The Great Grid Upgrade

Weston Marsh to East Leicestershire

Draft Environmental Statement

Appendix 12A Draft Outline Soil Management Plan

EN0210007

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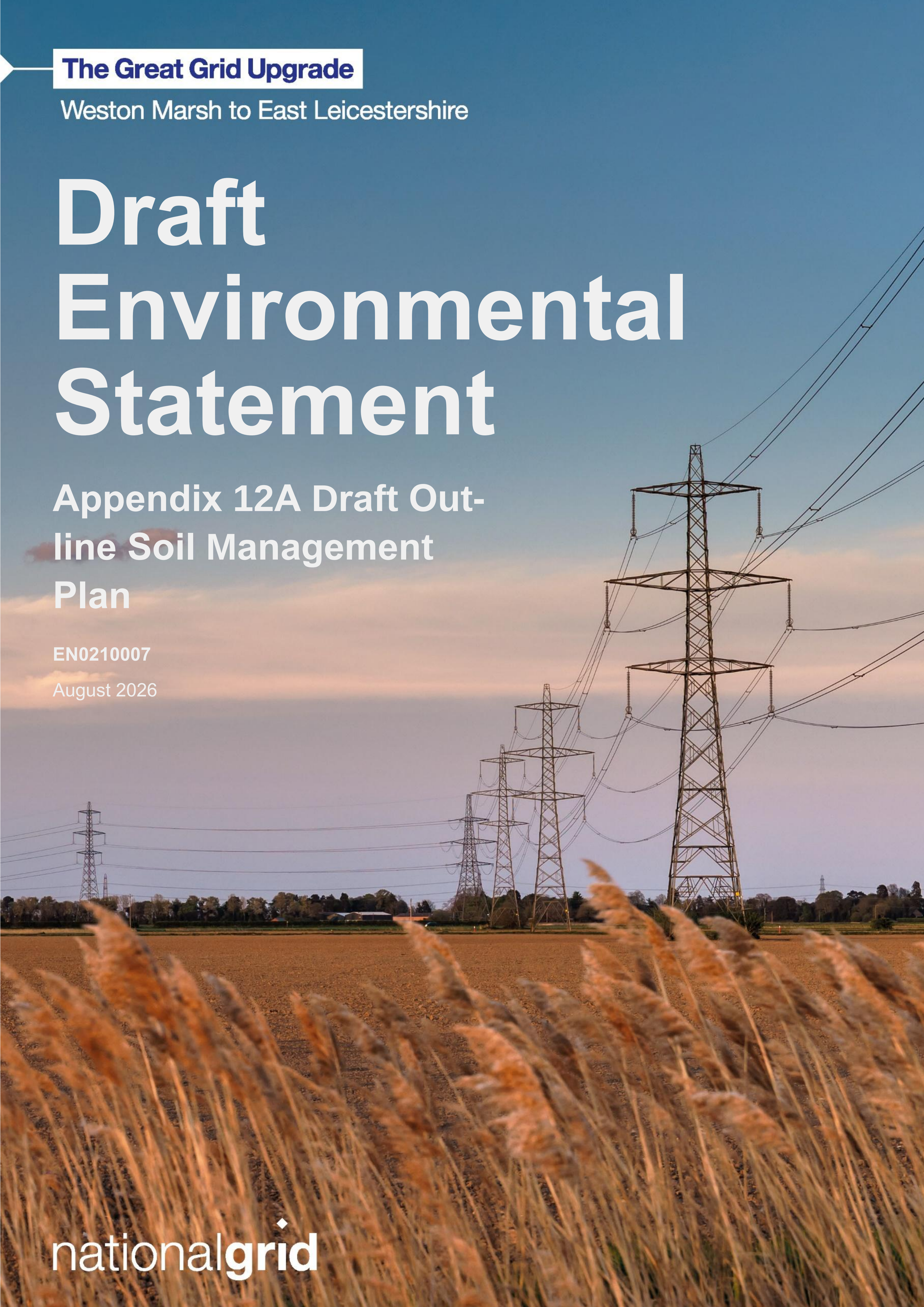

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12A.1 Introduction

Overview

12A.1.1 The Weston Marsh to East Leicestershire Project (the Project) is being developed by National Grid Electricity Transmission plc (National Grid) to increase the ability of the transmission system to transfer power between other proposed transmission infrastructure in the east of England and the Midlands. The objective of the Project is to reinforce the electricity transmission network, facilitating the connection of planned offshore wind generation, interconnectors with other countries and other sources of electricity, allowing clean green energy to be carried on the network.

12A.1.2 The Project is expected to include the following elements:

- Approximately 60 km of new 400 kV overhead transmission line.
- A new 400 kV substation to be built in the vicinity of the existing 4VK (Cottam – Wymondley) 400 kV overhead line to the west of Corby Glen, South Kesteven (referred to as 'WMEL-A').
- A new 400 kV substation to be built in the vicinity of the existing ZA (Cottam – Sundon) 400 kV overhead line to the west of the village of Ab Kettleby and north west of Melton Mowbray, Melton (referred to as 'WMEL-B').
- Reconductoring of approximately 66 km of the existing ZA 400 kV overhead line from WMEL-B to the existing Grendon substation, east of Northampton;
- Re-configure a short section of existing 4VK and ZA 400 kV overhead lines to facilitate connections to WMEL-A and WMEL-B substations; and,
- Local changes to the lower voltage distribution networks to facilitate the construction of the new overhead line and substations.

12A.1.3 In addition, third party utilities diversion and/or modifications may also be required to facilitate the construction of the Project. Further details would be included within the Environmental Statement (ES).

12A.1.4 The Project has been divided five Sections, refer to **Figure 1.1 Site Location Plan** and **Table 4.1** of **Chapter 4 Description of the Project**:

- Section 1: in South Holland District;
- Section 2: in South Kesteven District;
- Section 3: in Melton Borough;
- Section 4: on Harborough District; and
- Section 5: in Northamptonshire (including both North Northamptonshire and West Northamptonshire unitary areas).

12A.2 Purpose of the Soil Management Plan

12A.2.1 This is the draft Outline Soil Management Plan (oSMP) for the Project, which has been produced to support the non-statutory Draft Environmental Statement (DES) (referred to in this document as "DES" and non-statutory DES").

12A.2.2 Soil is vulnerable to being lost through mismanagement where there is not enough consideration given to planning and supervision of the handling, transportation, storage, and placement of this finite resource. The oSMP will be submitted with the application for development consent alongside the Outline Code of Construction Practice (CoCP). The Outline CoCP sets out control and management measures that will be undertaken during construction of the Project, and ensures that adverse effects from the construction phase of the Project, on local communities and on the environment, including soil, are minimised and controlled appropriately.

12A.2.3 This draft oSMP is a live document to be updated as the Project evolves to include additional measures identified through the engineering design, the Environmental Impact Assessment (EIA) process, and from engagement with stakeholders. The oSMP will be submitted as an appendix to the Environmental Statement (ES) as part of the application for development consent. During examination and decision period for the application, the oSMP may be updated as agreed with the Examining Authority. The development of a fully detailed Soil Management Plan (SMP), substantially in accordance with the approved oSMP will be secured by way of a Requirement in the Development Consent Order.

12A.2.4 The following guidance is in place to protect soil resources during the construction phase of any project and is considered in this oSMP:

- Department for Environment, Food & Rural Affairs (DEFRA) – The Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, March 2011 (Ref 12A.1).
- Institute for Quarrying's (IoQ) Good Practice Guide for Handling Soils in Mineral Workings (Ref 12A.2).

12A.2.5 The oSMP shall include the following:

- Areas of soil to be protected from earthworks and construction activities.
- Areas and types of topsoil/subsoil to be stripped, haulage routes and stockpile locations.
- Methods for stripping, stockpiling, respreading and ameliorating landscape soils.

12A.2.6 The Project will be delivered in compliance with all relevant legislation, consents and permits. Any statutory requirements listed in this document and industry good practice guidance which has informed each part of the document are not to be seen as exhaustive.

12A.2.7 National Grid will put in place robust procedures to audit and inspect the Project, including its supply chain of contractors, to make sure the control measures set out in the oSMP are adopted when constructing the Project. The SMP will apply to all areas of the Project delivered pursuant to the DCO, during construction.

12A.3 Glossary of terms

12A.3.1 The following definitions are provided to aid understanding of this draft oSMP.

- **Topsoil** - Natural topsoil or manufactured topsoil, varies in depth with soil type but typically occupies the uppermost 200 to 300 mm and contains organic matter, microorganisms and nutrients to sustain plant growth.
- **Subsoil** - Layer (or horizon) of soil immediately beneath the surface topsoil. Generally, it is less structurally developed and less nutrient rich than the topsoil.
- **Field Capacity** - The maximum water holding capacity of the soil after excess water has drained from large pores, typically 24–48 hours after heavy irrigation or rainfall. It represents the upper limit of plant-available water, where large, drained soil pores are filled with air and small soil pores are filled with water.
- **Soil Wetness Class** – A classification of soil wetness according to depth and duration of waterlogging in the soil from Class 1 (least wet) to Class VI (wettest).
- **Plastic** - A plastic material can be moulded into a shape and the material will retain that shape. Where practicable, soil should not be handled when in a plastic state (considered to be too wet) and if handling is unavoidable additional measures must be in place.
- **Lower Plastic Limit** - The lower plastic limit is defined as the moisture content at which soil begins to behave as a plastic material. If the moisture content is below the lower plastic limit, it is considered to behave as a solid, or a non-plastic material.
- **Soil Ped** - Soil peds are natural, relatively permanent aggregates of soil particles, separated from each other by voids or natural surfaces of weakness; and which persist through cycles of wetting and drying.
- **Tilth** - Soil tilth is its physical condition, especially in relation to its suitability for planting or growing a crop. Soil with good tilth has large pore spaces for air infiltration and water movement. Roots only grow where the soil tilth allows for adequate levels of soil oxygen. Such soil also holds a reasonable supply of water and nutrients.
- **Soil series** - the lowest category in the soil classification system and are precisely defined based upon particle-size distribution, parent material (substrate) type, colour and mineralogical characteristics.
- **Soil associations** are groupings of related soil series.
- **Soil stabilisation** are techniques to enhance the physical and engineering properties of soil, typically involving mixing cementitious binders. The purpose is to increase the bearing capacity of the soil, and resistance to erosion.

12A.4 Roles and Responsibilities

Project responsibilities

12A.4.1 Roles responsible for environmental work are included within **Appendix 4A draft Outline Code of Construction Practice**. Key roles and responsibilities relevant to this draft oSMP are set out in **Table 12A.1**.

Table 12A.1 Illustrative key roles and responsibilities for implementing the SMP

Role	Organisation	Responsibilities
Environmental Manager(s)	Contractor(s)	The Environmental Manager will be responsible for the maintenance of all environmental plans and registers (including SMP), including monitoring that the environmental measures and mitigation are implemented on site and as recorded within the Materials and Waste Management Plan (MWMP). They will be the main point of contact for all environmental matters on the project. They will also develop good working relationships with external stakeholders such as the Environment Agency and the relevant planning authorities.
Environmental Clerks of Works (ENvCoWs)	Contractor(s)	The EnvCoW(s) will monitor that the works proceed in accordance with relevant environmental DCO requirements and adhere to the required mitigation measures. The EnvCoW will be supported by appropriate technical specialist advisors, such as soil scientists and agricultural engineers, depending on the location and potential impacts. Duties will include: • Assessment of the soil condition during and after the works using tactile and visual methods; • Assessing compliance of the work on site with the oSMP; • Signing off the quality of restoration to allow for the commencement of the aftercare; • Ensuring the adequacy of the detailed aftercare programme and its annual updates (if required); • Soil sampling and production of annual aftercare reports; and • Signing off completion of the aftercare. • Handover of records between parties during transition between project stages.
Land Officer(s)	Contractor(s)	The Land Officer will have an agricultural background and experience of working with utility companies. They will provide a single point of contact for both the contractor(s) and the landowner/occupier of the land. They will be responsible for delivering site access in line with pre-agreed timescales, help facilitate the dialogue between the contractor(s) and the landowner/occupier as necessary and will be the first point of contact for any issues escalated by the landowner/occupier or the contractor(s). They will be responsible for agreeing all land condition surveys conducted by the contractor(s).
Technical soils specialist advisors	Contractor(s)/	Technical specialists will include soil scientists and agricultural engineers with the relevant experience to supervise the relevant aspects of soil management. Duties will include:

Role	Organisation	Responsibilities
		• Providing training on the application of field testing of soil conditions to nominated site staff; • Undertaking any necessary pre-construction surveys and supervising the implementation of specific mitigation measures, where required, including the use of soil stabilisation; • Undertaking any required monitoring related to their specialism; • Providing reports and maintaining contact with relevant stakeholders, as required; and • Providing specific advice with respect to any issues that arise.

12A.5 Soil Resources

12A.5.1 A Soil Resource Survey will be undertaken, by a suitably qualified and experienced soil scientist or practitioner, to inform the site working strategies of the oSMP. Currently mapping is held at the level of soil associations, derived from the National Soil Map (published at 1:250,000) but additional surveys, prior to construction, will identify soil types, particularly to understand their resilience to structural damage. The soil types identified will provide individual soil handling units to be described in the final detailed SMP. The resilience of soils is based on soil textural assessment with lighter textured soils, such as sandy loams having high resilience and heavy clay soils having low resilience.

12A.5.2 This draft oSMP will be updated to reflect developing understanding of the soil resources as survey result are obtained.

12A.6 Good Practice Mitigation

General Principles of Soil Handling

12A.6.1 The main threats to soil resources during construction are trafficking of vehicles/plant and incorrect handling, which can cause damage to soil structure through compaction and smearing (both effects are sometimes referred to as deformation). These effects compromise the ability of the soil to perform its functions, such as providing adequate amounts of water, air and nutrients to plant roots. The risk of compaction and smearing increases with soil wetness.

12A.6.2 To minimise the risk of damage to soil structure, the following main rules should be observed during all soil handling tasks:

- Driving of vehicles/plant on designated routes and no driving of vehicles/plant off-route without a recorded methodology to limit effects to soil.
- No driving of vehicles/plant on reinstated soil (topsoil or subsoil) other than for the purposes of reinstatement, including cultivation or seeding.

- Storage of materials in designated areas and only direct movement of soil from donor to receptor areas (no triple handling and/or ad hoc storage).
- Soils should be handled when dry and friable. Soil handling to be carried out when the soil moisture content is above the lower plastic limit and soils should only be moved under the driest practicable conditions and this must take account of prevailing weather conditions.
- No mixing of topsoil with subsoil, or of soil with other materials.
- Daily records of operations undertaken, and site and soil conditions should be maintained.

12A.6.3 Low ground pressure (LGP) tractors and tracked vehicles should be used where possible. This will greatly minimise the extent and/or intensity of the soil loosening required after restoration. Consequently, it will reduce the costs and potential delays due to the need for additional soil cultivation.

Soil moisture state

12A.6.4 Soils should be tested for soil moisture state as per the methodology in **Table 12A.2**. Further tests of soil consistency may be required following steps in

12A.6.5 **Table** 12A.3.

Table 12A.2 Testing for Soil Moisture State

Test	Handling Rule
If soil sample is wet, films of water are visible on the surfaces of soil particles and aggregates; or If soil sample readily deforms into a cohesive 'ball' when squeezed	Soils should not be handled. If handling cannot be avoided e.g. for timing in relation to protected species additional measures will be required such as reducing stockpile height to low single tier mounds. Advice is required from the technical specialist advisor.
Soil peds break up/crumble readily when squeezed in the hand. Sample does not form a cohesive ball.	Soils can be handled.
If the sample is moist, there is a slight dampness when squeezed between the fingers, but it does not significantly change colour (darken) on further wetting.	Avoid handling by dozers but may be handled by excavators if the consistency test is passed.
Sample is dry and brittle. Sample looks dry and changes colour (darkens) on wetting.	Soils can be handled if the consistency test is passed.

Table 12A.3 Testing for Soil Consistency

Step	Action	Soil Response	Handling Rule
A	Attempt to roll sample into a ball by hand	It is impossible because the soil is too hard (dry).	Soils can be handled.
A	Attempt to roll sample into a ball by hand	It is impossible because the soil is too loose (dry).	Soils can be handled.
A	Attempt to roll sample into a ball by hand	It is impossible because the soil is too loose (wet).	Soils should not be handled (or if handling cannot be avoided under exceptional circumstances, then additional measures be required under the guidance of the Technical Specialist Advisor
A	Attempt to roll sample into a ball by hand	It is possible to roll the sample into a ball by hand.	See Step B
B	Attempt to roll the ball into a thread of 3mm diameter on a flat non-adhesive surface using light pressure from the flat of a hand	It is impossible as the soil crumbles or disintegrates.	Soils can be handled.
B	Attempt to roll the ball into a thread of 3mm diameter on a flat non-adhesive surface using light pressure from the flat of a hand	It is possible to roll a 3 mm diameter thread.	Soils should not be handled (or if handling cannot be avoided under exceptional circumstances, then additional measures be required under the guidance of the Technical Specialist Advisor

Stop Conditions

12A.6.6 In certain weather conditions, the handling of topsoil and subsoil must be effectively managed to prevent damage. Soil handling operations must be suspended if sustained rainfall results in the soils becoming waterlogged or water pools on the surface or the ground becomes frozen/covered in snow. The Site Environmental Manager (in collaboration with the technical specialist advisor where required) will ensure there is continuous awareness of ground conditions as weather patterns change and take pro-active decisions regarding whether and when soil handling operations should be suspended/ restarted (based on the soil plasticity text described in **Table 12A.2**).

12A.6.7 If the works are interrupted by a rainfall event, soil stripping should be suspended; and where the soil profile has already been disturbed, the works should be completed to the base level in that location.

12A.7 Soil Stripping, Stockpiling and Reinstatement

Soil Stripping

12A.7.1 Soil horizons should be stripped according to their natural occurrence and separately according to their main functional characteristics. Therefore, to avoid mixing of different soil horizons and soil types, topsoil and subsoil will be handled and stored separately. Topsoil can be stored on either topsoil (of the same type) or on subsoil. Subsoil can only be stored on subsoil and therefore the topsoil must be stripped from subsoil storage areas in advance of subsoil stripping and subsequent storage.

12A.7.2 The stripping method should follow one of the suggested methods described in the Institute of Quarrying's Good Practice Guide for Handling Soils in Mineral Workings (Ref 12A.2).

12A.7.3 It is preferred that (in most locations) excavated soil will be stored on the margin of the working area and that the use of dumper trucks will not be required. Where soils are to be stored away from the excavation area, additional plant will be required to undertake the soil stripping, for soil transfer, and to then form the soil stockpiles at the storage site. The excavator undertaking the soil stripping should be fitted with a toothed bucket, except where use of a toothless bucket is required to prevent damage to potential underlying archaeology. The method, if correctly carried out, should avoid severe compaction as soil trafficking is minimised.

12A.7.4 If archaeological investigations require the handling of soils, the soils will be stripped as agreed in a separate Written Scheme of Investigation for the works.

Stockpiles

12A.7.5 Correct storage/stockpiling will maintain soil quality and minimise damage to soil structure and soil biota. This ensures that the soil will readily recover once re-spread, promoting timely and effective restoration. Stockpiled soil must not be vulnerable to compaction or erosion, must not cause pollution to surrounding watercourses, and must not increase flood risk to the surrounding area.

12A.7.6 Potential soil erosion and water pollution can be minimised through a number of good practice measures, including, but not limited to, the avoidance of trafficking over/driving on the soil stockpiles, the seeding of stockpiles, and the use of intermittent spaces in the stockpiles.

12A.7.7 Generally, topsoil stockpiles should not exceed 3 m in height and subsoil stockpiles should not exceed 5 m in height. However, if the soil to be stockpiled is dry (below the plastic limit) formation of higher stockpiles may be permissible, if required, as the soil is likely to remain dry in the core of the stockpile for the entire storage period. However, the appropriateness of higher stockpiles will need to be established in agreement with the Technical Soils Specialist Advisor.

12A.7.8 Where soil is expected to be stored for a period of more than six months, the stockpiles should be seeded with appropriate low maintenance grass/clover mixture or similar: to be agreed with landowner and to protect the soil against erosion, minimise soil nutrient loss, and maintain soil biological activity. Appropriate seeding will also help prevent colonisation of the stockpile by nuisance weeds that could spread seed onto adjacent land.

12A.7.9 The locations and footprints of each stockpile should be accurately recorded. This may use digital mapping or on a plan of appropriate scale. Each stockpile should be assigned a unique identifier code, so that records regarding the stockpile are clearly traceable and distinguishable from those of other stockpiles. Marker posts should be provided in locations which have been surveyed and recorded; marker posts should display the stockpile identifier code.

12A.7.10 The approximate volume of each (uniquely identified) stockpile should be recorded, along with details of the type of soil stored and the location from which the soil was stripped, which will allow cross reference with the detailed soil survey data if required.

12A.7.11 Gaps shall be left between soil stockpiles where necessary to allow for surface water drainage and avoid the catchment (ponding) of water behind stockpiles. In certain areas shallow surface drains, commonly referred to as ‘grips’, may be dug across the working area to prevent erosion and prevent ponding against stockpiles.

12A.8 Site Machinery and Vehicle Movement

12A.8.1 On any construction site there exists the risk of soil compaction from the use of heavy machinery and traversing land in unsuitable ground conditions. The aim should be to minimise the risk through appropriate site management of operations during the commissioning, operation and decommissioning phases. Much of the site is classified as having a low resilience to structural soil damage and hence the risk of soil compaction.

12A.8.2 The management of trafficking on site and traversing the land when the soil is in a suitable dry condition is key to managing the risk of soil compaction. Where land is to be returned to agricultural use it is important that the risk of soil compaction and its management is considered as part of the pre-construction planning.

12A.8.3 The term Field Capacity is the amount of moisture remaining in the soil, following heavy rain or irrigation and after the large soil pores have drained under gravity. Field Capacity Days is a measure of the duration of climatic wetness when soils hold this maximum amount of water. In a normal year the soils are likely to return to Field Capacity in early December and remain at Field Capacity until early April. As a broad guide planning of the construction works should take this into consideration and seek to undertake minimal traversing across the site and soil handling during the period early December to early April and/or to develop appropriate procedures to do so such as the use of matting. An on-site inspection of the soil condition prior to vehicle movement across the site is essential.

12A.8.4 Using machinery such as dump trucks fitted with tracks or low ground pressure tyres to spread the weight of the machinery should be used.

12A.8.5 When travelling across the site all machinery and vehicles should keep to identified access routes where possible to contain the risk of soil compaction.

12A.9 Access Routes and Soil Stabilisation

12A.9.1 Different haul road construction methods may be used across the Project including traditional stone haul roads, soil stabilisation, track matting and the use of geogrids. Soil stripping, storage and reinstatement does not differ between the majority of the different haul road construction techniques (where stripping is required). However, the reinstatement of soils within areas of soil stabilisation haul roads requires specific methods.

12A.9.2 Prior to soil stabilisation, additional soil samples should be taken. The mapping and testing will provide additional and location specific information on pH, soil carbon, microbial activity and other parameters to support reinstatement.

12A.9.3 For soil stabilisation the subsoils are typically rotavated, towed by agricultural machinery to a depth of approximately 300 mm incorporating a binder (typically containing cement). The water content of the soil is measured to assist with the binder and roughly levelled before being fully compacted with a vibrating roller. The road is tested at intervals but gains full strength by 28 days following construction. A top layer of stone may be applied to the finished surface to provide a finished level with appropriate skid resistance, dependent upon the ground conditions and anticipated traffic levels. A geotextile may also be used as a separation layer.

12A.10 Reinstatement of Stored Soil

12A.10.1 Soil reinstatement shall be subject to the same constraints of weather and soil moisture conditions as soil stripping. All methods must adhere to the general principles set out below.

12A.10.2 The Site Environmental Manager (in collaboration with the technical specialist advisor where required) will assess if the stockpile vegetation cover includes woody or otherwise undesirable weed species and determine if herbicide application should be applied before soil reinstatement. Herbicide use, following the conditions of safe product application, should be made at least 10 days prior to soil re-use.

12A.10.3 Stabilised soils need preparatory work as part of reinstatement. The stone layer should be first removed to prevent contamination of the subsoils. The binder will typically have resulted in elevated soil pH, to be confirmed by testing. Elevated pH should be balanced, before any physical reinstatement, with a soil amendment (such as ammonium sulphate). A tractor towed winged tine should be drawn to alleviate compaction prior to rotavating to pulverise to 100 mm below the 300 mm deep cementitious layer to alleviate compaction. Soil samples can then be taken to help inform future restoration actions.

12A.10.4 Species rich cover crops should be sown into the pulverised subsoils. Germination and rooting for a minimum 6-8 weeks will support increased soil biology, structure and organic matter. This should be tested by sampling and once normalised to the baseline parameters, the topsoil is reinstated.

12A.10.5 When excavating the stockpile, the size of earthmoving plant to be used should be tailored to the size of the area to be reinstated. Front loading machines may be used, in which case they will not need to enter the top of the stockpile. Any exposed edges/surfaces should be shaped at the onset of rain and at the end of each day.

12A.10.6 Where soils stockpiles are local to the excavation and reinstatement, direct excavation and restoration of the soil from the stockpiles using a long-reach back-acting/360° excavator is the preferred method. In this method, the subsoil will be replaced first, with the excavator travelling on the subsoil and gradually taking the topsoil from the stockpile and depositing it on the subsoil. The deposition is to be carried out by loose tipping and a toothed digger bucket used.

12A.10.7 Where stockpiles are remote from the area of reinstatement, subsoils and topsoils will be transported separately to the reinstatement area, before the same method is adopted.

12A.10.8 Soil replacement should follow the methodology set out in Institute of Quarrying Guide, Sheet D: Soil Replacement with Excavators and Dump Trucks (Ref 12A.2). In this method, the soil is replaced in strips above the base layer to recreate the original soil profile. The topsoil is replaced on decompacted subsoil. The replacement is carried out in strips in a similar manner to the stripping operations.

12A.11 Biosecurity

12A.11.1 During large-scale projects, there is the potential for disease and pathogen transfer between different areas of agricultural land (i.e. a biosecurity risk). The relocation of soil resource is considered as the main cause of disease and pathogen transfer, due to the transfer of soil (and incorporated seed/spore bank and pathogens) from infected to uninfected areas.

12A.11.2 To minimise biosecurity risks, appropriate cleaning and/or disinfection of machinery, equipment, clothing and footwear between holdings to mitigate against any disease outbreak or transfer of weeds between holdings may be required. This should be undertaken after working in areas considered to be at high risk before moving into uninfected areas.

12A.12 Alleviating Compaction

Bulk Density of Soil

12A.12.1 Soils at construction sites may be compacted because of excavation, stockpiling, equipment storage, and equipment traffic. When soil is compacted, porosity decreases, and bulk density increases. Bulk density is the mass of soil in relation to its volume which includes both the volume of the soil particles and the volume of pores among soil particles. As a result of compaction, permeability of air and water in soil decreases, soil water-holding capacity is reduced, and root growth is impeded. On a watershed scale, soil compaction leads to increased runoff and erosion.

12A.12.2 Soil compaction can be evident through field observations, including presence of ponded water, poor plant growth, and eroded soil. Compaction can be determined through field measurements, including taking bulk density samples, using commercially available penetrometers. Other measurements, such as soil infiltration, may be used as indicators of compaction.

12A.12.3 Natural processes can alleviate soil compaction but additional measures to alleviate soil compaction are often desirable because:

- it can take many years for natural processes to loosen soil;

- natural processes operate primarily within the upper horizons of soil, and compaction from development can be present lower in the soil profile; and
- once soil compaction becomes so severe that plants and soil microbes can no longer thrive, natural processes are no longer able to reduce soil compaction.

12A.12.4 The two most common methods for alleviating compaction are soil ripping (also called subsoiling or tilling) and addition of organic matter.

Subsoiling or Soil Ripping

12A.12.5 The aim of subsoiling (also known as soil ripping) is to fracture compacted soil without adversely disturbing plant life, topsoil, and surface residue. Soil compaction occurs most frequently with soils having a high clay content. Fracturing compacted soil promotes root penetration by reducing soil density and strength, improving moisture infiltration and retention, and increasing air spaces in the soil. Subsoilers (rippers) break up the compacted layer without destroying soil aggregate structure, surface vegetation, or mixing soil layers.

12A.12.6 The efficacy of fracturing compacted layers depends on the soil's moisture, structure, texture, type, composition, porosity, density, and clay content. Success depends on the type of equipment selected, its configuration, and the speed with which it is pulled through the ground. No one piece of equipment or configuration works best for all situations and soil conditions, making it difficult to define exact specifications within this draft oSMP.

12A.12.7 Subsoilers are available with a wide variety of shank designs: swept, straight, parabolic or semi-parabolic. Shank design affects subsoiler performance, shank strength, surface and residue disturbance, effectiveness in fracturing soil, and the horsepower required to pull the subsoiler. The subsoiler may be conventionally tipped or winged, with winged designs requiring greater horsepower but typically employed at wider spacing.

12A.12.8 There is a critical depth below which compaction occurs rather than effective loosening. The depth is dependent upon the width, inclination and lift height of the tine foot of the subsoiler and on the moisture and density status of the soil. The wetter and more plastic a soil is, the shallower is the critical depth. At shallow working depths the soil is displaced forwards, side-ways and upwards (crescent failure), failing along well-defined rupture planes which radiate from just above the tine tip to the surface. The solution is to work progressively deeper with repeated passes with the tractor operating on the same traffic lane. The shanks on the subsoiler should be spaced so that they run in the tracks of the tractor, because the equipment used to pull subsoilers is heavy enough to create compaction itself.

12A.12.9 If subsoiling is required, then a suitably qualified agricultural engineer should specify subsoiler design and operation.

12A.12.10 If subsoiling is effective then the ground should be lifted slightly and remain relatively even behind the subsoiler, without major disruption of surface residues and plants. No more than a little subsoil and a few rocks should be pulled to the surface.

12A.12.11 The creation of furrows behind the subsoiler is an indicator that the shanks may not be deep enough, the angle on winged tips may be too aggressive, or the travel speed may be too high. Further information on the soil decompaction is available in Institute of Quarrying guidance (Ref 12A.2).

12A.12.12 Subsoiling must be compatible with locations of field drains and buried infrastructure.

Compost

12A.12.13 The application of compost to the soil surface or by shallow incorporation offers a simple and relatively low-cost approach to the alleviation of soil compaction.

12A.12.14 Compost results from the controlled biological decomposition of organic materials that has been sanitised through the generation of heat and stabilised to the point that it is beneficial to plant growth. It is an organic matter resource that improves the chemical, physical, and biological characteristics of soil. Compost has a lower bulk density than mineral soil particles (sand, silt, and clay) and, furthermore, aggregates soil particles into larger particles thereby creating additional porosity. Both the dilution and aggregation effects reduce the bulk density of the soil and water holding capacity of the soil is increased. Other benefits attributed to compost include increased plant production, increased root penetrability, reduction of soil diseases.

References

Ref 12A.1 Department of Environment, Food and Rural Affairs (DEFRA) (2009), Construction Code of Practice for the Sustainable Use of Soils on Construction Sites. Accessed: 20 April 2026. Available at: https://www.gov.uk/government/publications/code-of-practice-for-the-sustainable-use-of-soils-on-construction-sites

Ref 12A.2 Institute of Quarrying (2021). Good Practice Guide for Handling Soils in Mineral Workings. Accessed 20 April 2026. Available at: https://www.quarrying.org/soils-guidance.

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