Dean Moor

Solar Farm

Environmental Statement: Appendix 5.3 – Outline Soil Management Plan

on behalf of **FVS Dean Moor Limited**

March 2025
Prepared by: Stantec UK Ltd
PINS Ref: EN010155
Document Ref: 6.3
Revision: 1

DEAN MOOR SOLAR FARM

ENVIRONMENTAL STATEMENT

APPENDIX 5.3 – OUTLINE SOIL MANAGEMENT PLAN

PLANNING INSPECTORATE REFERENCE EN010155

PREPARED ON BEHALF OF FVS DEAN MOOR LIMITED

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, Regulation 5(2)(a)

Project Ref:	**EN010155/Appendix 5.3: Outline Soil Management Plan**
Status	Final
Issue/ Rev:	1
Date:	March 2025

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1 Introduction

1.1 Background

1.1.1 This Outline Soil Management Plan ('OSMP') has been prepared for FVS Dean Moor Limited (the Applicant) to support the DCO application for the Dean Moor Solar Farm (the Proposed Development) located between the villages of Gilgarran and Branthwaite in West Cumbria (the Site), which is situated within the administrative area of Cumberland Council (the Council). The Proposed Development will be within the 'Order Limits' (the land shown on the Work Plans) [**REF: 2.3**] within which the Proposed Development can be carried out. For the purpose of this OSMP, the terms 'Order Limits' and 'Site' are used interchangeably.

1.1.2 The purpose of this OSMP and any Soil Management Plan ('SMP') is to identify and safeguard the soil resources (topsoil and subsoil) on land required for the part of the Proposed Development to which the SMP applies (the Site is currently in pastoral agricultural production), and to support best practice for the protection of the soil resource during the Proposed Development's construction phase.

1.1.3 Soil is recognised as a resource in-itself and the conservation of soils through good construction practice makes an important contribution to Site environmental management commitments across construction (including in relation to water management, ecological protections, and ground conditions management) and provides benefits for the operational phase.

1.1.4 Prior to the construction of any part of the Proposed Development, the Applicant must produce a SMP for that part of the Proposed Development, that must be substantially in accordance with this OSMP. Preparation of the SMP is secured by a DCO Requirement and will be submitted for approval by the Council. The construction of any part of the Proposed Development must be carried out in accordance with the approved SMP for that part.

1.1.5 Site specific measures in the OSMP are derived from the author's expertise in soil science along with fieldwork and desk-based studies as set out in the Agricultural Land Classification ('ALC') Report (ES Appendix 2.8), and the OSMP has been relied on by ES Chapter 10 Ground Conditions. The SMP will be substantially in accordance with what is set out in this OSMP, and will be informed by updating environmental assessments, including further ground investigations as discussed in OCEMP section 11 (ES Appendix 5.1).

1.1.6 This OSMP is informed by the ALC Report at ES Appendix 2.8 which provides information on climate, topography, geology, and soil. The ALC Report determined there is no '*Best and Most Versatile'* ('BMV') agricultural land at the Site, i.e., agricultural land in ALC Grades 1, 2, and Subgrade 3a. Most of the agricultural land on the Site is Grade 4 (i.e., *poor quality*), with smaller proportions of Subgrade 3b (i.e., *moderate quality*), and Grade 5 (i.e., *very poor quality*).

1.1.7 Although the SMP is targeted at the construction phase, in implementing the SMP, alongside the CEMP the outcomes of this management regime will support the success of the Site's landscape and ecological mitigation, and enhancement works. This will be delivered via a Landscape and Ecological Plan ('LEP') and a Landscape Ecological Management Plan ('LEMP') as outlined in the OLEMP (ES Appendix 7.7).

1.1.8 The best practice measures and outcomes to be implemented by the SMP during construction are also expected to be adopted for operational and maintenance '(O&M') works and taken forward in a future decommissioning phase document suite as outlined in the Framework Decommissioning Management Plan ('FDMP') (ES Appendix 5.4).

1.2 Competency

1.2.1 This OSMP was prepared by Robert Askew, a Chartered Scientist ('CSci'), who is a Fellow (F.I. Soil Sci) of the British Society of Soil Science ('BSSS'). Robert meets the requirements of the BSSS Professional Competency Standard ('PCS') scheme '*Soil Science in Soil Handling and*

Restoration' (see BSSS Document 4)[1]. The BSSS PCS scheme is endorsed, amongst others, by the Department for Food and Rural Affairs ('Defra'), Natural England, the Science Council, and IEMA.

1.2.2 As an Expert Witness in agriculture and land use, he has given evidence at numerous public inquiries, including Town and Country Planning Act, local plan inquiries, 1925 Allotment Act inquiries, and Section 78 appeals. He has recently been Topic Lead for Agriculture, Forestry and Soil for HS2 Phase 2B (Crewe to Manchester), and recently managed Agricultural Land Classification (ALC) and Soil Resource Surveys as part of National Highways Lower Thames Crossing highway scheme. Robert has also given evidence on soil and ALC at the All Party Parliamentary Group (APPG) on Agroecology at the Palace of Westminster.

1.3 Roles and Responsibilities

1.3.1 Specific job titles, roles, and responsibilities applicable to the OSMP are aligned with those set out in the OCEMP at Section 2, with full details to be provided in the CEMP. Relevant roles and responsibilities in relation to soil management will be set out in the SMP.

1.3.2 While the Applicant, as Site owner/operator, will be ultimately responsible for compliance of the construction management plans, the key function for the SMP will be that of the Principal Contractor (PC). For the purposes of this OSMP, the PC is defined as per the Construction, Design and Management (CDM) Regulations[2] as *'the contractor with control over the construction phase of a project involving more than one contractor'.*

1.3.3 The PC will be supported by a range of technical experts such as an Ecological Clerk of Works ('ECoW') who will have a more regular presence on-Site. This will be complemented by monitoring oversight and advice by a qualified soils expert who will act as the project Soil Advisor. Details of the Soil Advisor, their personal details including qualifications,

[1] British Society of Soil Science. Professional Competency Standard Scheme Document 4 'Soil Science in Soil Handling and Restoration'.

[2] Health and Safety Executive (2015). The Construction (Design and Management) Regulations 2015.

and their scope of work will be included in the SMP and will be a function to support the successful implementation of the SMP.

1.4 Assumptions and Limitations

1.4.1 The OSMP sets out (i) the best practice, and (ii) a framework of practical mitigation measures that the Principal Contractor will implement during construction safeguard soil resources on-Site. The PC will be required to monitor the works to ensure they comply with the SMP.

1.5 Aims and Objectives

1.5.1 The OSMP aims to maintain the quality and quantity of soil resources (i.e., topsoil and subsoil) at the Site in its current physical condition (e.g., soil depth, soil texture, soil structure, soil drainage status), chemical condition (e.g., pH level, nutrient status of available phosphorus, available potassium, available magnesium, and soil organic matter ('SOM') content, to maintain soil health (see section 1.6) primarily during the construction of the Proposed Development.

1.5.2 This subsequently enables the LEMP's operational management measures to improve soil quality and for the preservation of soil resources to support the LEMP in delivering biodiversity net gain ('BNG').

1.5.3 The SMP will include at least the following details to support the Proposed Development's soil management objectives of maintaining the quality and quantity of the soil resource in as much as possible:

- The location, extent, and quality of in-situ soil resources (topsoil and subsoil) at the Site before construction (i.e., baseline soil status);
- Outcomes of assessments of types (units) of soil according to their resilience to structural damage (e.g., compaction) during soil handling based on final design and further surveys;
- A map showing the location and extent of soil resources in separate soil handling units in accordance with Figure 2 Soil Handling Units;
- Maps showing the location and content of stockpiles, e.g., topsoil or subsoil;
- Measures to ensure vehicular traffic over the land is restricted to internal access tracks or only across land without tracks in appropriate

weather conditions and soil-wetness state during the construction phase;

- Final details relating to soil handling including, where necessary, to strip, store, and respread soil resources in appropriate weather conditions and soil-wetness state during construction;
- An expectation for the use of low ground pressure (LGP) models and tracked vehicles where possible; and
- Identification of a person responsible for supervising soil management and detail their function and supervisory, monitoring, and measurement mechanisms as a technical expert supporting the PC and Site Manager.

1.5.4 Overall, the aim of this OSMP is to achieve, as far as possible:

- The avoidance of unnecessary damage to all soil layers, especially by compaction and smearing;
- The maintenance of a reasonable degree of fissuring, drainage, and aerobic conditions in stored soils;
- The reasonable replication of the original sequence of textural horizons and permeability of the soil profile when the materials are reinstated, based on a target restoration profile (i.e., the original/baseline soil profile determined for the SMP before commencement of construction); and
- The preservation of soil biodiversity and SOM.

1.6 Soil Health and Best Practice Guidance

1.6.1 The Government's aims and objectives for safeguarding and, where possible, improving soil health are described in the ALC Report at ES Appendix 2.8.

1.6.2 The assessment of agricultural land and soil and has drawn on best practice guidance set out in section 2.5 of the ALC Report.

Soil receptor sensitivity / resilience

1.6.3 When considering soil as a growing medium for food and biomass production and a habitat that supports microbial, plant, and animal life, its sensitivity to change is mainly dependent on its resilience to structural damage during cultivation and soil handling (i.e., soil stripping, storing in stockpiles, and re-spreading).

1.6.4 As detailed in guidelines for soil handling, including the '*Code of Practice for Sustainable Management of Soil on Construction Sites*'[3], the key to understanding soil resilience to structural damage during soil handling is the interaction between soil texture and soil moisture, as well as the effect of this interaction on soil structure, as described in Appendix A.

1.6.5 For the SMP the methodology for assessing soil wetness will be used to place the different soil types at the Site into one of three soil handling units which have different resilience (i.e., high resilience, medium resilience, and low resilience) to structural damage according to their respective soil cohesion and soil strength and resistance to compression and smear at different soil moisture contents. These three categories of resilience should be related to the prevailing climate, namely Field Capacity Days, as set out in Table 1.1.

Table 1.1: Soil handling units

Soil Handling Unit / Sensitivity	Resilience to structural damage during soil handling	Soil Texture Class
Unit 1 (Green) – Low Sensitivity	High	Light textured soils: sand (S), loamy sands (LS), sandy loam (SL), sandy silt loams (SZL); where fewer than 225 Field Capacity Days (FCD) (Average Annual Rainfall (AAR) less than 1000mm).
Unit 2 (Orange) – Medium Sensitivity	Moderate	Above textures where there are 225 FCD or more (AAR 1000mm or greater). Medium textured soils with less than 27% clay content: silt loam (ZL), medium silty clay loam (MZCL), medium clay loam (MCL), sandy clay loam (SCL); where there are 225 FCD or fewer (AAR 1000mm or less). Heavy textures below (i.e., more than 27% clay content) where fewer than 150 FCD (AAR less than 700mm).
Unit 3 (Red) – High Sensitivity	Low	Medium textures above where there are more than 225 FCD (AAR greater than 1000mm). Heavy textures soils with more than 27% clay content: heavy silty clay loams (HZCL), heavy clay loam (HCL), sandy clay (SC) silty clay (ZC) clay (C); where FCD are 150 or more (AAR 700mm or greater). Organic and peaty soils.

[3] HM Government (2011, last updated in 2018). Department for Environment, Food and Rural Affairs 'Code of Practice for the Sustainable Use of Soils on Construction Sites'.

2 Soil Resource Assessment

2.1 Background

2.1.1 This section of the OSMP describes key Site characteristics that affect soil management at the Site as follows:

- Climate (e.g., the opportunity for soil handling in suitably dry conditions); and
- Information on soil texture/resilience.

2.1.2 This section uses relevant climate and soil texture information from the ALC Report at ES Appendix 2.8, as summarised below.

Climate

2.1.3 Interpolated climate data relevant to the determination of the ALC grade of land at the Site is given in Table 2.1.

Table 2.1: ALC climate data for the Site

Climate Parameter	Northeast BGR* NY044242	Central BGR NY046229	Southwest BGR NY412223
Average Altitude (m)	117	144	197
Average Annual Rainfall (mm)	1390	1459	1519
Accumulated Temperature above 0˚C (January – June)	1273	1243	1175
Field Capacity Days (FCD)	294	303	287
Moisture Deficit (mm) Wheat	51	42	40
Moisture Deficit (mm) Potatoes	27	16	33
Grade According to Climate	3b	4	4

*British Grid Reference

2.1.4 Of crucial relevance to soil management, the Site receives a high Average Annual Rainfall (AAR) of 1390-1519mm compared with the AAR for central lowland England, which is between 625mm and 700mm[4].

[4] J.M. Ragg et al (1984). Page 20 in 'Soils and their use in Midland and Western England', Soil Survey of England and Wales Bulletin No.12, Harpenden

2.1.5 The soil is predicted to be at field capacity (i.e., the amount of soil moisture or water content held in the soil after excess water has drained away) for between 287-303 Field Capacity Days (FCD) per year. These values are high compared to the average FCD for central lowland England, which is between 125-175 FCD.

Detailed ALC and Soil Resource Survey (SRS)

2.1.6 A detailed ALC and Soil Resource Survey (SRS) was carried out at the Site in July 2024 (see soil profile logs given in ALC Report, Appendix D) The ALC/SRS survey involved the examination of the soil's physical properties at 50 auger-bore locations on an approximate 100m grid pattern at a sampling density of approximately 1 auger bore per ha of agricultural land. A log of the soil profiles recorded on the Site (see Figure 2 of ALC Report) and a soil pit description are given in ALC Report, Appendix D.

Soil texture

2.1.7 The texture of the topsoil was determined on Site by hand-texturing, as described in Natural England's Technical Information Note 037 '*Soil Texture*'[5], and by laboratory particle size analysis (see below).

2.1.8 To validate soil texture recorded on-Site, a topsoil sample was collected at 15 locations (i.e., SMP – SMP15), as shown in Figure 1 of this OSMP. Based on the BSI particle size grades, the topsoil samples were sent to an accredited laboratory for particle size (texture) analysis. A certificate of analysis is given in Appendix B to this OSMP. The findings of the topsoil texture analysis are shown in Table 2.2.

[5] Natural England (2008). Natural England's Technical Information Note 037 'Soil Texture'.

Table 2.2: Topsoil texture (re Table 10, ALC guidelines)

Topsoil Sample Location *(See Fig. 1)*	% sand 0.063-2.0 mm	% silt 0.002-0.063 mm	% clay <0.002 mm	ALC Soil Texture Class
SMP1	42	31	27	Heavy Clay Loam
SMP2	41	31	28	Heavy Clay Loam
SMP3	38	31	31	Heavy Clay Loam
SMP4	26	35	39	Clay
SMP5	44	28	28	Heavy Clay Loam
SMP6	25	34	41	Heavy Clay Loam
SMP7	26	36	38	Clay
SMP8	43	29	28	Heavy Clay Loam
SMP9	37	33	30	Heavy Clay Loam
SMP10	37	34	29	Heavy Clay Loam
SMP11	36	36	28	Heavy Clay Loam
SMP12	41	32	27	Heavy Clay Loam
SMP13	42	33	25	Medium Clay Loam
SMP14	59	21	20	Sandy Clay Loam
SMP15	34	32	34	Heavy Clay Loam

2.1.9 The detailed ALC/SRS determined dark greyish brown (Munsell colour 10YR4/2), stoneless, predominantly heavy clay loam topsoil over clay subsoil. The soil profiles are slowly permeable and seasonally waterlogged for long periods over the winter (i.e., Wetness Class IV).

Soil handling units

2.1.10 By applying the climate and soil texture criteria set out in Table 1.1 ‘Soil Handling Units’, the topsoil at the Site may be assigned to Soil Handling Units, i.e., high, medium, or low resilience to structural damage during soil handling, as shown in Table 2.3 and Figure 2.

Table 2.3: Soil handling units at the Site

Topsoil Sample Location	Topsoil Texture	Resilience to Soil Handling Unit
1	Heavy Clay Loam (HCL)	Unit 3 Low
2	Heavy Clay Loam (HCL)	Unit 3 Low
3	Heavy Clay Loam (HCL)	Unit 3 Low
4	Clay (C)	Unit 3 Low
5	Heavy Clay Loam (HCL)	Unit 3 Low
6	Heavy Clay Loam (HCL)	Unit 3 Low
7	Clay	Unit 3 Low
8	Heavy Clay Loam (HCL)	Unit 3 Low
9	Heavy Clay Loam (HCL)	Unit 3 Low
10	Heavy Clay Loam (HCL)	Unit 3 Low
11	Heavy Clay Loam (HCL)	Unit 3 Low
12	Heavy Clay Loam (HCL)	Unit 3 Low
13	Medium Clay Loam (MCL)	Unit 3 Low
14	Sandy Clay Loam (SCL)	Unit 3 Low
15	Heavy Clay Loam (HCL)	Unit 3 Low

2.1.11 Although not relevant to the SMP's construction management, it is recommended that when SMP measures are considered in relation to a DMP suite, that when Site is cleared and restored to agriculture, an appropriate number of topsoil samples (e.g., 15) should be collected and tested at a laboratory against BS3882:2015 to determine any deficiencies in nutrient status that may affect landscape restoration measures and agricultural use options.

3 Soil Management Measures

3.1 Proposed Development Construction Phase

3.1.1 Most of the Proposed Development's land use (as represented by Work No. 1) involves solar PV arrays over pasture (grassland) (as shown on the Parameter Plan (ES Figure 3.4)). The existing grass sward (i.e., no bare ground) will be maintained over the Work No. 1 area before trafficking over by construction plant and delivery vehicles, with supplementary pre-seeding to occur in areas of bare earth depending on conditions as assessed in pre-commencement. If required, such measures would be set out in the CEMP.

3.1.2 The Solar PV mounting framework is typically secured via pile-driven posts into the ground with no requirement to excavate, move, or seal the soil below the solar PV arrays. Further information is available from ES Chapter 3 – Site and Proposed Development Description and the Design Parameters Document ('DPD') [**REF: 5.7**].

3.1.3 Cabling for the Proposed Development will be laid in trenches up to 2m in depth and up to 2.5m wide (typically much less than this, with these values representing maximum design parameters). Cable trenches will be backfilled with topsoil and subsoil in their original sequence (i.e., topsoil at the tops) and depths (i.e., thickness of soil layers) with further controls on excavation methods and excavation materials handling outlined in the OCEMP (ES Appendix 5.1). A perimeter fence will also form part of the Proposed Development which will be 'deer fencing' secured by wooden posts driven into the ground with no expectation of a need for excavation for fence implementation.

3.1.4 The main elements of the Proposed Development that will require the stripping and storage of topsoil within the Site include the following:

- Implementation of temporary construction compounds to be located only within areas as defined by Work No. 4 and formed of permeable aggregate); construction of temporary or permanent internal access tracks (to be located across the Site where required but with the primary network making use of an existing established track network that will be upgraded as opposed to new routes (to be formed of permeable aggregate);

- Implementation of a PCS Unit (inverters/transformers) and other ancillary containers and the provision of any targeted SuDS (e.g., aggregate subbase or filter trench) for these discrete elements dispersed across Work No. 1 and 3; and
- Implementation of Grid Connection Infrastructure (Work No. 2) to include a compound housing external electrical equipment that will be up to 1.2ha in size and have gravel/aggregate ground coverage along with DNO and Customer Substation buildings which will require ground clearance for their foundations and any associated SuDS measures.

3.1.5 The SMP will provide further detailed specifications on the locations of clearance requirements and their nature (permanent or temporary). Matters relating to the management of excavated soils that are not to be retained on-Site and therefore handled as waste will be dealt with in the CEMP under its waste management header. Soils to be retained on-Site will be governed in accordance with this OSMP and any additional requirements arising from the CEMP.

3.2 Supervision

3.2.1 Throughout the construction phase, a regular routine of inspections will be provided by a suitably experienced Soil Adviser alongside any programme/works specific supervision requirements.

3.2.2 As a minimum, inspections will check for compliance with the SMP such as the depth of material stripped for areas of track, confirmation of soil handling and trafficking over land being stopped when soil has wetted to a plastic consistence, and condition of soil material in storage bunds.

3.2.3 The use of a third-party soils expert to inform requirements, monitor, and verify compliance will be implemented for the construction phase. This function will also be taken forward through the operational and decommissioning phases where appropriate. An example would be looking for areas of subsoil compaction that have developed where O&M

vehicles have been used off the access track routes, specifying appropriate subsoil cultivation, and assessing the effectiveness of that cultivation. Provision for soils expertise as a management mechanism during the operational phase will be covered by the LEMP and must form a part of the DMP suite as set out in the FDMP (ES Appendix 5.4).

3.2.4 The SMP for the construction phase will detail supervision and monitoring mechanisms by the Soil Advisor and will make provision for any additional monitoring that may be required by relevant stakeholders (e.g., the Mining Remediation Authority ('MRA') or the Council's Environmental Health Officer (EHO)).

3.3 Review and Update of OSMP

3.3.1 While the SMP and CEMP will provide for comprehensive environmental management, both will be 'live' documents that can be updated by the Applicant and provided to the Council in response to on-the-ground conditions where required. This is to account for possible:

- Changes in environmental receptors, or sensitivity of environmental receptors as a consequence of changes in the environment;
- Changes in personnel responsible for supervising soil management on Site; and
- Changes to the construction design, method, or programme of the Proposed Development.

3.3.2 Any SMP submitted approved will be a 'live' document and will be updated as required. Existing management measures and mitigation outcomes will not be amended without the prior agreement of the Council.

3.4 General Requirements for Soil Handling

3.4.1 This section outlines general requirements for vehicular traffic over agricultural land and soil handling, i.e., soil stripping, storage, and placement/re-spreading during the construction phase of the Proposed Development. It supplements requirements for groundwork and soil in the OCEMP (Appendix 5.1) and should be read in conjunction with that document.

3.4.2 Best practice for solar farm design, layout, and construction set out in the BRE National Solar Centre's (2014) '*Agricultural Good Practice Guidance for Solar Farms*' will be followed.

3.4.3 The quality and quantity of soil resources (topsoil and subsoil) within the Site will be maintained by following the approach of the DEFRA '*Code of Practice for the Sustainable Management and Use of Soil on Construction Sites'*.

3.4.4 All soil and soil forming materials shall be handled following the BSSS on '*Benefitting from Soil Management in Development and Construction*'[6] and the Institute of Quarrying's Good Practice Guide for Handling Soil[7], Sheets A – E (handling soil using backacters (tractor + backhoe portmanteau) and dump trucks).

3.4.5 Where relevant, handling peaty/organic soils should aim to maintain peatland ecosystem services (such as carbon sequestration), minimise risks to ecosystem services (such as the loss of habitat, water quality, storage or ground stability), and retain excavated peat in storage as close to the point of extraction as practicable.

3.4.6 By following the best practice guidance above, the SMP may include the following non-exhaustive list of mitigation measures:

- Soil will be moved directly from donor to receptor areas to avoid triple handling and/or storage;
- Soil handling will not carried out when the soil moisture content is above the plastic limit (see section 1.7 and Appendix A of this OSMP);
- Soils will only be moved under the driest practicable conditions and suitable weather conditions;
- Topsoil will not be mixed with subsoil or other materials;
- Soil will be stored in designated soil storage areas;
- Plant and machinery will only work when ground or soil surface conditions enable their maximum operating efficiency;
- No vehicles or plant will drive outside designated areas or on reinstated soil;

[6] British Society of Soil Science (2022). Working with Soil Guidance Note on Benefitting from Soil Management in Development and Construction

[7] Institute of Quarrying. Good Practice Guide for Handling Soils in Mineral Workings, 2021.

- No materials will be stored outside designated areas or on reinstated soil;
- All plant and machinery must always be maintained in a safe and efficient working condition; and
- Daily records of operations undertaken, and Site weather and soil conditions should be maintained.

3.5 Stop Conditions

3.5.1 As described in section 1.7 and Appendix A, when soil is handled when it is too wet (i.e., the moisture content is at or exceeds the lower plastic limit), soil strength is reduced, and it becomes prone to structural damage, (i.e., less resistance to compression and shear). The wet (or plastic) soil can lose its structure and become compacted by introducing a force, such as a mechanical excavator. As described in best practice produced by the Institute of Quarrying (IoQ) (see '*Supplementary Note 4 – Soil Wetness'* given as Appendix B):

'…The degree of effect due to soil handling is likely to vary between the soil textural class, structural condition, and organic matter content, the local climate and daily weather conditions, but also between the types and size of machinery used and handling practice adopted. The primary cause of compaction arises from the compression caused by trafficking by the machinery and stockpiling of soil in storage. Whilst some degree of remedial actions might be possible, experience has demonstrated that minimising compaction by handling soil in a dry condition is the more effective and reliable, and likely most cost-effective option.'

3.5.2 Advice is given in Appendix B on the general timing of activities. A field/area based determination of when the actual activities should start, cease or restart based upon actual soil wetness is provided. The SMP will carefully consider the timing of:

- Vehicles trafficking over the land and soil; and
- Land-work and soil handling operations.

3.5.3 The SMP will be substantially in accordance with this OSMP's recommendations for soil handling. The SMP will provide mitigation measures to avoid or reduce damage to soil structure, especially when the soil is wet. It will include a method statement for determining when land-work and soil handling operations should start, cease, and restart based upon actual soil wetness.

3.5.4 An *'Indicative on-average months when vegetated mineral soils might be in a sufficiently dry condition according to geographic location, depth of soil and clay content'* is given in Appendix B. The Site is in Climate Zone 1 (taken from the (IoQ) Supplementary Note on Soil Wetness).

3.5.5 In general, soil handling should be minimised during October to March unless it is in a suitable dry and friable condition. The guidance above and provided in Appendix A for ceasing and restarting work involving soil handling should be reflected in the SMP.

3.5.6 Regarding adverse weather conditions:

- Soil handling operations can continue in drizzle or light, intermittent rain for up to four hours or until the soil moisture exceeds the plastic limit (see Appendix B for field test to assess the soil's plastic limit);
- Soil handling operations must stop immediately if there is heavy rain (e.g. heavy showers, slow moving depressions);
- Soil handling should be suspended and not restarted until the ground has had at least a full day to dry, or the soil moisture is below the plastic limit, if there is sustained heavy rainfall of more than 10mm in 24 hours; and
- Soil will not be handled or trafficked over/driven on immediately after heavy rainfall (or snow/hail) in a waterlogged condition, or when there are standing pools of water on the soil surface.

3.6 Drainage

3.6.1 The SMP will align with hydrological management requirements set out in the CEMP. Accordingly, throughout the period of construction activity, the PC shall take all reasonable steps to ensure that drainage from areas within and adjoining the Site is not impaired or rendered less efficient by construction activities.

3.6.2 The PC will take all reasonable steps, including the provision of any necessary works, to prevent damage by erosion, silting or flooding and to make proper provision for the disposal of all water entering, arising on or leaving the Site during the permitted operations.

3.7 Accidental Spillages

3.7.1 The SMP will align with guidance for accidental spillages set out in the CEMP. Accordingly, any oil, fuel, lubricant, paint or solvent within the Site shall be stored so as to prevent such material from contaminating topsoil, subsoil, soil forming material, or reaching any watercourse.

3.8 Biosecurity

3.8.1 The SMP will align with the Biosecurity Management Plan as set out in the CEMP. Accordingly, throughout the period of working, and restoration, the PC shall have regard to the need to adhere to the precautions for preventing the spread of Invasive Non-Native Species published by the Government online[8].

3.9 Ground Preparation

3.9.1 All undisturbed areas where no construction activities or vehicles are allowed, will be clearly marked out and signposted.

3.9.2 Underground utilities or services crossing the area of soil stripping will be surveyed, and their depth and position will be clearly marked to ensure soil stripping works do not impact them. The utility or service location may require cordoning/fencing off.

3.9.3 Any trees, hedgerows, or valuable habitats that are to be retained will be marked out with barrier tape and subsequently protected and managed in accordance with the CEMP.

3.9.4 Prior to stripping agricultural topsoil (e.g., access roads, ancillary buildings, cable trenches, and the Grid Connection Infrastructure), all above-ground vegetation will be cleared off the part of the Site to be stripped, so that the amount of vegetation within the topsoil strip is minimised. This is to minimise the amount of anaerobic decomposition of vegetation / organic matter that will occur within the topsoil stockpiles.

[8] HM Government (2014, last updated 2022). Natural England, DEFRA, and Environment Agency Guidance How to stop invasive non-native plants from spreading.

3.10 Temporary Access Tracks and Compounds

3.10.1 Heavy goods vehicles (‘HGV’) delivering construction materials, will be restricted to public highways, internal access tracks, and dedicated construction compounds. Compounds for the delivery of materials will be located near accesses to public highways within the areas provided by Work No. 4.

3.10.2 For the construction of temporary access tracks and compounds, the topsoil (i.e., 20cm layer) will be removed by LGP or tracked machinery and stored in a low bund alongside the track/compound. A geotextile membrane will then be laid down to prevent stones mixing with the soil. Onto this is placed a mix of as-dug stone-topped, if needed, with the smaller stone placed and rolled level. At the end of the construction phase, the stone will be dug up and removed, the membrane removed, the area is loosened by a subsoiler or plough, and the topsoil spread back over before being harrowed with standard agricultural machinery. It will then be reseeded.

3.10.3 Construction machinery such as piling machines and telehandlers will not traffic over agricultural land which is left in-situ (i.e., where the topsoil has not been stripped) when the soil is too wet. This is to avoid causing soil structural damage by compaction and smearing, and to avoid creating ruts/vehicle wheelings at the ground surface (see ‘*General Requirements for Soil Handling*’ above for guidance on appropriate soil moisture content for soil handling).

3.10.4 The use of temporary access road systems for installing the generating station equipment to minimise structural damage to the soil is recommended where ground conditions dictate. This could involve a heavy-duty composite plastic trackway system on a thin layer of stone, or no stone, e.g., GroundGuards Xtreme Mats 4mx2m Large Mats[9], or SignaRoad 3mX2m Large Mats[10], or other similar geotextile material.

[9] GroundGuards Xtreme Mats 4mx2m Large Mats.
[10] SignaRoad 3mX2m Large Mats.

3.10.5 Where a peaty/organic layer is present, construction machinery, e.g., piling machines and telehandlers, will not traffic directly over such land in any weather. Such areas must be demarcated with appropriate barriers put in place to prevent vehicle tracking. In the unlikely event that the use of such land is deemed necessary, the SMP will govern any such use and would stipulate the specifications of a temporary haul road system to prevent structural damage, shrinkage, or erosion of the peat/SOM. No routing of this nature would be supported by the SMP without the Soil Advisor being satisfied that the objectives of peat/SOM safeguarding could be achieved.

3.11 Solar Panel Installation

3.11.1 No additional mitigation measures are required that are applicable to the implementation of solar PV infrastructure, that are not sufficiently covered off by the general governance measures of the OSMP (see Section 3.4). Any further measures that are identified will be set out in this section of the SMP.

3.12 Underground Cable Installation and Other Trenches

3.12.1 Cabling will be connected once the solar PV arrays are installed. This is done mostly with either a mini-digger or a trenching machine. Trenches will mostly be at depths of 0.8m where soil depth permits, although CCTV trenching around the periphery is likely to be shallower, i.e., 50cm depth.

3.12.2 Low ground pressure ('LGP') or tracked mechanical diggers will be used to minimise soil compaction (see also appropriate trenching machinery in BRE National Solar Centre '*Agricultural Good Practice Guidance for Solar Farms*' (2013).

3.12.3 Topsoil will be stripped and stored next to one side of the trench. Subsoil will then be stripped to the required depth and stored on the opposite side of the trench to the topsoil.

3.12.4 Topsoil and subsoil that is excavated for cable trenches within the Site will be restored to their original position, i.e., topsoil at the top, and thickness as soon as the cable is laid. This avoids the need to store soil in storage bunds for a long time.

3.12.5 The restored trenches are narrow and grass in the restored topsoil will recover rapidly. Where necessary, additional grass seed will be spread on restored ground that remains bare after a few weeks.

3.12.6 While these procedures set out the methodology that will apply to cable trenching, they will be applied to any other works involving excavations for the implementation of ancillary structures or SuDS infrastructure.

3.13 Grid Connection Infrastructure

3.13.1 Regarding the infrastructure within Work No. 2 (Grid Connection Infrastructure), the following measures are likely to be taken forward into the SMP with further details to be provided following the detailed design.

- The topsoil (expected to be a 20cm layer but potentially more) will be stripped in a soil bund (see 'Soil Storage' below) adjacent to any concrete pad and/or secondary security fence around the fixed external electrical equipment.
- A stone base will then be added, and formwork (shuttering) will be put around before concrete is poured to create the pad to the desired thickness. The fixed equipment will then be located on the concrete pad once it has set.
- Security fencing around the fixed equipment may be added once the cabling and connections are complete.
- For restoration the stone and matting will be removed where it is not forming a permanent feature of the external electrical equipment area. For areas that will be returned to grassland in this Work No. 2, the Soil Advisor will return to review the area once the matting is removed. The Soil Adviser will advise whether there needs to be any loosening of the area before the topsoil is replaced over the top. The area will then be harrowed with standard agricultural spring-tine harrows or a power harrow, to loosen the topsoil and level the area. The area can then be sown to grass.
- Areas where long-term fixed equipment is to be placed, typically on a concrete pad, need to be built with future restoration in mind. The key consideration is to strip the topsoil and set it to one side in a suitable

bund so that it remains in an aerobic condition for spreading when the area is restored in the future.

3.14 Soil Storage

3.14.1 Before any part of the Site is excavated or is built upon, or used for the stacking of topsoil, subsoil or overburden, or as a machinery dump or plant yard, or for the construction of a road, all available topsoil and subsoil will be stripped from that part.

3.14.2 Bunds for the storage of soils shall conform to the following criteria.

- Topsoil and subsoil (referred to as overburden) in the different soil handling units will be stored separately.
- Where continuous bunds are used, dissimilar soils will be separated by a third material.

Soil with high sensitivity / low resilience

- Topsoil and subsoil with high sensitivity/low resilience to soil handling will be stored in bunds that do not exceed 3m height.
- Materials will be stored like upon like, so topsoil shall be stripped from beneath subsoil bunds.
- All storage bunds containing soils intended to remain in situ for more than 6 months or over the winter period will be grassed over and weed control, and other necessary maintenance will be carried out. The seed mixture and the application rates will be set out in the SMP.
- All topsoil and subsoil shall be retained on the Site.
- The SMP will identify the locations and footprint of each stockpile on a plan of appropriate scale.
- Regular inspections of soil stockpiles will be undertaken to check for signs of erosion. Where erosion occurs, the sides of the stockpiles will be reformed.

3.15 Soil Restoration

3.15.1 Soil restoration measures are not considered to be relevant to the construction phase of the Proposed Development but are not ruled out, particularly if any pre-commencement ground investigations reveal contaminated land which requires remediation. Soil restoration measures may also be required during the operational phase (e.g., following the removal of the Wind Farm (within Area D), if not adequately provided for in that development's decommissioning documentation). This will be a key topic for the Proposed Development's DMP suite following the framework provided by the FDMP which advises of an expectation for a Decommissioning Soil Management Plan ('DSMP') for that phase.

3.15.2 This section of the OSMP sets out general measures related to soil restoration which may be applicable for all phases of the Proposed Development. The main objective for the restoration of agricultural land is to reinstate the land to its original (pre-development) ALC grade (see ES Appendix 2.8). As maintaining the quality and quantity of soils is a key objective of the SMP, it is not only a matter for decommissioning; it is also relevant to the construction and operational phases of the Proposed Development. Where it is required, restoration will be achieved by restoring the soil profiles in the correct sequence of horizons, i.e., topsoil at the top. The topsoil will be levelled, cultivated, and reseeded as agreed with the landowner/occupier.

3.15.3 In areas where land compaction occurs at the Site it may be necessary to undertake subsoil restoration techniques to restore the structure of the subsoil and to assist with land drainage.

3.15.4 The PC will clear all temporary working areas and accesses as the work proceeds and when they are no longer required for the works. On completion of the construction activities, all temporary construction plant, materials, and works/structures will be removed.

4 Conclusion

4.1.1 The OSMP provides an outline of the SMP to govern soil resource management during the Proposed Development's construction phase. Through implementation of the SMP alongside the CEMP's broader environmental governance during the construction phase, the outcomes of soil management measures will support the success of the Site's landscape and ecological mitigation and enhancement strategy while also conserving the quality and quantity of Site soils as a natural capital resource. The best practice measures and outcomes supported by the SMP are expected to be taken forward across the operational and decommissioning phases via the LEMP and a DSMP within the DMP suite.

4.1.2 The SMP will follow best practice guidance set out in the OSMP and will provide further detail on:

- Roles and Responsibilities;
- Site Conditions (reflecting updating ecological assessment and ground investigation outcomes);
- General Soil Management Methods;
- Works-specific Soil Management Methods;
- Crossover Topics with CEMP (e.g., drainage, pollution prevention, ground preparation);
- Soil Storage;
- Soil Restoration; and
- SMP Quality Management (Monitoring, Recording, Updating)

Figures

Figure 1: Topsoil Sample Locations (SMP1 to SMP15), July 2015
Figure 2: Soil Handling Units
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Path: C:\Users\tletendrie\Documents\ArcGIS\Projects\332511471\332511471.aprx

Legend
- Order Limits
- Topsoil Sample Location

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Project Title

Dean Moor Solar Farm

Client

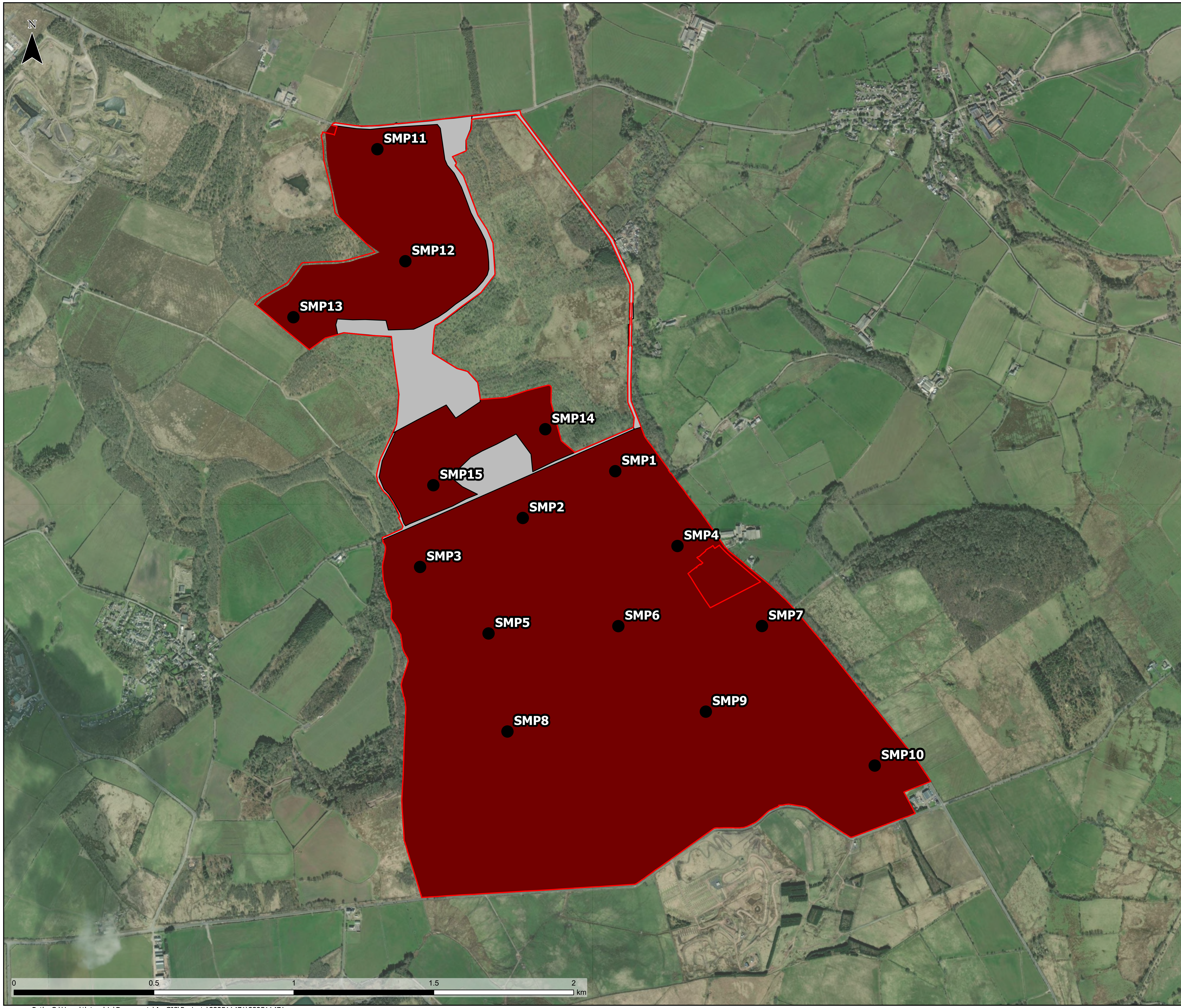
FVS Dean Moor Limited

Title

DEAN MOOR SOLAR FARM DEVELOPMENT CONSENT ORDER Topsoil Sample Locations, July 2024

Scale: 1:12,500 @ A3	Date: 24/10/2024
Drawn: TL	Checked: JL
Figure: 3	Rev: A

Stantec



Legend

- Order Limits
- Topsoil Sample Location
- Soil Handling Unit 3 - Low Resilience to Stuctural Damage
- Non-Agricultural Land

Project Title

Dean Moor Solar Farm

Client

FVS Dean Moor Limited

Title

DEAN MOOR SOLAR FARM
DEVELOPMENT CONSENT ORDER
Soil Handling Units

Scale: 1:12,500 @ A3	Date: 08/11/2024
Drawn: TL	Checked: JL
Figure: 2	Rev: A

Stantec

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Appendix A Soil Resilience

DEAN MOOR SOLAR FARM

ENVIRONMENTAL STATEMENT

APPENDIX A – SOIL RESILIENCE

PLANNING INSPECTORATE REFERENCE E N010155

PREPARED ON BEHALF OF FVS DEAN MOOR LIMITED

Project Ref:	**EN010155/Appendix A: Soil Resilience**
Status	Final
Issue/ Rev:	1
Date:	January 2025

Contents

1 Soil Resilience

1.1 Introduction

1.1.1 This Appendix A (of ES Appendix 5.3 OSMP) on soil resilience has been produced for FVS Dean Moor Limited (the 'Applicant') to support the DCO application for the Dean Moor Solar Farm ('the Proposed Development') on approximately 276.50ha of land located between the villages of Gilgarran and Branthwaite in West Cumbria (the 'Site'), which is situated within the administrative area of Cumberland Council ('the Council').

1.2 Soil receptor sensitivity / resilience

1.2.1 When considering soil as a growing medium for food and biomass production (i.e., the land at the Site is currently in agricultural production), and a habitat that supports microbial, plant, and animal life, its sensitivity to change is mainly dependent on its resilience to structural damage during cultivation and soil handling (i.e., soil stripping, storing in stockpiles, and re-spreading).

1.2.2 As detailed in numerous guidelines for soil handling, including the '*Code of Practice for Sustainable Management of Soil on Construction Sites*' (2009)[1], the key to understanding soil resilience to structural damage during soil handling is the interaction between soil texture and soil moisture, as well as the effect of this interaction on soil structure.

1.3 Soil texture

1.3.1 Soil texture describes how the mineral element of soil comprises a mixture of mineral particles of different sizes and a different texture class can be ascribed according to the proportion of (according to the British Standards Institution):

- Clay (<0.002mm);
- Silt (0.002mm to 0.06mm);

[1] Department for Environment, Food and Rural Affairs (September 2009) 'Code of Practice for the Sustainable Use of Soils on Construction Sites'. Available at: https://www.gov.uk/government/publications/code-of-practice-for-the-sustainable-use-of-soils-on-construction-sites Accessed December 2024

- Sand;
    - fine sand (0.06mm to 0.2mm);
    - medium sand (0.2mm to 0.6mm); and
    - coarse sand (0.6mm to 2.0mm).

1.3.2 The amount of moisture in the soil is known to affect key soil properties[2], including:

- **Soil strength** (i.e., cohesion, internal friction) - This is an important feature of soils regarding their response to soil handling, and importantly to their resistance to fracture, compression, smearing, moulding, and compaction.
- **Soil consistency** - This is commonly used to describe the 'feel' of the soil and includes properties such as friability, plasticity, stickiness, and resistance to compression and shear. Changes in consistency are described in terms of various limits (for which there is a British Standard Institute (BSI) methodology for the Plastic Limit):
    - The Plastic Limit (or Lower Plastic Limit), i.e., the moisture content at which the soil changes from friable to plastic and is taken to be the minimum moisture content at which the soil can be puddled. This can be measured in a laboratory under BS1377:1990 '*Methods of test for soils for civil engineering purposes'* by rolling threads of soil that shear longitudinally and transversely at approximately 3mm diameter. An appropriate method for assessing the plastic limit of soil in the field is given in Appendix B to the Outline Soil Management Plan (OSMP); and
    - The Liquid Limit (or Upper Plastic Limit), i.e., the water content at which soil cohesion is so reduced that the soil mass will flow when a force is applied.

1.4 Soil structure

1.4.1 The most important structural features of soils are the size, shape, and stability of the peds (soil aggregates), which influence how the soil is penetrated by water, air, and roots. Generally, soil with a good structure is well drained and aerated and most suitable for soil flora and fauna.

1.4.2 When soil is handled when it is too wet (i.e., the moisture content is at or exceeds the lower plastic limit), then soil strength is reduced, and it becomes prone to structural damage, i.e., it has less resistance to compression and shear. The wet (or plastic) soil can lose its structure and

[2] Landon, J. R (Editor) (1991). Chapter 6 'Soil Physics' in 'Booker Tropical Soil Manual'. Longman Scientific & Technical

become compacted by introducing a force, such as a mechanical excavator.

1.4.3 In the worst-case scenario, well-structured and aerated soil can become poorly structured (even massive) by soil handling when it is too wet (plastic). If stored in this state, it can become anaerobic, with distinctive grey colouration and associated ‘sour’ smell. Poor drainage and anaerobic conditions cause stress and often death to plants (crops) and soil fauna.

1.4.4 The Ministry of Agriculture, Fisheries and Food (MAFF) ‘*Agricultural Land Classification (ALC) of England and Wales*’ system has developed a methodology for assessing the interaction between soil texture and soil moisture, and, in part, classifies agricultural land quality according to soil wetness (i.e. the interaction between soil topsoil texture, soil wetness class (WC)[3], and the number of days that the soil profile is predicted to be at field capacity (i.e., the maximum amount of water a soil profile can hold following free drainage).

[3] The Wetness Class (WC) of a soil is classified in Appendix II of Hodgson, J.M. (1977), The Soil Survey Field Handbook. Soil Survey and Land Research Centre, Technical Monograph No.5, according to the depth and duration of waterlogging in the soil profile and has six bands ranging from Wetness Class I (well drained) to Wetness Class VI (permanently waterlogged).

Appendix B Soil Guidance

DEAN MOOR SOLAR FARM

ENVIRONMENTAL STATEMENT

APPENDIX B – SOIL GUIDANCE

PLANNING INSPECTORATE REFERENCE EN010155

PREPARED ON BEHALF OF FVS DEAN MOOR LIMITED

Project Ref:	**EN010155/Appendix B: Soil Guidance**
Status	Draft
Issue/ Rev:	2
Date:	January 2025

Contents

1 Soil wetness

1.1 Background

1.1.1 Soil wetness is a major determinant of land use, and environmental and ecosystem services in the UK. It is also a factor in the occurrence of significant compaction arising from handling soils with earth- moving machines and the practices used (Duncan & Bransden, 1986).

1.1.2 Relative soil wetness can range from the waterlogged to moist (‘mesic’) or dry (‘xeric’) depending on rainfall distribution and depth to a water-table and duration of waterlogging. In the UK, soil wetness is largely seasonal with higher evapo-transpiration rates potentially exceeding rainfall in the summer resulting in the soil profile becoming drier where there is vegetation. Whilst soil wetness is largely weather system and equinox (climate) driven, it varies with geographical and altitudinal locations, and importantly the physical characteristics of the soil profile, such as texture structure, porosity, and depth to the water-table and topography including flood risk (MAFF, 1988). The Soil Wetness Class is based on the expected average duration of waterlogging at different depths in the soil throughout the year (days per year) and can be determined by reference to soil characteristics and local climate (MAFF, 1988).

1.1.3 The likely inherent wetness and resilience status of a soil will be indicated in the Soil Management Plan (SMP), which will be secured by a DCO Requirement, (see Part 1, Table 2 and Supplementary Note 1), reflecting potential risks for soil handling such as low permeability, permanently high groundwater, or a wet upland climate.

1.1.4 Wet soils can also be a result of other circumstances. For example, the interception of water courses, drainage ditches and field land drains. Where these occur, the provisions are to be made in the SMP to protect the soils being handled and the operational area.

1.1.5 Soils, when in a wet condition, generally have a lower strength and have less resistance to compression and smearing than when dry. Lower strength when soils are wet also affects the bearing capacity of soils and their ability to support the safe and efficient operation of machines compared to when soils are in a dry state.

1.1.6 In terms of resilience and susceptibility to soil wetness, the clay content of the soil largely determines the change from a solid to a plastic state (the water content at which this occurs is called the 'plastic limit' (MAFF, 1982)). This is the point at which an increasing soil wetness has reduced the cohesion and strength of the soil and its resistance to compression and smearing.

1.1.7 Whilst coarse textured sandy soils are not inherently plastic when wet, they are still prone to compaction when in a wet condition. Hence, handling all soils when wet will have adverse effects on plant root growth and profile permeability, which may be of significance for the intended land use and the provision of services reliant on soil drainage and plant root growth. It may be less so in other circumstances where wet soil profiles, perched water tables and ponding are the reclamation objectives, though drainage control, for example to control flooding, may still be important in these contexts.

1.1.8 In cases of permanently wet soils, such as riverine sites, upland or deep organic soils where there is a persistent high water-table throughout the seasons within the depth of soil to be stripped and/or the soil profile remains too wet, a strategic decision has to be made to be able to proceed with the development of the mineral resource. This may mean alternative and less favourable soil handling practices have to be agreed with the planning authority.

1.2 Predicting and determination of soil wetness

1.2.1 There are well established methods to predict and determine soil wetness of undisturbed and restored soil profiles (Reeve, 1994). The challenge has been the prediction of the best time for soil stripping.

Models based on soil moisture deficits and field capacity dates for a range of soil textures can provide indicative regional summaries (Table 1.1) that can help with planning operations at broad scale but cannot be relied upon in practice for deciding operationally whether to proceed on the ground given the actual variation in weather events from year to year and within years.

Table 1.1: Indicative on average months when vegetated mineral soils might be in a sufficiently dry condition according to geographic location depth of soil and day content

Soil clay content	Climatic zones		
	1	2	3
Soil depth <30cm			
<10%	Mid Apr - Early Oct	Late Mar – Early Nov	Late Mar – Early Dec
10 -27%	Late May - Early Oct	Early May – Early Nov	Early Apr – Early Dec
Soil depth 30-60cm			
<10%	Late Apr - Early Oct	Mid Apr – Early Nov	Early Apr – Early Dec
10-27%	Late May - Early Oct	Early May – Early Nov	Early Apr – Early Dec
>27%	Late June – Early Oct	Early June – Early Nov	Late May – Early Dec
Soil depth >60cm			
<10%	Late Apr - Early Oct	Mid Apr – Early Nov	Early Apr – Early Dec
10-18%	Late May - Early Oct	Early May – Early Nov	Early Apr – Early Dec

Soil clay content	Climatic zones		
	1	**2**	**3**
18-27%	Late June – Early Oct	Early June – Early Nov	Late May – Early Dec
>27	Mid July – Mid Sept	Early July – Mid Oct	Late June – Mid Oct

1.2.2 The timing of most soil handling operations takes place between April and September, although in western (Zone 1) and central (Zone 2) areas it typically can be a later start in May with an earlier termination in August. Whilst the return to climatically 'excess rainfall' is later in the eastern counties (Zone 3) and can be as late as November/early December, there is a need to maintain transpiring vegetation to keep the soils being handled in a dry as possible condition, and to establish new vegetation covers as soon as possible (on replaced soils and storage mounds). Hence, soil handling operations generally need to be completed no later than the end of September (Natural England, 2021), unless appropriate provisions can be assured.

1.2.3 Where data is available, more realistic local and real-time predictions can be made, however, because weather patterns and events differ between and within years, and soils can be varied locally in their condition. Experience has shown that the most practical approach for operations is to inspect the site and soils in question near to/ at the time when soil handling is to take place. Professional soil surveyors can advise on the best time for soil handling (stripping, storage and replacement) and carry out site assessments of soil wetness condition prior to the start of operations.

1.3 A practical method for determining soil wetness limitation

1.3.1 During the soil handling season (see Table 1.1 above), prior to the start or recommencement of soil handling, soils should be tested to confirm they are in suitably dry condition (Table 1.2). The 'testing' during operations can be done by suitably trained site staff and reviewed periodically by the professional soil surveyors.

1.3.2 The method is simply the ability to roll intact threads (3mm diameter) of soil, indicating the soils are in a plastic and wet condition (MAFF, 1982; Natural England, 2021). Representative samples are to be taken through the soil profile and across the area to be stripped. It is the best available indicator of soils being too wet to be handled, meaning operations should be delayed until a thread cannot be formed. For coarse textured soils which do not roll into threads, a professional's view as to soil wetness and the risk of compaction may have to be taken.

1.3.3 Soil tests are to be undertaken in the field. Samples shall be taken from at least five locations in the soil handling area and at each soil horizon to the full depth of the profile to be recovered/replaced. The tests shall include visual examination of the soil and physical assessment of the soil consistency.

Table 1.2: Field tests for suitably dry soils

Examination
1. If the soil is wet, films of water are visible on the surface of soil particles or aggregates (e.g. clods or peds) and/or when a clod or ped is squeezed in the hand it readily deforms into a cohesive 'ball' means **no soil handling to take place.**
2. If the samples is moist (i.e. there is a slight dampness when squeezed in the hand) but it does not significantly change colour (darken) on further wetting, and clods break up/crumble readily when squeezed in the hand rather than forming into a ball means **soil handling can take place.**
3. If the sample is dry, it looks dry and changes colour (darkens) if water is added, and it is brittle means **soil handling can take place.**

Consistency
First test – attempt to mould soil sample into a ball by hand: **1.** Impossible because soil is too dry and hard or too loose and dry means soil handling can take place. **2.** Impossible because the soil is too loose and wet means no soil handling to take place. **3.** Possible - Go to second text. **Second test** – attempt to roll ball into a 3mm diameter thread by hand: **1.** Impossible because soil crumbles or collapses means soil handling can take place. **2.** Possible means no soil handling can take place.

N.B.: It is possible to roll most coarse loamy and sandy soils into a thread even when they are wet. For these soils, the Examination Test alone is to be used.

1.4 A rainfall protocol to suspend and restart soil handling operations

1.4.1 Local weather forecasts of possible rainfall events during operations and the occurrence of surface lying water have been used to advise on a day-to-day basis if operations should stop (Natural England, 2021). Single events such as >5mm/day in spring and autumn months, and >10mm/day in the summer have been suggested as more precise triggers for determining soil handling operations (Reeve, 1994). However, in practice the following generic guidelines are often used:

- In light drizzle soil handling may continue for up to four hours unless the soils are already at/near to their moisture limit.
- In light rain soil handling must cease after 15 minutes.
- In heavy rain and intense showers, handling shall cease immediately.

1.4.2 In all of the above it is assumed that soils were in a dry condition. These are only general rules, and it is at the local level decisions to proceed or stop should be based on the actual wetness state of the soils being handled. After the above rain event has ceased, the soil tests in Table 1.2 above should be applied to determine whether handling may re- start, provided that the ground is free from ponding and ground conditions are safe to do so. There can be extreme instances where soil horizons have become very dry and are difficult to handle resulting in dust and windblown losses. In these conditions the operation should be suspended. The artificial wetting of extremely dry soils is not usually a practice recommended but has been successful in some cases.

1.5 References

Duncan N A and Bransden B E, 1986. The effects on a restored soil caused by soil moving under different moisture contents. Applied Geography, 6, 3, pp 267-273

MAFF, 1982. Reference Book 441: Techniques for measuring soil physical properties. Her Majesty's Stationery Office, London

MAFF, 1988. Agricultural Land Classification of England and Wales

Natural England, 2021. Planning and aftercare advice for reclaiming land to agricultural use

Reeve M J, 1994. Improving land restoration in Britain by better timing of soil movement, pp 28-37. In, Proceedings American Society of Mining and Reclamation. DOI: 10.21000/ JASMR94030028

Appendix C Certificates of Topsoil Analysis

ANALYTICAL REPORT

Report Number	**45774-24**	**N717**	**ROB ASKEW**	**Client DEAN MOOR SOLAR FARM**
Date Received	**01-AUG-2024**		**RW ASKEW**	**WEST CUMBRIA**
Date Reported	**23-AUG-2024**		**THE OLD STABLES**	
Project	**C1115**		**UPEXE**	
Reference	**DEAN MOOR SOLAR**		**EXETER**	
Order Number			**DEVON EX5 5ND**	

Laboratory Reference		**SOIL706277**	**SOIL706278**	**SOIL706279**	**SOIL706280**	**SOIL706281**	**SOIL706282**	**SOIL706283**	**SOIL706284**	**SOIL706285**	**SOIL706286**
Sample Reference		**SMP1**	**SMP2**	**SMP3**	**SMP4**	**SMP5**	**SMP6**	**SMP7**	**SMP8**	**SMP9**	**SMP10**
Determinand	**Unit**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**
pH water [1:2.5]		5.6	5.6	5.8	6.0	5.7	6.1	6.0	5.7	6.1	5.9
Available Phosphorus (Index)	mg/l	25.2 (2)	18.0 (2)	26.8 (3)	11.2 (1)	22.0 (2)	13.4 (1)	11.4 (1)	23.2 (2)	7.4 (0)	9.2 (0)
Available Potassium (Index)	mg/l	62.8 (1)	56.4 (0)	66.8 (1)	64.5 (1)	87.8 (1)	71.3 (1)	52.0 (0)	66.4 (1)	93.9 (1)	49.2 (0)
Available Magnesium (Index)	mg/l	60.0 (2)	77.7 (2)	78.2 (2)	76.1 (2)	92.3 (2)	80.3 (2)	80.2 (2)	74.3 (2)	71.9 (2)	92.2 (2)
Sand 2.00-0.063mm	% w/w	42	41	38	26	44	25	26	43	37	37
Silt 0.063-0.002mm	% w/w	31	31	31	35	28	34	36	29	33	34
Clay <0.002mm	% w/w	27	28	31	39	28	41	38	28	30	29
Organic Carbon by DUMAS	%	7.6	6.0	6.9	8.4	6.9	9.6	8.5	7.0	4.2	3.5
Organic Matter [calculation]	%	13.1	10.2	11.9	14.4	11.8	16.6	14.7	12.1	7.2	6.0
Textural Class **		O-HCL	O-HCL	O-HCL	O-C	O-HCL	O-C	O-C	O-HCL	HCL	HCL

Notes

Analysis Notes: The sample submitted was of adequate size to complete all analysis requested.
The results as reported relate only to the item(s) submitted for testing.
The results are presented on a dry matter basis unless otherwise stipulated.

Document Control: **This test report shall not be reproduced, except in full, without the written approval of the laboratory.**

** Please see the attached document for the definition of textural classes.

Reported by: *Teresa Clyne*

Natural Resource Management, a trading division of Cawood Scientific Ltd.
Coopers Bridge, Braziers Lane, Bracknell, Berkshire, RG42 6NS
Tel: 01344 886338
Fax: 01344 890972
email: enquiries@nrm.uk.com

ANALYTICAL REPORT

Report Number	**45775-24**	**N717**	**ROB ASKEW**	**Client**	**DEAN MOOR SOLAR FARM**
Date Received	**01-AUG-2024**		**RW ASKEW**		**WEST CUMBRIA**
Date Reported	**23-AUG-2024**		**THE OLD STABLES**		
Project	**C1115**		**UPEXE**		
Reference	**DEAN MOOR SOLAR**		**EXETER**		
Order Number			**DEVON EX5 5ND**		

Laboratory Reference		**SOIL706287**	**SOIL706288**	**SOIL706289**	**SOIL706290**	**SOIL706291**					
Sample Reference		**SMP11**	**SMP12**	**SMP13**	**SMP14**	**SMP15**					
Determinand	**Unit**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**					
pH water [1:2.5]		5.6	5.7	5.6	6.4	5.7					
Available Phosphorus (Index)	mg/l	7.4 (0)	7.6 (0)	6.4 (0)	4.0 (0)	4.2 (0)					
Available Potassium (Index)	mg/l	74.9 (1)	93.1 (1)	48.4 (0)	40.7 (0)	76.2 (1)					
Available Magnesium (Index)	mg/l	108 (3)	97.4 (2)	83.5 (2)	74.9 (2)	102 (3)					
Sand 2.00-0.063mm	% w/w	36	41	42	59	34					
Silt 0.063-0.002mm	% w/w	36	32	33	21	32					
Clay <0.002mm	% w/w	28	27	25	20	34					
Organic Carbon by DUMAS	%	4.7	2.8	3.1	8.2	3.0					
Organic Matter [calculation]	%	8.2	4.9	5.3	14.1	5.1					
Textural Class **		HCL	HCL	MCL	O-SCL	HCL					

Notes

Analysis Notes	The sample submitted was of adequate size to complete all analysis requested.
	The results as reported relate only to the item(s) submitted for testing.
	The results are presented on a dry matter basis unless otherwise stipulated.
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ADAS (UK) Textural Class Abbreviations

The texture classes are denoted by the following abbreviations:

Class	Code
Sand	S
Loamy sand	LS
Sandy loam	SL
Sandy Silt loam	SZL
Silt loam	ZL
Sandy clay loam	SCL
Clay loam	CL
Silt clay loam	ZCL
Clay	C
Silty clay	ZC
Sandy clay	SC

For the *sand, loamy sand, sandy loam* and *sandy silt loam* classes the predominant size of sand fraction may be indicated by the use of prefixes, thus:

vf Very Fine (more than 2/3's of sand less than 0.106 mm)
f Fine (more than 2/3's of sand less than 0.212 mm)
c Coarse (more than 1/3 of sand greater than 0.6 mm)
m Medium (less than 2/3's fine sand and less than 1/3 coarse sand).

The subdivisions of *clay loam* and *silty clay loam classes* according to clay content are indicated as follows:

M medium (less than 27% clay)
H heavy (27-35% clay)

Organic soils i.e. those with an organic matter greater than 10% will be preceded with a letter O.

Peaty soils i.e. those with an organic matter greater than 20% will be preceded with a letter P.

For further information on all analyses and services available from NRM Laboratories contact us on:
Tel: 01344 886 338 Fax: 01344 890 972 Email: enquiries@nrm.uk.com Website: www.nrm.uk.com

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