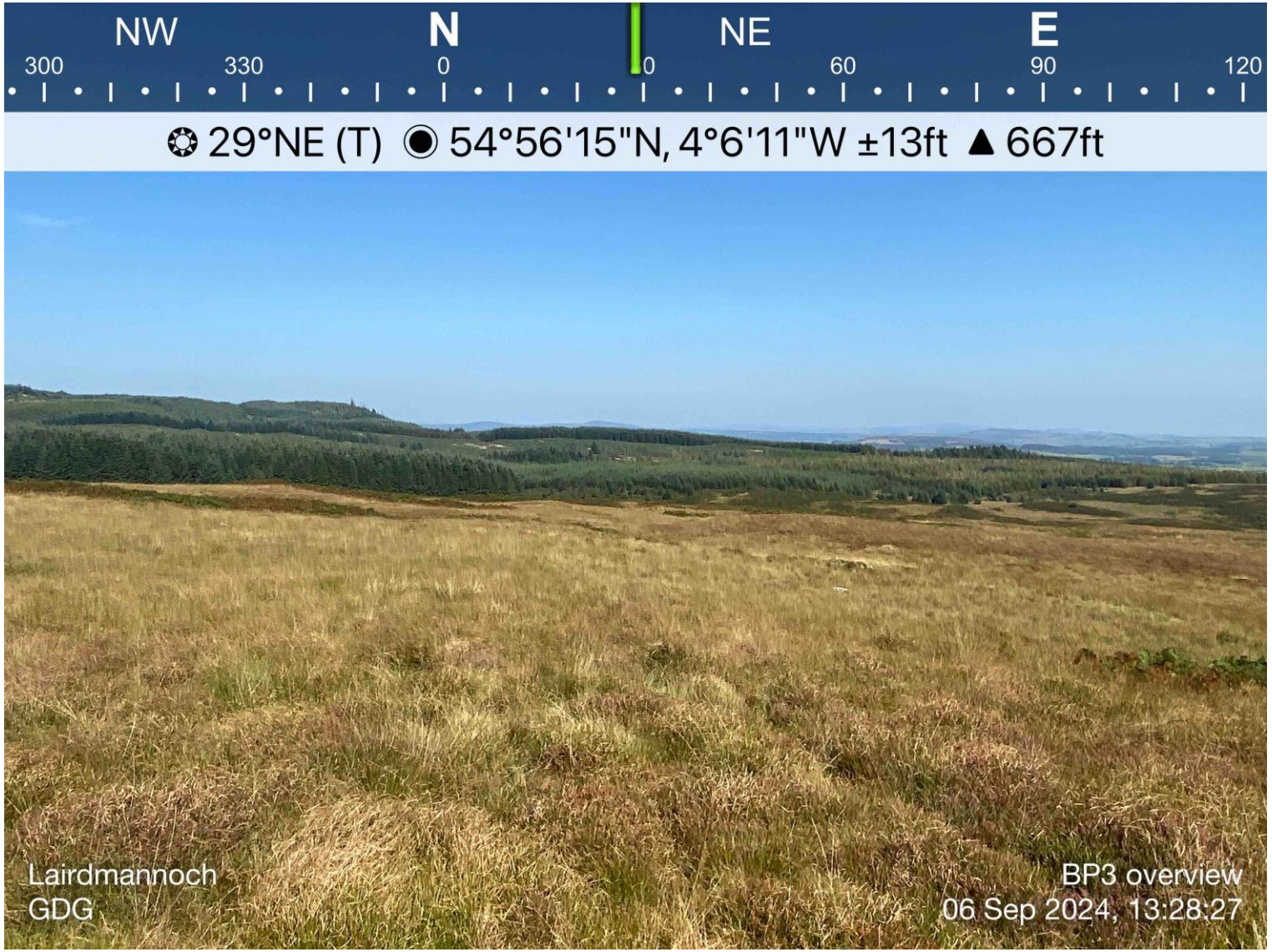
- Geotechnical laboratory testing of the bedrock, including but not limited to:
  - UCS and point load testing,
  - Abrasion testing,
  - Chemical testing – sulphate, sulphur and chloride.

Adequate mitigations shall be carried out by the Contractor during the borrow pit excavations to ensure the stability of the excavated rock faces and should be carried out by a suitably qualified geotechnical engineer.

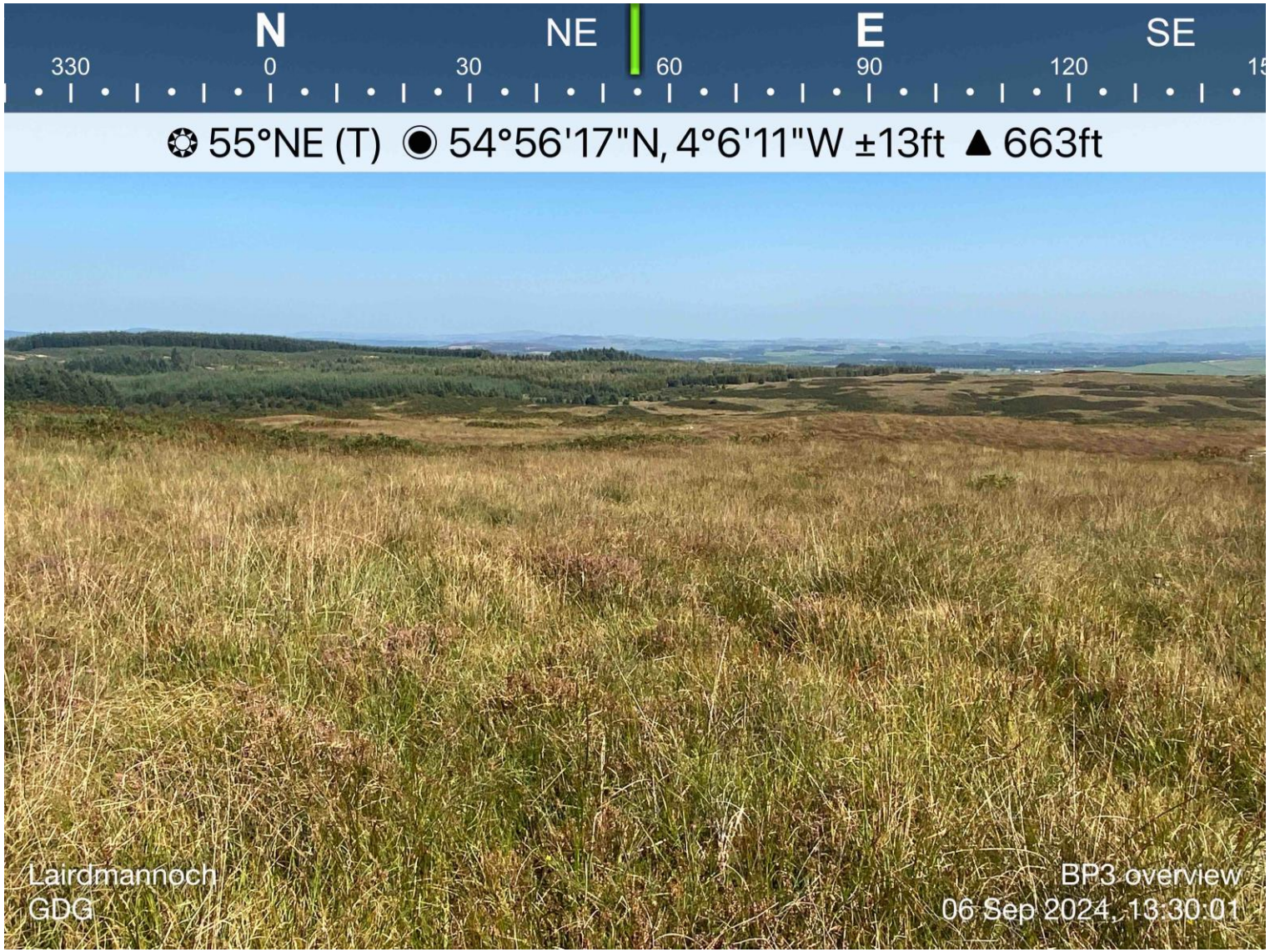
APPENDIX A – SITE WALKOVER OBSERVATIONS AND PHOTOGRAPHS

PRELIMINARY BORROW PIT 3

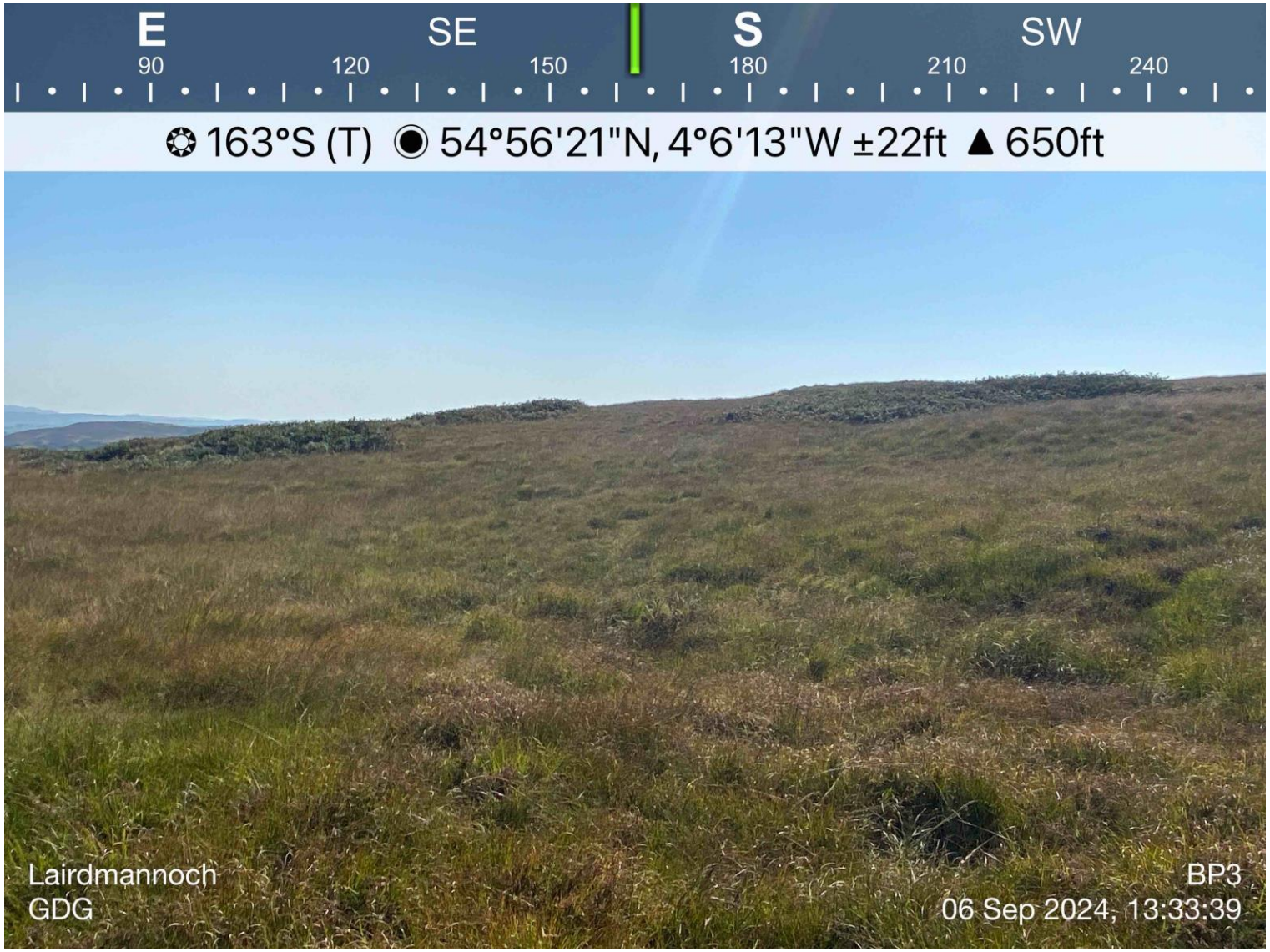
Photographs and Observations



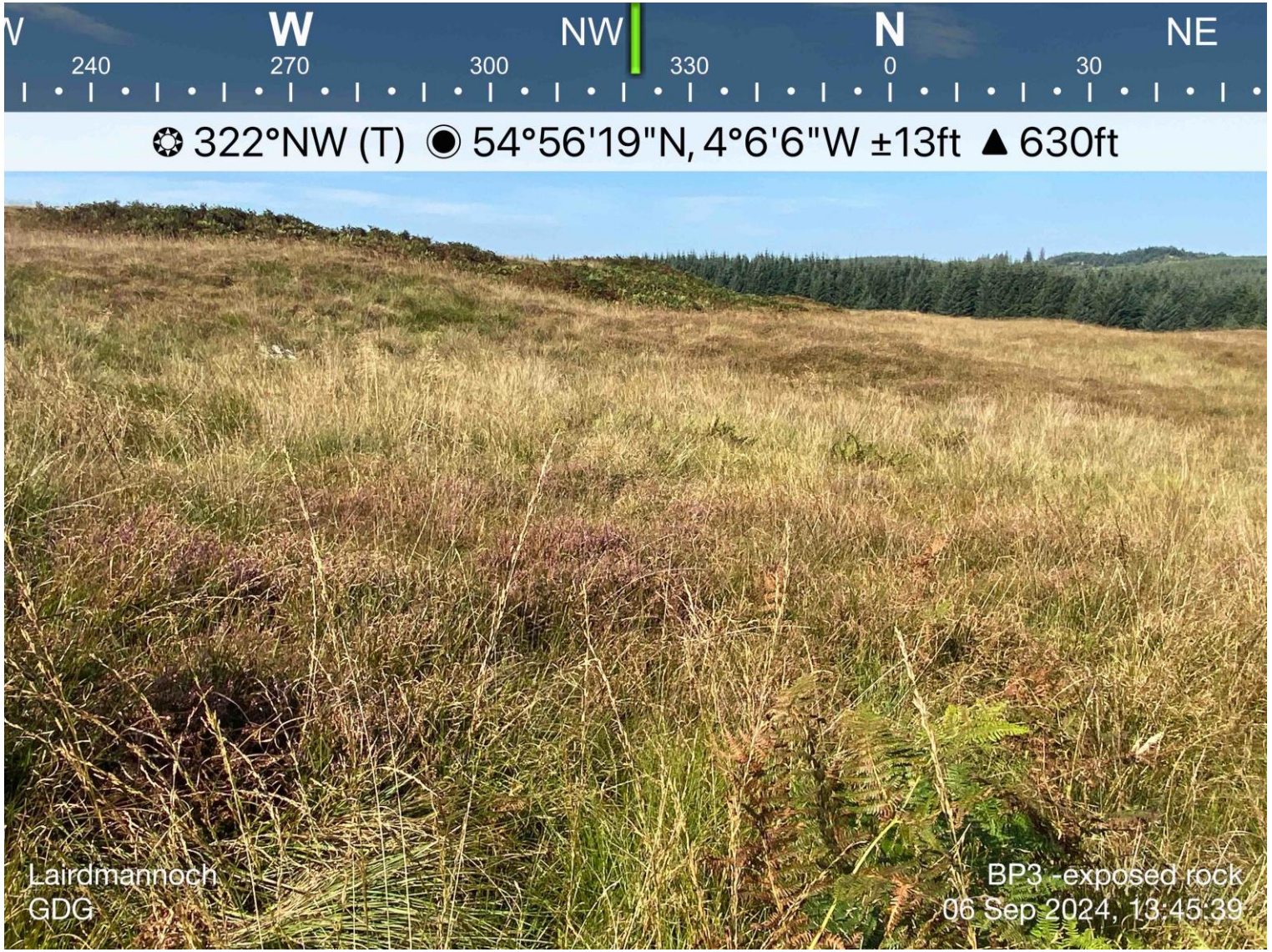
Photograph 1: Overview of BP3 looking north down-slope



Photograph 2: Overview of BP3 looking north down-slope

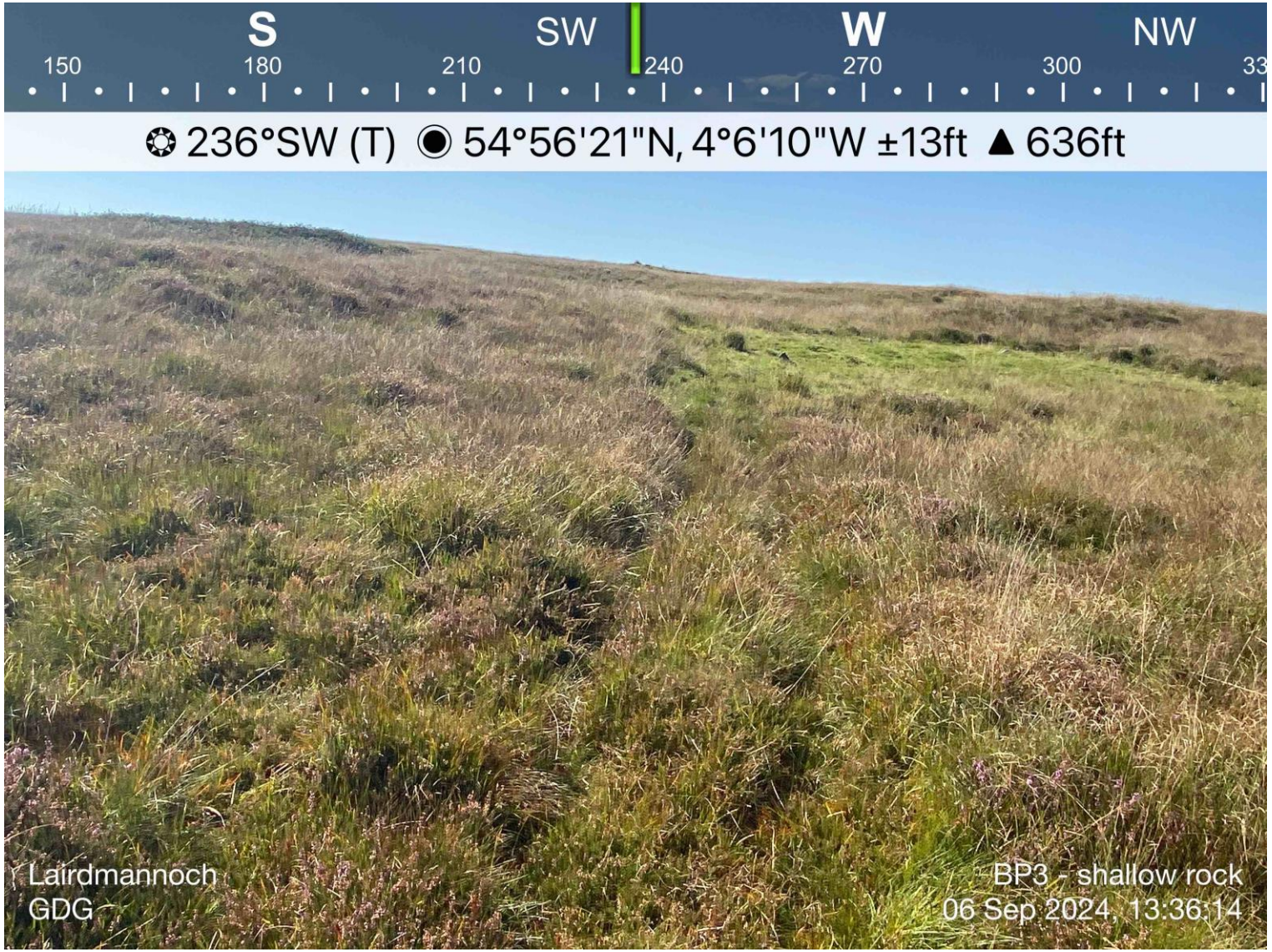


Photograph 3: Overview of BP3 from the northern boundary, looking at the sloping Site. Bracken vegetation representing shallow superficial soil areas.



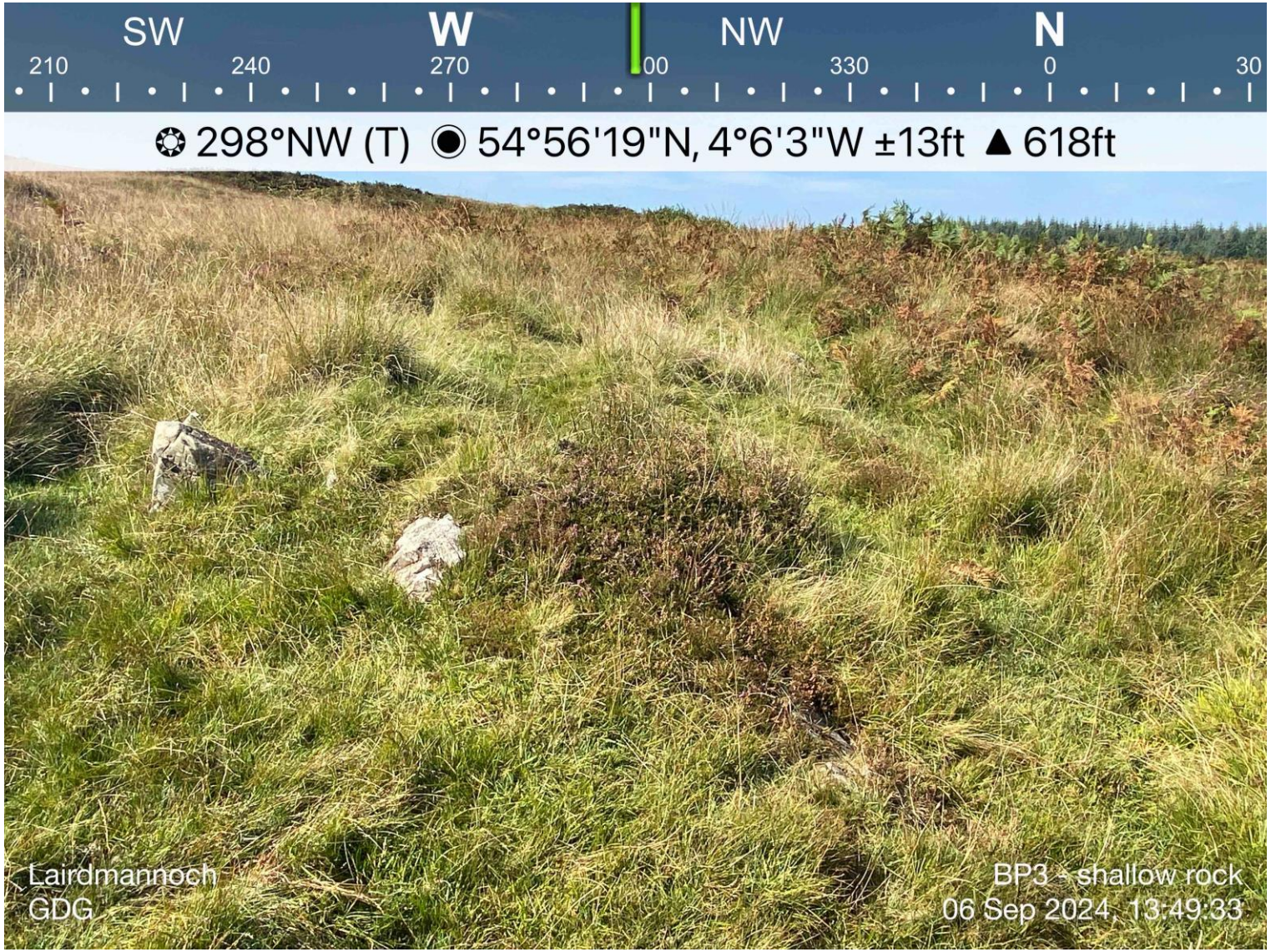
Photograph 4: Overview northwest towards the northern boundary of BP3

Photograph 5: View west from the southeastern boundary, looking upslope towards the northern boundary

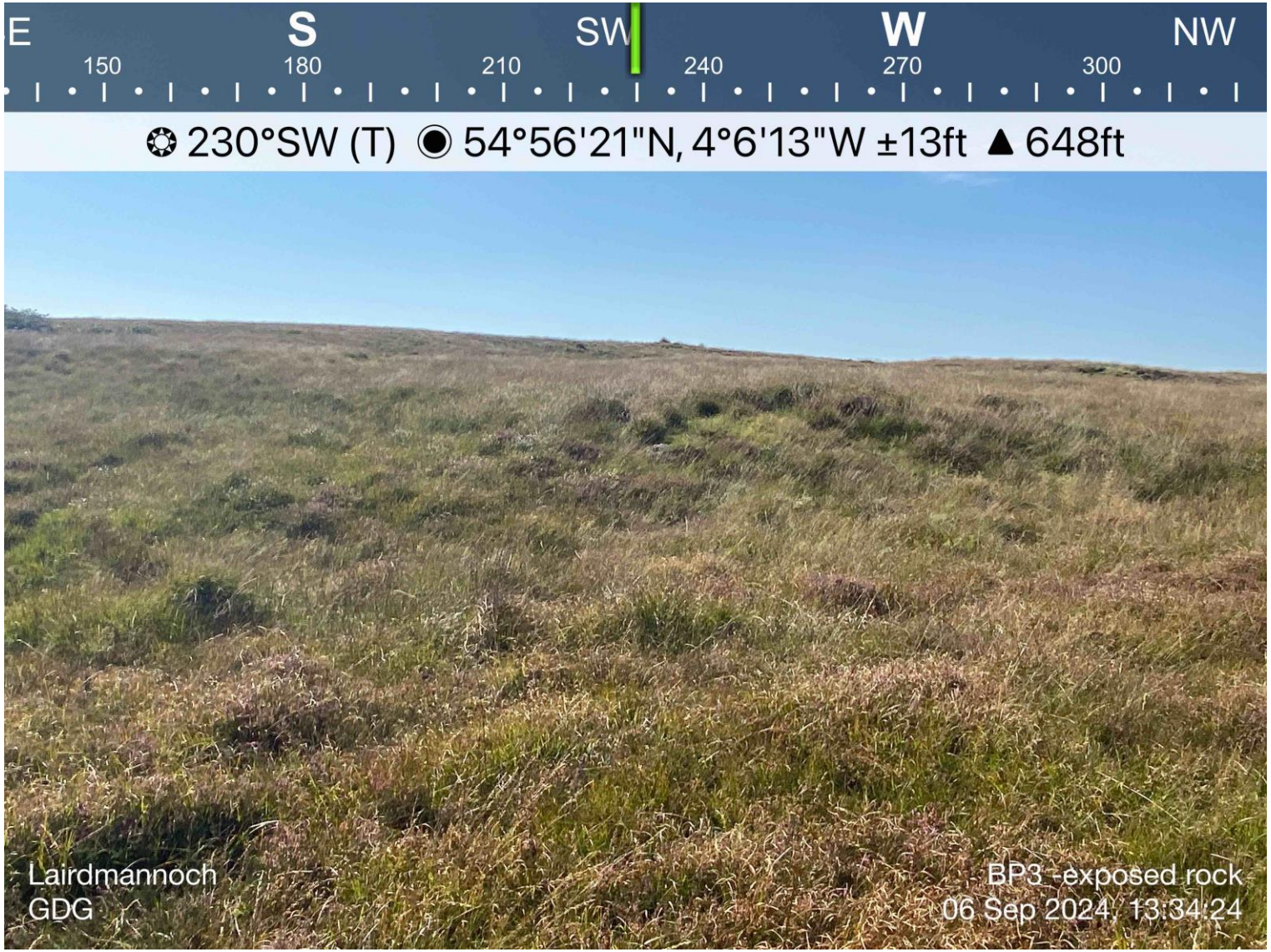


Photograph 6: View southwest towards an area of shallow rock on a sloping surface (represented by the shorter green grass)

Photograph 7: Close-up of the shallow and exposed rock

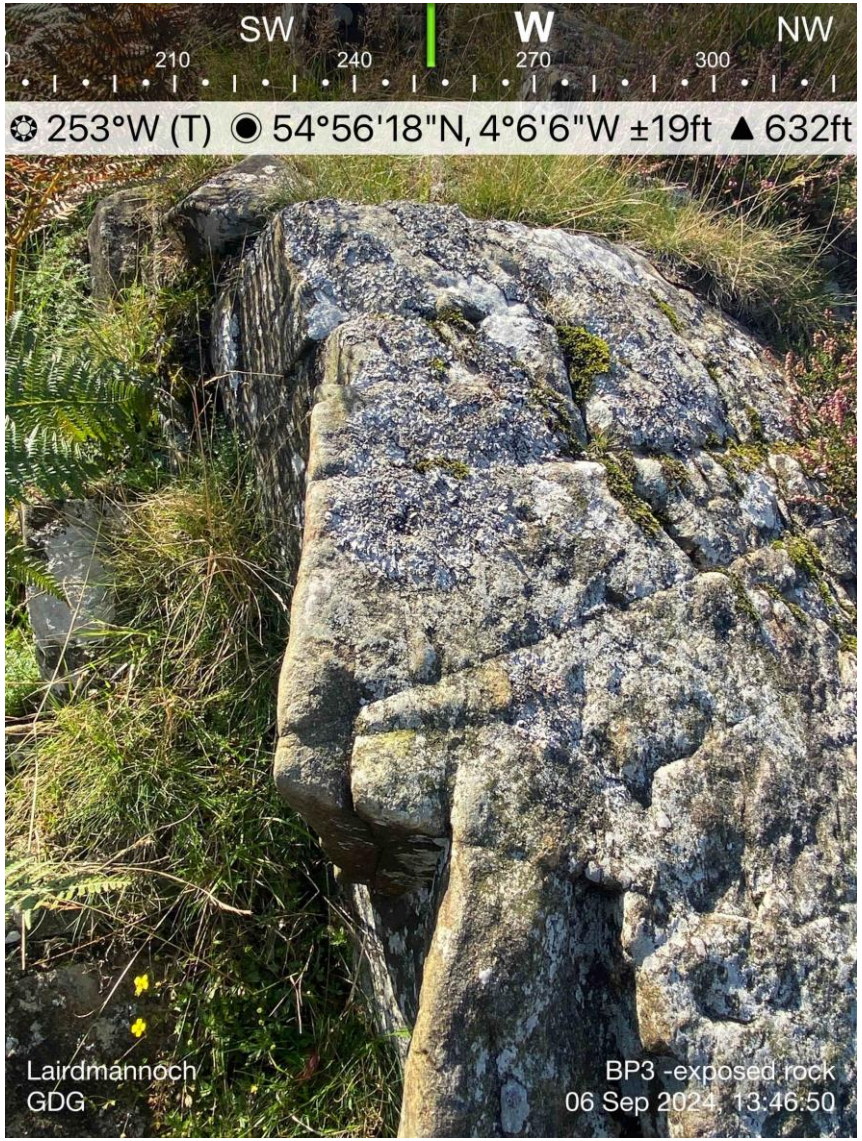


Photograph 8: View northwest, up-slope, at an area of shallow and exposed rock



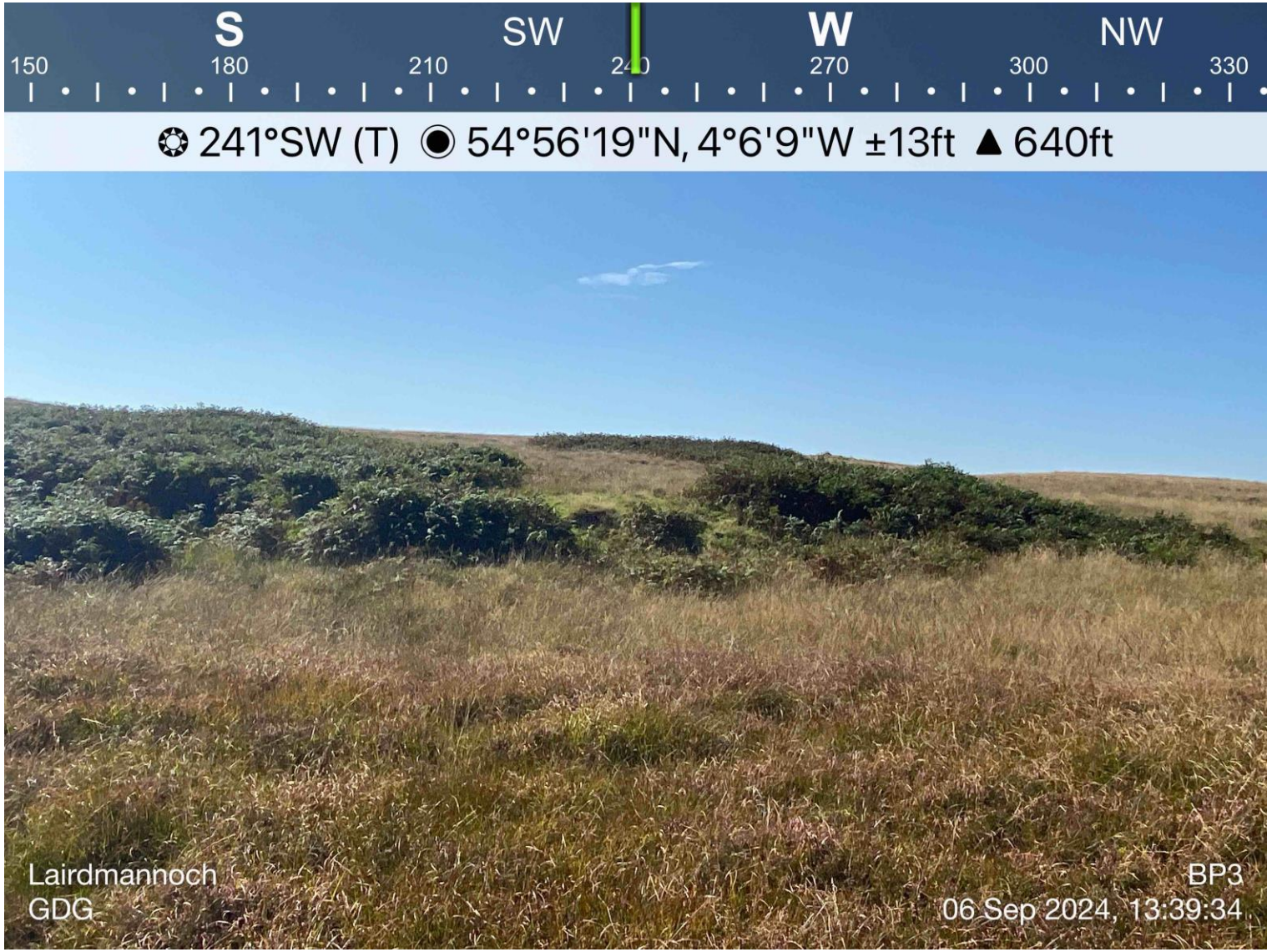
Photograph 9: View southwest from the eastern portion of BP3, towards an area of exposed and shallow rock

Photograph 10: View southwest of a slope face with exposed competent rock



Photograph 11: Close-up of exposed rock outcrop. Slightly weathered and covered in lichen.

Photograph 12: View north looking along a steeper slope within BP3. Shallow rock potentially represented by the bracken vegetation



Photograph 13: View southwest up-slope towards a steeper slope within BP

Photograph 14: View northwest of an exposed rock outcrop within BP3