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# East West Rail Phase 2

## Subsection 2A1 Soil Management Plan

### Client name: Network Rail

**Date: 29/08/2019**

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### Document History

| **Level 4 IMS Document Authorisation** | | First name, last name | Wet signature |
|---|---|---|---|
| **Prepared By** | Author | Zara Rostance | |
| **Technical Review** | Subject matter expert | Rosemary Peel | |
| **Approved By** | Functional AMT approval | Ruth Voigt | |

| | |
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# 1. Introduction

This plan is to be used for the purpose of protecting and managing soils that are excavated from temporary land that is to be returned to its original use. This use will include agriculture, allotment, gardens, road verges and recreational areas as well as some residential gardens. An overview of this procedure is provided in Appendix A, which outlines the requirements for two keys stages: Enabling Works / Construction Phase Considerations and Post-Final Completion Requirements.

This document incorporates the core principles that are set out in the following documentation:

- EWR Charter
- Project Alliance Agreement (PAA)
- Sustainability Policy
- Health and Safety Policy
- Quality Policy
- Collaborative Working Policy

Under the EWR Charter there are 9 core principles that are to be adhered to. These core principles are as follows:

- Best for Project. We will make all our decisions on a best for project basis.
- Win – win. Participants will either all win or all lose. Win/Lose outcomes will not be acceptable.
- Unanimous decisions. Alliance Leadership Team decisions will be unanimous.
- Safety underpins every decision. Make safety everyone's number one priority to transform it in to a personal core value.
- Value for Money. VfM is intrinsic to our approach.
- Best person for the job. We will select on the basis of technical capability and collaborative ability.
- Stakeholder expectations and sustainability underpins every decision.
- Safeguard the future competitiveness of the rail sector by investing in new and emerging.
- Technologies with payback periods that exceed the life of the project.

This document has been produced to ensure that we meet the core principles highlighted above. In particular, best for project, safety, VfM and Stakeholder expectations. The soil management plans will provide a methodology to manage soils appropriately ensuring that they are suitable for the reinstatement of land to be returned to agriculture, allotments, gardens, road verges or recreational land. The re-use of materials and restoring land to its previous condition is important for the project liaising with land owners, as stakeholders, and providing value for money. Stockpile management shall consider the health and safety implications of storing materials at height directing readers to appropriate documentation. As well as following the Health and Safety Policy of the project.

Under the PAA there is a requirement for ensuring that the project is 'Fit for Purpose', this is making sure that the design is appropriate for the site and in line with the Environmental Statement (ES). Under the ES there is a requirement for the restoration of land that is to be used temporarily to allow the construction of the project, for use a compounds, temporary storage and offline highways. The SMP provides the methodology to ensure that soils are managed appropriately to maintain the integrity of the soil components to allow restoration of land in line with the ES and the sustainability policy. The sustainability policy requires that the project minimises its impact on the environment and delivers environmental benefits throughout the project lifecycle as well as managing the needs and expectations of stakeholders. The project aims to leave a lasting positive legacy in the local community.

The quality policy has been adhered to following the check and review process as required by the project and documented at the front of this report. Collaboration has been sought with various teams including the development environmental management team and the earthworks team. The document shall be made available through eB cross-referencing other associated documentation. This document has been reviewed by key team members who shall be using to document to ensure that it is fit for purpose.

# 2. Scope/Purpose

## 2.1 Overview

The East West Rail (EWR) programme of works aims to establish a strategic railway connecting East Anglia with central, southern and western England. The Phase 2 project comprises works along an approximately 78 km route of existing railway and railway alignment, running between Bicester in the west to Bedford in the east, with a spur south to Aylesbury and a short spur north to Bletchley.

In order to manage soil disturbance and to mitigate the impacts to primarily agricultural soil for the Temporary Land Take areas where agricultural soil will be stripped, stored and restored, a number of Soil Management Plans (SMPs) have been prepared with the purpose of safeguarding soil resources by ensuring their protection, conservation, appropriate reinstatement and aftercare. A separate SMP covers each construction compound and its subsection of route section (Appendix B).

A responsible person will be provided as a contact point for landowners affected by temporary works to ensure the liaison between the owners/farmers and contractors runs as smoothly as possible for land to be returned.

This SMP provides advice on soil and aftercare management of the approximately 2.2 km section of route known as Subsection A1, within Route Section 2A. This section of route lies to the east of Bicester to the north of Launton and its location is shown in the Soil Resources Plan in Appendix B. Subsection A1 has permanent engineering and temporary land take of approximately 13.42 ha of which approximately 9.59 ha will be restored. The report includes information on site preparation, soil stripping, soil storage, soil restoration and soil aftercare. The report is split into six main sections i.e.:

1. Introduction – general site introduction.

2. Land use and soil resource assessment - details the desk and field-based study of the soils, with division into soil units containing soils with similar physical characteristics.

3. Soil management during site works - details on how to prepare the site, strip and store the soil and maintain drainage.

4. Site clearance and soil reinstatement - details on how to clear up the site and replace the soil on completion of the works.

5. Agricultural land restoration of the temporary site compound and associated route - details on the work required to complete the restoration including how to remove any compaction and requirements for drainage.

6. Aftercare - details on how to manage sites in the early years after restoration.

This plan is to inform GRIP stage 6 using information available at the time of writing GRIP stage 5.

# 3. References

- Alliance Charter
- VfM Statement (133735-EWR-REP-MAN-000003)
- Waste (England and Wales) Regulations 2011
- Environmental Protection Act 1990
- Definition of Waste: Development Industry Code of Practice (DoWCoP) 2008
- DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites 2009
- NR/L3/CIV/140/052C Issue 2 – Model Clauses 052C: Earthworks 04/12/2010
- NR/L3/CIV/140/050C Issue 2 – Model Clause 050C: General Requirements for Earthworks and Excavations 04/12/2010
- BS3882:2007 Specification for topsoil and requirements for reuse
- BS8601:2013 Specification for subsoil and requirement for use

# 4. Definitions/Abbreviations

| Term | Description |
|---|---|
| Agroclimatic area | A subdivision of the country with broadly similar land use and weather |
| Bund/soil bund | A mound of soil placed into long narrow rows for temporary or permanent storage or landscaping. |
| Cultivate/cultivations | The turning of soils to prepare the land for the next crop. |
| Dutch auger | A hand-held tool for extracting by increments a core of soil to a depth of 1 m. |
| Erosion | The movement of soil particles from their place of origin by wind or water. |
| Field capacity | A soil moisture state beyond which field drains start to flow. This state is normally reached in autumn and continues until plants start to grow in the spring. |
| Geotextile | A synthetic membrane placed between the soil surface and a protective stone layer, with the aim of protecting the soils and keeping the stone clean. |
| Glacial drift | Superficial mineral deposits left after the retreat of glaciers. |
| Gley/ed | Developed under conditions of poor drainage, a soil in which iron or other compounds have been altered by intermittent water saturation to give typical blue/grey colours. |
| Horizon | A distinct layer of soil within the soil profile which has different characteristics for soil texture, drainage and stone content to the layers above or below. These layers are normally described separately from one another. |
| Microrelief | A description of local undulations in the main slopes. |
| Mottles | Localised areas of secondary soil colours which are distinct from colour variation associated with the parent material. Mottles form in intermittently wet soil conditions and so provide an indication of impeded drainage. |
| Made Ground | Anthropogenic ground in which the material has been placed without engineering control and/or manufactured by humans in some way, such as through crushing or washing, or arising from an industrial process. |
| Organic matter | Decomposed plant residues found in the surface horizon of soils. |
| Particle size distribution | A laboratory measurement of the different sized particles in the soil sample, giving an accurate measurement of the proportions of sand, silt and clay. |
| Plough layer | The top 20-25 cm of soil which is regularly turned by cultivations. |
| Plastic limit | A measure of the moisture content of the soil. Above the plastic limit the soil is sticky and more prone to structural damage if trafficked or moved. The plastic limit test is not applicable on sandy soils which cannot be rolled into threads. |
| Ridge and furrow | An historic land form consisting of pronounced linear ridges separated by depressions; formed by historic ploughing to cultivate the soil and improve drainage. |
| Saturated zone | The zone in which the voids of the rock or soil are filled with water at a pressure greater than that of the atmosphere. |
| Slowly permeable layer | A dense or heavy textured layer of soil which reduces water flow through the soil. |
| Silt trap | A physical structure designed to trap sediment from water, to reduce pollution of watercourses. |
| Soil Association | A grouping of different soils which regularly occur together in the landscape. |

| Term | Description |
|---|---|
| **Soil profile** | A term used to include the whole soil column up to 1m deep including topsoil and subsoil horizons. |
| **Soil stripping** | The action of lifting soil from the field for storage or use elsewhere. |
| **Soil reinstatement** | The process of replacing the stripped soils in the correct horizon sequence back into a field or other area. |
| **Soil structure** | An assessment of the way soil particles hold together to form the porosity and three-dimensional architecture of the soil. |
| **Soil texture** | A physical description of the soil's sand, silt and clay content, the feel and working characteristics of which can be modified by the organic matter content. |
| **Soil unit** | A grouping of soils which have similar physical characteristics especially relating to soil texture, drainage and stone content. |
| **Subsoil** | Layers of soil below the topsoil which are modified by weathering but contain less organic matter and soil organisms. |
| **Surface layer** | A layer of soils taken from the top of potentially disturbed non-agricultural land such as road verges and railways. |
| **Topsoil** | The surface layer of soil which has been modified by the build-up of organic matter and soil flora and fauna. |
| **Waterlogged soil** | Saturated soil where all the air spaces have been filled with water. |
| **Weathered layer** | The lower part of the soil profile which has been modified by temperature and chemical actions since the last ice age. |
| **(Soil) Wetness (Class) [WC]** | A measure of the average duration of waterlogging at specified depths in the soil; WC 1 is well drained and WC 4-6 are poorly drained. |

# 5. Roles and Responsibilities

**Table 5.1 – RACI**

| East West Rail Alliance RACI | EWR Roles | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **R = Responsible**<br>**A = Accountable**<br>**C = Consulted**<br>**I = Informed**<br>**Accountabilities shall not be delegated. Responsibilities may be delegated but all such delegations shall be formally recorded.** | Alliance Director | Deputy Alliance Director | Environment and Sustainability Functional Lead | Section Environment Manager | Project Leader | Consultant Soil Scientist | Earthworks Contractor | Materials Management Specialist |
| **Document Production** | I | I | R | C | I | C | C | C |
| **Document Acceptance** | C | C | R | C | I | I | I | A |
| **Document Implementation** | I | I | C | A | I | C | A | R |
| **Document Review/Update** | I | I | A | C | I | C | C | R |

# 6. Procedure, Plan, Strategy

## 6.1 Aim of the Soil Management Plan

The aims of this SMP are to:

- Identify the different soil resources on site by undertaking a Land Use and Soil Resource Assessment.
- Ensure the protection and conservation of all soil resources on site.
- Maintain the physical and chemical properties of the soils on site.
- Retain soil function during and after restoration.
- Provide suitable mitigation and aftercare measures appropriate to the soil types on site including soil which contains anthropogenic components.
- Minimise the risks from erosion or flooding by controlling drainage.
- Provide on-site reference on soil management for site operators.

Although the soil resource survey did cover areas within the Permanent Land Take, these areas within the Permanent Land Take shall be considered within the scheme Material Management Plan (MMP) and are outside the scope of this document.

There is the potential for a small volume of Unit 6 soil (Made Ground) to be identified between observation points but due to the likelihood of its occurrence and the small volume involved, this material if found will be managed via the SMP. A separate MMP has not been produced in order to minimise documentation overlap and any resultant confusion that could arise during implementation. As such, requirements relating to the reuse of soils using an MMP (such as a verification report) have been incorporated into this SMP. Surplus subsoils and overburden should be removed from site under the main MMP.

# 7. Land use and soil resource assessment

## 7.1 Overview

The aim of the land use and soil resource assessment is to establish a baseline of pre-existing land use and soil conditions to enable the grouping of topsoils and subsoils into different soil units which have similar physical characteristics. Detail was collected on soil texture, depth, drainage characteristics, stone content and foreign objects so that soils could be grouped into soil units of similar soil texture. Within the site boundary the soils were sufficiently similar to be handled as two soil units i.e. a heavy textured unit and a medium textured over heavy textured unit, as summarised in **Table** . Further detail is provided at Section 7.2.

A small area of a third soil unit (Unit 6) is present along the boundary of the field in which compound A1 which is part of subsection 1A. There is also a potential for a small volume of non-agricultural soils especially Unit 6 to be found around road verges and embankments. This Unit 6 material may contain anthropogenic material and there is the potential for contamination but this material would require reinstatement following the temporary works.

There is also the potential for a small volume of non-agricultural soils (especially around road verges / embankments (Unit 6) and Made Ground) to be identified in areas which have not been surveyed and between auger boring locations, but this material would also require reinstatement as per Section 9. There are also allotments adjacent to the railway line at the western boundary of the subsection. Further detail is provided at Section 7.2.

**Table 7.1: Summary of soil units**

| Soil unit | Description |
|---|---|
| Unit 1 | Heavy textured topsoils and subsoils |
| Unit 4 | Medium textured topsoils over heavy textured subsoils |
| Unit 4 allotments | Unit 4 soils with a modified topsoil |
| Unit 6 | Variable soils containing some anthropogenic materials, road verges and non-agricultural topsoil |

The soil data was used to develop a site specific soil handling specification for site preparation, soil stripping, storage, reinstatement and aftercare.

An on-site soil resources survey was undertaken by qualified soil scientists/soil surveyors during winter 2018 with additional sampling undertaken in April 2019 and the results are further described below.

A glossary of technical terminology has been included in Section 4 above.

## 7.2 Soil resources baseline

### *7.2.1 Landforms*

The affected land lies adjacent to the railway and on both sides of Charbridge Lane railway crossing near Bicester. The land is mainly level.

### *7.2.2 Historical land use*

From publicly available historical and current ordnance survey maps, the temporary land take areas are indicated to have been used for agricultural land, including localised surface drains and ponds from the earliest available map dated 1878 to the present day.

### *7.2.3 Current land use*

The land is in mostly in agricultural use; grassland to the south of the railway and a mix of grass and arable land to the north of the railway. There are allotments and amenity grassland alongside the northern end of Charbridge Lane.

### 7.2.4 *Soil types – desk study*

Before the soil resource surveys were carried out, a desk study of geology, soils and flood risk was completed. Subsection A1 was classified, by the Soil Survey of England and Wales, as Denchworth Association in the east and Wickham 2 Association in the west[1].

Denchworth Association soil are characterised by slowly permeable, heavy textured soils showing signs of seasonal wetness.

Wickham 2 Association soils are similar soils formed in drift and often have a lighter textured topsoil than the Denchworth soils.

The results from the soil resource survey confirmed the presence of both heavy textured soils and medium textured topsoils over heavy textured poorly drained subsoils.

No Made Ground is recorded as being present on site, on British Geological Survey maps[2].

### 7.2.5 *Soil Resources Survey*

Soils were investigated at 100 m spacing (linear length) and to a depth of up to one metre using a 50 mm Dutch auger. In addition, one soil pit was dug in the site compound (at auger point 186) to assess soil physical conditions in the topsoil and subsoil. The position of each investigation point is shown on the Soil Resource Plan in Appendix B and details of individual auger borings and the soil pit are listed in Appendix C. The soil survey results have been validated prior to use to ensure consistency between surveyors.

To enable the division of the soils into soil units which have similar physical characteristics, detailed information was collected on:

- Soil colour, depth and texture of each horizon.
- Drainage characteristics such as gley colours, mottles and saturated zones.
- Approximate stone content and type.
- Presence of foreign materials in the soil profile.

The soils along the whole of the route will be separated into six soil units based primarily on their soil texture as shown in **Table 7.2**.

**Table 7.2: Summary of soil unit classification**

| Soil unit | Soil type | Predominant soil textures included |
|---|---|---|
| Unit 1 | Heavy | Heavy clay loam and clays |
| Unit 2 | Medium | Silt loam, silty clay loam, sandy clay loam and medium clay loam |
| Unit 3 | Light | Sand to sandy loams, some with a high stone content |
| Unit 4 | Medium topsoil over heavy subsoil | Topsoil: Silt loam, sandy clay loam, medium clay loam and silty clay loam<br>Subsoil: heavy clay loam and clay |
| Unit 5 | Light topsoil over medium subsoil | Topsoil: Sand to sandy loams, some with a high stone content<br>Subsoil: silt loam to medium clay loam |
| Unit 6 | - | Poor Quality topsoil / subsoil: variable in composition with limited anthropogenic materials, therefore potential for contamination. |

Based on the current survey information only Soil Units 1 and 4 occur on the agricultural land in this subsection of the route with allotment soils. Unit 6 soils are likely to be present on roads, embankments, railway cutting slopes and verges. The topsoil located along the sides of the mainline of the route (Soil Unit 6) is considered to be poor quality topsoil with the potential for contamination, but this material will be replaced where it was excavated in order to restore the land to its original purpose, i.e. scrub-planted

[1] SSEW 1983; Soils of Midland and Western England.
[2] British Geological Survey. [online]. http://www.bgs.ac.uk/GeoIndex/ (accessed December 2018).

roadside/railway verges. No Made Ground or any signs of visual or olfactory contamination were recorded during the soil auguring.

The survey did not include gardens, rail embankments, road verges, woodland and proposed environmental design areas (landscaping, ecological compensation or flood storage areas) where potentially non-agricultural soil types including Unit 6 and Made Ground could be found. These materials along with Made Ground if identified will be managed by the SMP but with additional measures implemented to manage this material in line with the CL:AIRE Definition of Waste Code of Practice.

Soil sampling for phosphorus, potassium, magnesium, pH and organic matter was undertaken to provide baseline data on soil nutrients (see Appendix D).

### *7.2.6 Soil handling units*

The soil texture was found to be fairly uniform in this subsection; either medium topsoil over heavy subsoil, or heavy topsoil and subsoil. For the purposes of soil stripping, storage and reinstatement the subsection can be considered as two soil units consisting of topsoil and subsoil over unweathered clay. The soils are classified as Unit 1 and Unit 4.

Unit 1 includes dark grey brown heavy clay loam to clay topsoil with a mean depth of 230 mm on the arable land and 180 mm on the grassland.

Unit 4 includes dark grey brown and dark brown medium clay loam topsoil, with a mean depth of 210 mm. Topsoil depth will also be deeper in the furrows in Field A1/F, where more organic matter accumulates. This unit was only found in grassland within this subsection. The topsoil contains few small stones. The subsoils are typically clay which show signs of poor drainage, having gley colours and mottles usually within 400 mm of the surface.

Unit 6 has been found in a small area along the boundary of the field in which compound A1 will be set up and is poor quality, disturbed soil from recent roadworks, but could also be found in areas of road verges and embankments. In addition, small areas of made ground could occur within the agricultural fields, therefore the procedure in the CEMP (133735-EWR-EMP-EEN-000002) should be followed and advice sought from the Alliance Environment and Sustainability Team. Unit 6 is considered to be soiled Made Ground i.e. ground that has been subject to anthropogenic intervention and therefore there has the potential for contamination.

The allotment soils were similar to those mapped as Unit 4 but have a modified topsoil which should be kept separate; the subsoils can be stored with Unit 4 subsoil.

**Table 7-1: Summary of soils on site**

| Material | Bottom mean depth of horizon (mm) | Texture | Drainage | Stones |
|---|---|---|---|---|
| Unit 1 | | | | |
| Topsoil | Arable = 230<br>Grass = 180 | Dark grey brown heavy clay loam to clay. Some calcareous.<br>Slightly organic in grass fields. | -<br>Some rusty root mottles in grassland | Very slightly stony |
| Subsoil | 180/230 - 1000 | Greyish brown clay, more grey with depth. | Ochreous mottles and gley colours | Very slightly stony |
| Unit 4 and allotments | | | | |
| Topsoil | Grass = 210 | Dark grey brown medium clay loam. | Some rusty root mottles in grassland | Very slightly stony |
| Subsoil | 210 - 400 in fields D & F only | Dark grey brown sandy loam to medium clay loam. | Ochreous mottles and gley colours | Very slightly stony |

| Material | Bottom mean depth of horizon (mm) | Texture | Drainage | Stones |
|---|---|---|---|---|
| | 210/400 - 1000 | Greyish brown heavy clay loam to clay. | Ochreous mottles and gley colours | - |
| Outside Agricultural Land/Fields | | | | |
| Unit 6 - Variable topsoil / subsoil containing some anthropogenic materials road verges and non-agricultural topsoil therefore potential for contamination. | 300 | Disturbed and variable soils on road verges and tarmac. | | |

# 8. Soil management during site works

## 8.1 Overview

The target completion date currently stands at May 2024 (TILOS 10.0), the construction period will last for approximately four years, during which the temporary land take area i.e. approximately 9.59 ha of agricultural land will be out of agricultural production. In order to minimise any damage to soil structure and soil quality it is intended to strip and store all topsoil, except from under the topsoil bunds. Good quality subsoil will be protected, paying particular attention to those identified and informed by the soil resource survey results as shown in Table 8. Where poor quality subsoil is identified it will remain in situ, and will be loosened as part of reinstatement. On this subsection of the route some of the soils have a better quality upper subsoil that require protection.

Agricultural soils, non-agricultural soils including Unit 6 soils, Made Ground and any soil with visual / olfactory evidence of contamination will be stripped and stockpiled separately.

All soil management works including soil stripping, soil storage, drainage and soil reinstatement should be undertaken in accordance with the measures set out in the Code of Construction Practice (CoCP, eB reference: 133753-EWR-EMP-EEN-000004) and CEMP to reduce potential impacts from dust, soil erosion, run-off and contamination.

The soil stripping will also take into consideration any archaeological and ecological requirements and service installations. A strip map and sample archaeological excavation is required on Subsection A1. The soil will be stored in bunds. All topsoil should be stripped and stored separately as shown in **Error! Reference source not found.**. Following soil stripping the site can be levelled; a geotextile, geogrid and stone cover will be laid to provide a firm working surface where one is required.

The average period when the most suitable ground conditions for construction are likely to prevail in this agroclimatic area is between mid-April and early November; although this commonly varies by a month either side of these dates. This is the period when soil moisture is most likely to be below field capacity and when field drains are least likely to be flowing.

Prior to work commencing the following should be agreed with the landowner/farmer:

- The position of soil stockpiles and buildings to ensure no essential access points/services are covered.
- The control of plant and animal diseases, by retaining soil within the field of origin wherever possible. Any specific trafficking/vehicle cleaning requirements to be agreed prior to work commencing. Advice on avoiding such problems is available in a Department of Environment, Food and Rural Affairs (Defra formerly MAFF) publication[3].
- The location of known drains.

## 8.2 Soil stripping

Immediately prior to soil stripping the site any vegetation growth higher than 100 mm will be cut and removed from site.

A topographic survey of the site should be undertaken to map out the ridge and furrow patterns and to provide detail on land levels prior to the works. This information is presented on drawing number 133735_RW-EWR-XX-XX-M3-G-050053.

The location from where all soils are stripped must be recorded with details of the volume of soils of each type that are stripped and placed into a storage bund. The locations and volumes of the storage bunds must be recorded. This data will be included in the verification report produced once restoration is complete.

The soil stripping is designed to keep topsoil and subsoil separate at all times. Soils from agricultural uses, from allotments, from non-agricultural uses including Unit 6 soils and Made Ground should be kept separate at all times. The topsoil from varying fields should be kept separately to avoid cross

[3] MAFF (1991) 'Preventing the spread of plant and animal diseases' (PB 0486).

contamination of soils, as well as varying soil units. All topsoil, or subsoil which needs to be removed for any required archaeological investigation or service installation should be stripped, except for the root protection zone against hedges or trees. Subsoils should be re-spread on completion of any archaeological investigation and service installation. Soils should be stored ensuring that they do not impact on the root protection zone, which means that all bunds should be kept outside the tree canopy. It is advised that the root protection zone is fenced off preventing the inadvertent loss of trees. The root protection zone should be confirmed by a review of the tree protection plan (133735_2A-EWR-OXD-XX-DR-L-019001 to 019002). Stripped soils will be placed in bunds for the duration of the project. Soils will be stripped with 360º excavators working across the site, or along the ridges in any ridge and furrow fields, taking account of the topsoil depth difference between the ridge and the furrow. Soil will be transported to the storage bunds in dump trucks and lifted onto the bunds with a 360º excavator.

Topsoils will be stripped from the haul routes and subsoil storage areas to the base of the darker topsoil layer which is typically to a depth of between 130 - 280 mm (as shown in Table 8 below).

The stripping of soil, identification of visual / olfactory evidence of contamination and overseeing of what material is placed in what stockpiles should be the responsibility of the Environmental Manager.

Topsoil stripping will only occur when the soils are as dry as reasonably practicable, normally when they are below the plastic limit and not normally within 24 hrs of significant rainfall (i.e. >10 mm in 24 hrs). The soil will be tested on site by attempting to form a worm of soil 3 mm in diameter by rolling it out on a flat non-porous surface. If the soil 'worm' will not form or is cracked the soil is sufficiently dry to handle.

Soil will be stripped when in a dry state where ever possible, but if the soils are at or above their plastic limit when stripped they will be deposited into windrows prior to lifting them into their final bund once they have dried out sufficiently. Windrows will be placed at a height of no more than 2.0m with sufficient distance between each to allow movement of tracked plant to gain access.

Care will be taken to remove the correct depth of topsoil from undulating layers such as ridge and furrow surfaces by stripping parallel with the ridges ensuring the blade of the excavator follows the contours and by adjusting the stripping depth as necessary to remove the full depth of organic stained topsoil.

The stripped topsoil will be stored in a bund at agreed areas within the compound. Bunds will not normally exceed 2 m but may be up to 3 m if necessary, to avoid the need for a greater land take. Topsoil will not be stripped under topsoil bunds so that topsoil is stored on similar material.

Bunds will be set back from the stripped area by at least 0.5 m to prevent the loss of topsoil onto the excavation. Bunds will be fenced off from the compound to prevent materials being stored on the sides of the mounds.

Subsoil will not require stripping except if required for archaeological investigation or for the installation of any service channels, however it should be protected from compaction and contamination from construction materials. This shall be achieved by using a geotextile lining that is resistant to tearing and a geogrid filled with stone to distribute the weight evenly across the subsoil layer, thereby reducing compaction damage.

Once the required topsoil and any Made Ground (if found) has been stripped the surface of the compound can be levelled to provide an even surface to receive the geotextile / geogrid and stone, to form the required areas of hardstanding and carparks.

Any visual or olfactory evidence of contamination encountered during soil stripping must be reported immediately to the Environment and Sustainability Team and dealt with in accordance with the incident response plan (133735-EWR-EMP-EEN-000003). All soil stripping in that location must cease until advice is provided.

**Table 8.1: Recommended soil stripping depth by field***

| Field | Soil unit | Bottom depth of topsoil horizon (mm) | Need for protection of subsoil | Comments |
|---|---|---|---|---|
| A1/A | 4 | 240 | - | Heavy upper subsoil |
| A1/B | 1 | 150 | - | |

| Field | Soil unit | Bottom depth of topsoil horizon (mm) | Need for protection of subsoil | Comments |
|---|---|---|---|---|
| A1/C | 1 | 140 | - | Northern part of field (Soil Unit 1) |
| | 4 | 210 | - | Southern part of field (Soil Unit 4). Heavy upper subsoil |
| A1/D | 4 | 280 | Protection required | Patches of sandy soil in upper subsoil |
| A1/E | 4 | 200 | - | Heavy upper subsoil |
| A1/F | 4 | 230 | - | Heavy upper subsoil |
| A1/G | 1 | 280 | - | |
| A1/H | 4 | 180 | - | Heavy upper subsoil |
| A1/I | 1 | 150 | - | |
| A1/J | 1 | 230 | - | |
| A1/K | 1 | 230 | - | |
| A1/L | 1 | 240 | - | |
| A1/M | 1 | 180 | - | Northern part of field (Soil Unit 1) |
| | | 160 | - | Southern part of field (Soil Unit 4). Heavy upper subsoil |
| A1/M1 | 4 | 130 | Protection required | |
| A1/N | | - | - | Access denied |
| A1/O | 4 | 280 | - | Heavy upper subsoil |
| A1/P | 4 | 280 | - | Heavy upper subsoil |
| A1/Q | - | - | | No observations in this field |
| A1/R | 4 | 230 | - | Heavy upper subsoil |
| A1/S | 4 | 280 | - | |
| A1/T | 1 | 200 | - | |
| A1/U | 4 | 200 | - | Heavy upper subsoil |
| A1/V | 4 | 180 | - | Bank to road |

* Non-agricultural soils are discussed in the three paragraphs below.

Non-agricultural uses such as gardens, verges and railway embankments were not surveyed as part of the study but along sections of the route some will be affected. The garden soils will have similar soil textures to the surrounding agricultural land but may have a deeper and more organic topsoil. To ensure there is a good depth of topsoil for restoration 300 mm of topsoil should be stripped from the gardens and stored separately from the agricultural soils and it should not be used in the restoration of agricultural land.

Soil on the allotments is classified as Unit 4 but due to their intensive use as allotments they are likely to be considerably more organic and nutrient rich than other Unit 4 soils and so should be stripped and stored in a separate soil bund.

Soil from road verges and railway embankments (Unit 6 soils) are likely to be found and should be stripped to the base of the darker more organic layer or to a maximum depth of 300 mm (considered to be topsoil). The stripped topsoil if suitable should be stored separately for reuse on verges and embankments or other landscaping areas; it should not be used in the restoration of agricultural land.

## 8.3 Drainage

This section of the route receives water from the north, although the land is relatively flat. There is a small watercourse which flows southwards between Fields H and I and between Fields M and N. A stream flows in a southerly direction along the western side of Field C and a second stream emerges at the eastern end of the subsection.

The soils are heavy textured and are likely to contain agricultural drainage schemes of varying ages. The depth of the drains is unknown and soil stripping could affect their condition if they are close to the surface.

- Any existing field drains which are cut off/damaged by the works should be discharged into local drainage ditches through silt traps, to minimise sediment release.
- Surface water flowing into the ditches and watercourses shall have a silt mitigation installed at the exit point to reduce the sediment load of the discharge water. Further details regarding surface water management can be found in the construction environmental management plan (133735-EWR-EMP-EEN-000002).
- A tracksheet should be developed to record any existing drainage features located during soil stripping, including their type, depth, size, angle and condition. This detail will then be available to aid a review of the requirements of post construction remedial drainage.
- Permanent post construction drainage is likely to be required as part of land reinstatement and existing agricultural land drainage will be replaced if damaged to ensure continued agricultural use.

## 8.4 Soil storage

The soils will be in store for approximately four years. Soil stores should be placed at the location shown in the compound design drawing, for screening and final restoration of the temporary land take area. Soil from agricultural uses, non-agricultural uses such as Unit 6 soils and Made Ground (if identified) will be kept separate at all times and stored in separate bunds to keep soils separate with significantly different soil textures. Bunds will be set back by more than 0.5 m from the edge of the excavation to prevent soils slumping into the cut. All bunds should be labelled with their volume and soil type (e.g. ***$m^3$; Unit 1 topsoil).

**Table 8.2: Soil bunds height**

| Soil Type | Store On | Bund number for subsection | Height (m) |
|---|---|---|---|
| Topsoils | | | |
| Unit 1 | Topsoil | Bund 2 | Ideally 2 m but up to 4 m if short of space.* |
| Unit 4 | Topsoil | Bund 1 | Ideally 2 m but up to 4 m if short of space. |
| Unit 4 allotments | Topsoil | Bund 3 | Can abut Bund 2 if short of space |
| Non-agricultural soils found in areas outside agricultural and community land | | | |
| Unit 6 - Variable topsoil / subsoil containing some anthropogenic materials therefore potential for contamination from road verges and embankments. | Surface layer | Bund 4 | Ideally 2 m but up to 4 m if short of space. |

*Soil generally gains strength and becomes more resistant to damage as it dries therefore stockpile heights should be minimised, where space allows.

Soil should be placed into store by tracked equipment where possible, in a loose condition and the top and sides of the bunds slightly firmed to consolidate the surface to reduce water penetration.

It is recommended that the topsoil stockpiles are sown on bunds that will be in place for more than 6 months, at a rate of 5 g/m$^2$, with a low maintenance grass seed mix such as ESG1 – Basic Fine Grass Mixture, this can be adjusted upon advice from the Landscape Architect for a suitable mixture to protect the soils and act as a barrier to problem weeds.

A soil scientist or agronomist shall be responsible for inspecting the soil bunds in early May each year with the aim of keeping the grass weed free, by mowing or spraying weeds with a selective herbicide before they set seed. The type of herbicide will be determined by the plant species present and in agreement with the landowner.

Once the soil has been placed in store and any archaeological investigations completed the compounds can be laid down. The surface of the soil will be protected with a membrane to reduce the risk of stones sinking into the subsoil.

For the entire period during which soil is stored, all stockpiled material will be reviewed annually, by the materials Management Spec, to ensure that it still meets the following:

- Materials remain suitable for their intended use (e.g. via visual inspections and testing, if required).
- Necessity/certainty of use for those materials remains (i.e. still required for restoration purposes).
- The quantity being stored does not exceed design requirements (i.e. what is required to restore the site).

Any stockpiled excavated materials that fail to meet all of these requirements may be considered waste. Advice on how any waste material can be managed should be sought from the Environment and Sustainability Team.

# 9. Site clearance and soil reinstatement

Once construction is completed and access is no longer required, all temporary land take areas should be restored and returned to agriculture, allotments, gardens, road verges and recreational land. Any construction materials, services and temporary matting / geogrid / stones should be lifted and removed from site prior to remediating the land and replacing the soils. It is important to note that the geogrid should be carefully lifted to reduce the risk of splintered plastic contaminating the subsoil.

Topsoils should be reinstated over subsoils from the same soil unit e.g. Unit 4 topsoil should be placed over Unit 4 subsoil, with the subsoil below ripped and contamination such as stone, plastic and remnants from the geotextile membrane removed. If Made Ground is found this should be returned to its place of origin.

To ensure the land can be reused effectively on completion of the works, it is essential to minimise and repair any soil structural issues caused during soil handling. The following methodology will be adopted to minimise soil damage:

- The soils should only be taken out of store when they and the site are sufficiently dry to prevent compaction of the underlying soil. Ideally the soil should only be replaced between mid-April and the end of October when they are at their driest. Soil replacement should only take place when the soils are below their plastic limit and not within 24 hrs of significant rainfall (i.e. <10 mm in 24 hrs) so that the soils have a full day of drying before work recommences.
- 10 days prior to soil reinstatement soil stores will be sprayed off with a total contact herbicide, such as glyphosate, to kill all vegetation. Refer to the construction environmental management plan (133735-EWR-EMP-EEN-000002) for further information regarding herbicide.
- Prior to spraying the following soil sampling should be undertaken:
  - In preparation for soil placement each topsoil bund should be sampled (using standard sampling techniques i.e. 25 subsamples from different depths bulked to form one sample) for major nutrients including, phosphorus, potassium, magnesium and pH, as per the testing suite in Appendix D. Samples from the deeper core of the bund should be collected with an excavator and added to the main sample.
  - Geochemical samples of the non-agricultural stockpiled topsoil and subsoil from allotments, gardens and recreational land should be collected at a rate of 1 per 5,000 $m^3$ with a minimum of 3 samples taken and tested in accordance with the testing suite in Appendix F. Soil test results from topsoil and subsoil should be compared against the scheme re-use criteria provided in Appendix G.
  - Geochemical samples of stockpiled Unit 6 and Made Ground soils should be collected and tested at a rate of 1 per 1,000 $m^3$, with a minimum of 3 samples to be taken and tested in accordance with the testing suite in Appendix F. Soil test results from the Unit 6 Topsoil / subsoil and Made Ground should be compared against the scheme re-use criteria provided in Appendix G.
- All construction material will be removed from site including the geotextile, geogrid and stone placed over the subsoil. Care will be taken to remove the stone and geotextile without removing the upper layer of subsoil.
- In Compound A1 following the removal of the geotextile / geogrid / stones, validation soil samples should be collected from the subsoil at ground surface at a rate of 5No. locations across the compound to be determined by the Environment and Sustainability Team. This is to target areas where vehicles have been parked or oils have been stored to assess the potential risk of contamination to subsoils following the use of the compound. Samples will be collected in near surface soils targeting these high risk areas and tested in accordance with Appendix F. Testing results should be compared against the baseline laboratory analysis results from Compound A1 in Appendix E.
- The Environment and Sustainability Team should be notified immediately should any soil testing results fail the assessment criteria, visual inspection identifies potential contamination, or if soils are no longer required for restoration. If soils are considered to be unsuitable due to contamination impacts, remediation may be required, and advice should be sought from the Environment and Sustainability Team.

- Any temporary services should be chased out and the trenches filled with subsoil from store.
- The site will be litter picked to remove any remaining construction waste and stones larger than 100 mm diameter and the material treated as waste.
- Displaced subsoil will be returned to any hollows created, to provide an even surface for topsoil placement.
- All agricultural and non-agricultural soils including Unit 6 soils and Made Ground soils if found will be returned in areas from which they were excavated referencing the records produced during the soil stripping.
- Unless otherwise agreed with the landowner any ridge and furrow undulations should be reinstated into the subsoil surface and tied into the contours on the undisturbed areas, leaving room for a full depth of topsoil. On these heavy soils continuity of the furrow is important to ensure that water can still flow across the site.
- The surface of the subsoil should be inspected to ensure that all construction material has been removed and that the site is in a state fit to receive the topsoil.
- If significant soil structural damage, or damage to existing land drains has occurred, install a suitably designed agricultural land drainage scheme into the subsoil and fill the trench with permeable back fill to the top of the subsoil.
- Remove compaction in the subsoil prior to replacing the topsoil, unless the presence of utilities prevent deep cultivation. The soils should be ripped with a winged tine subsoiler set 20 mm below the bottom depth of the compact layer, ensuring that the subsoiler crosses the drains to improve water discharge.
- On completion of subsoiling the agricultural areas should be inspected by a Soil Scientist to ensure the site is in a suitable condition to receive the topsoil.
- Topsoils should be replaced with minimum vehicular movements to avoid re-compacting the loosened surface. Restoration should start at the furthest point from the exit to ensure that soils once deposited are not run on by earth moving machinery.
- Particular care should be taken to minimise re-compaction of the subsoil by carefully controlling traffic movement along defined routes and working only in dry conditions. If there are any wet patches on the haul roads, they should be covered with temporary metal tracks to protect the subsoil.
- Replace topsoil to its full depth maintaining and tying into the original contours on either side of the disturbed area, to allow surface water flow.
- Unit 6 soils and Made Ground soils should be replaced in areas from which they were excavated referencing the records produced during soils stripping.

# 10. Agricultural land restoration

Once the soils have been placed in their original sequence the restoration will be completed by undertaking the following works in the agricultural area:

- Following topsoil replacement, the soil will be thoroughly loosened to a depth of 400mm to tie the topsoil and subsoil together, but only in dry conditions. Dry conditions when materials are below the lower plastic limit and not normally within 48 hrs of significant rainfall (i.e. <10 mm in 24 hrs). The soil will be tested on site by attempting to form a worm of soil 3 mm in diameter by rolling it out on a flat non-porous surface. If the soil 'worm' will not form or is cracked the soil is sufficiently dry to handle.
- Agricultural equipment should be used to loosen and aerate the soil and provide connection with the subsoil. Equipment is likely to comprise of tines capable of working at different depths and a leveller board but the exact equipment required can only be determined by soil conditions on the day of activity.
- Soil loosening will be carried out, at an angle to the line of the known drains and, where possible, extended into the undisturbed soil on the lower ground. The depth of working and the type of equipment used will be determined by the depth of compaction.
- The site will be litter picked to remove any remaining construction waste and large stones brought up by subsoiling, prior to sowing the crop. These should be managed in accordance with the SWMP (eB reference: 133735-EWR-REG-EEN-000007).
- As agreed with the farmer/land owner a suitable crop will be planted to help stabilise the soil structure. A seed bed will be established with secondary cultivation equipment such as discs, tines and press, suitable for the intended crop. The field will be sown with either a seed mix specified by the landowner or a permanent pasture mix, as presented in the landscape design drawings[4]. Sowing shall be at a rate of 50 kg/ha and established with fertiliser at rates to be determined by nutrient analysis at the restoration stage.
- Any damage to hedgerows will be repaired in the autumn with a double staggered row of mixed species quicks.
- If made ground is identified a verification report will be required post restoration of those areas using Made Ground soils. This should detail:
  - The location from which the soils were originally excavated, the bund that they were stored in, how long the soils were stored for and where in the subsection they have been reused. Records of volumes are also required.
  - Results of the annual stockpile reviews, including details of any soils that required removal from site during storage.
  - Photographs of the works.
  - Test results and confirmation that the soils are suitable for reuse.
  - Details of any soils deemed unsuitable for use during restoration and how they were managed.
  - Details of any soils imported for restoration purposes.

[4] 133735_2A-EWR-OXD-XX-DR-L-015003

# 11. Aftercare

On completion of the restoration works the soils will be in a fragile condition and all work should be geared towards stabilising the soil structure and establishing a strongly growing crop to ensure the best chance of a successful and sustainable restoration. Timing of cultivation operations will be critical to the success of the restoration with the soils only being worked when in a dry and friable condition.

Prior to disturbance the soils where tested contained low levels of phosphorus and potassium and good levels of magnesium, at index 1, 1 and 3 respectively. Soil pH was slightly acid at pH 6.3 (see Appendix D). Soil sampling should be undertaken on completion of the works if time permits.

During aftercare, all use of herbicides will be in compliance with Defra 'Code of Practice for Using Plant Protection Products' (2006).

The responsibility for undertaking the aftercare programme and the work required should be agreed between the Alliance and the farmer. A typical example of the work required is provided below.

## 11.1 Year 1

The fields will be sown with a crop with a good rooting system such as grass or winter cereals, as soon as possible after reinstatement of the soils. Crops will be limed, fertilised and sprayed with pesticides as necessary to maximise crop growth. The quantities of fertiliser required will be determined, by nutrient analysis of soils collected from the soil bunds prior to soil spreading, to ensure that major soil nutrient levels are sufficient for the growing crop.

At the end of the first year of cropping the land should be checked for settlement and any hollows should be infilled by scrapping back the topsoil and infilling the hollows with subsoil, before reinstating the topsoil.

The drain discharge points should be checked to ensure they are still clear of vegetation or silt and that all drains are flowing in winter or after wet weather.

## 11.2 Year 2 - 5

The site should be monitored each year by the agreed person, to check the condition of the soil and grass (or other crop as agreed with the farmer) and amelioration work undertaken as necessary. This work is likely to include filling of any settlement hollows, subsoiling to improve soil structure and crop patching areas of poor growth once any drainage issues have been addressed.

# 12. Records

## 12.1 Soil Records and Audits

As stated within the report under the SMP there should be a record kept of the following:

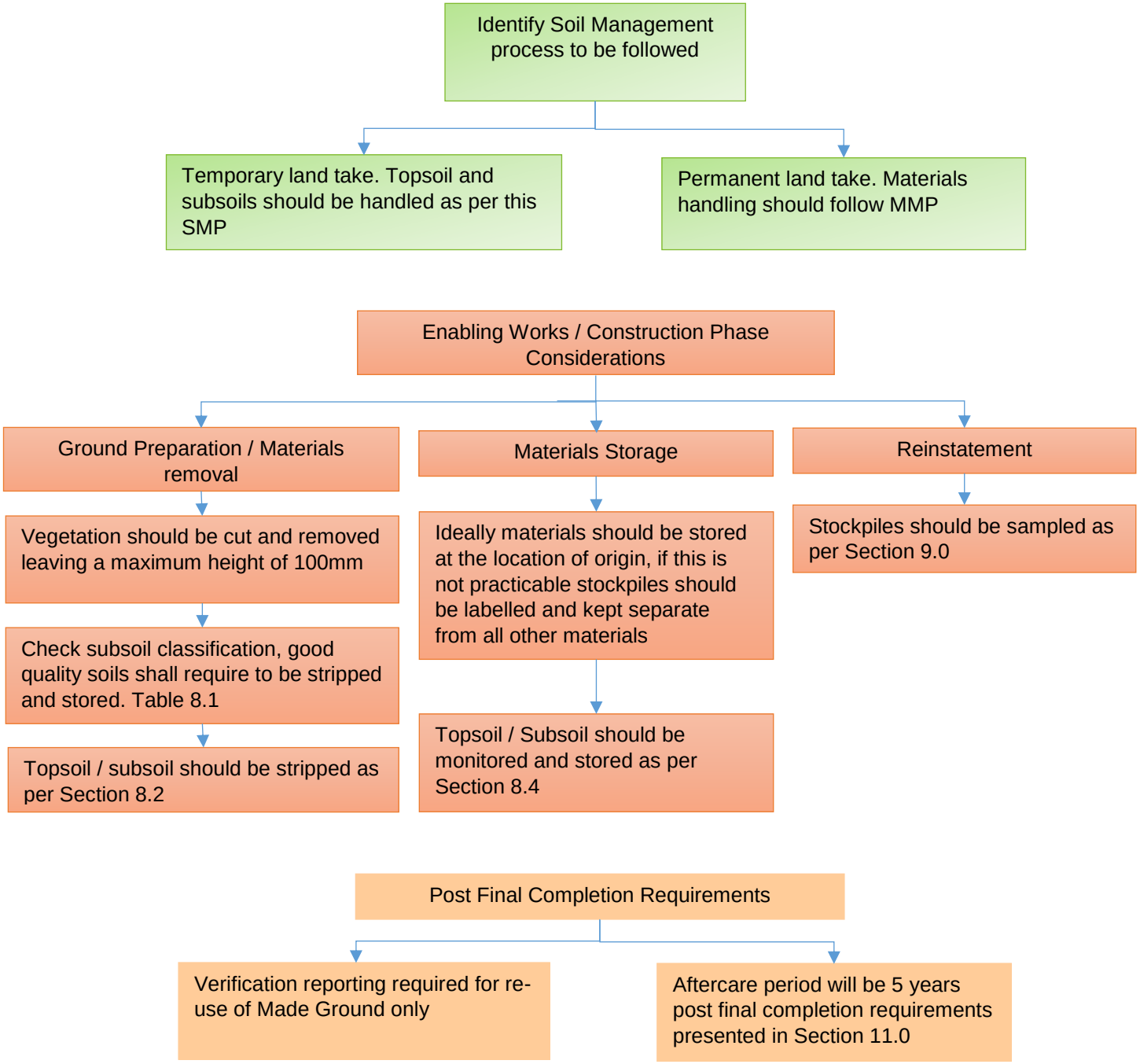
- Soil stripping and stockpiling locations to be tracked and mapped (as detailed in Section 8.2)
- The tracker should include any existing drainage features identified during stripping (Section 8.3)
- The soil type and volumes should be recorded for each bund (Section 8.4)
- An annual review of the stockpiles should be undertaken ensuring that the materials are stored in line with this SMP (Section 8.4)

# 13. Review Schedule

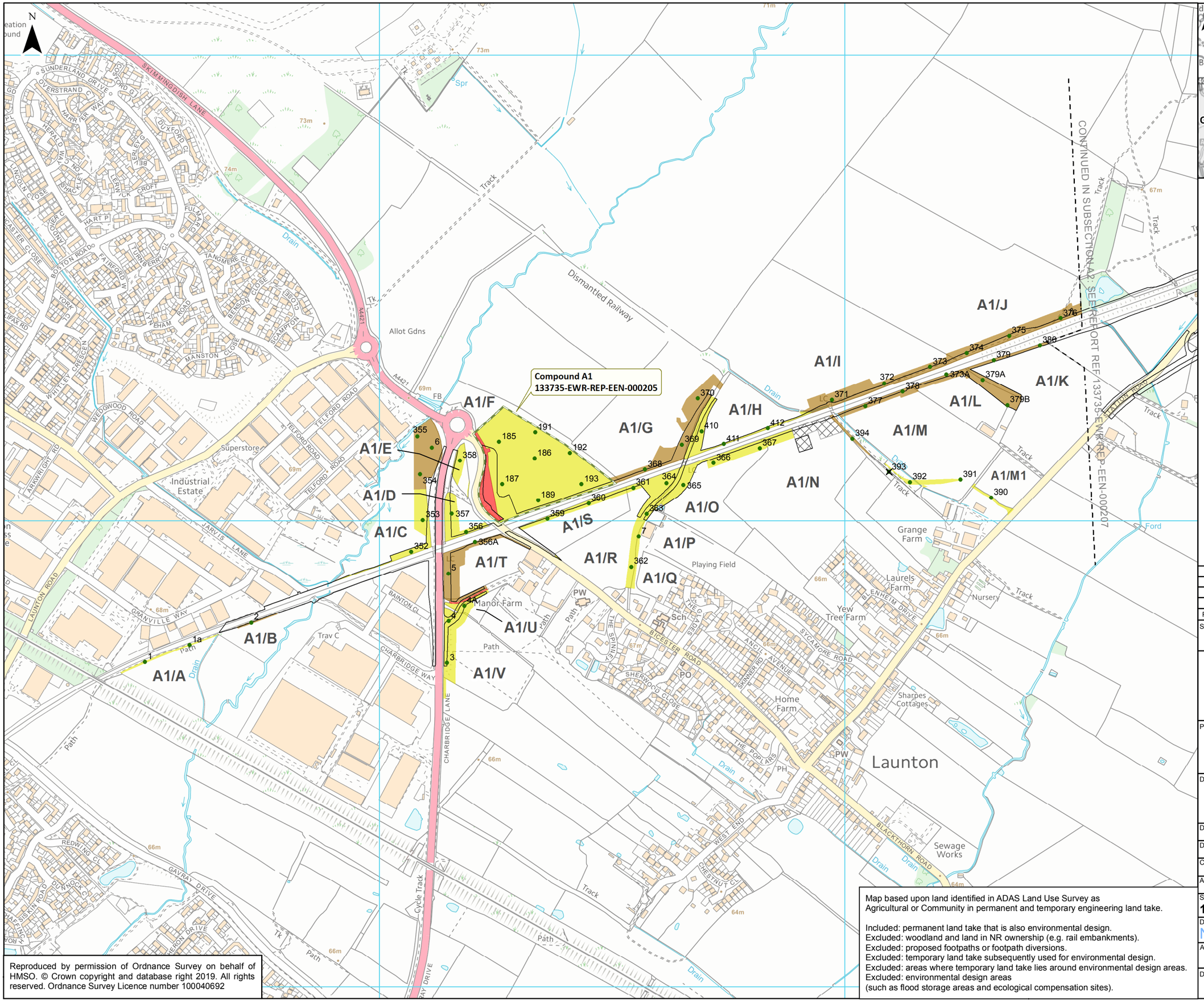
The annual review should be completed under the guidance of the Section Environmental Manager on a yearly basis and reported to the client. Reusing topsoil and subsoil materials on site and storing in the locality for reuse, where possible, follows the VfM approach required in the PAA and the core principles presented in the Alliance Charter.

Although this report should be reviewed annually it should also be updated in instances where additional land is leased for the storage of materials or plant. This will ensure that the land restoration requirements are met which shall be a stakeholder requirement as well as that within the EWR principles. The update of this report shall be the responsibility of the Environmental Manager responsible for the 2A Section of the works.

# Appendix A. Quick Guide



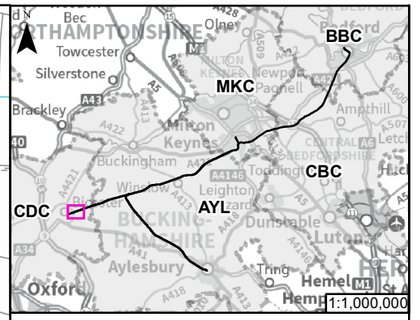
# Appendix B. Soil Resource Drawing






Map based upon land identified in ADAS Land Use Survey as Agricultural or Community in permanent and temporary engineering land take.

Included: permanent land take that is also environmental design.
Excluded: woodland and land in NR ownership (e.g. rail embankments).
Excluded: proposed footpaths or footpath diversions.
Excluded: temporary land take subsequently used for environmental design.
Excluded: areas where temporary land take lies around environmental design areas.
Excluded: environmental design areas
(such as flood storage areas and ecological compensation sites).




- PROJECT EXTENTS
- PERMANENT ENGINEERING LAND TAKE BOUNDARY
- AUGER POINTS
- AUGER LOCATION NOT SURVEYED
- ADJACENT SUBSECTION
- CONSTRUCTION COMPOUND

**SOIL RESOURCES**

- SOIL UNIT 1
- SOIL UNIT 2
- SOIL UNIT 3
- SOIL UNIT 4
- SOIL UNIT 5
- SOIL UNIT 6
- NOT SURVEYED

**LAND TAKE NOTE:**

LAND OUTSIDE THE PERMANENT ENGINEERING LAND TAKE BOUNDARY IS TEMPORARY LAND TAKE - (MAY INCLUDE SMALL AREAS OF PERMANENT LANDSCAPING)

0 50 100 150 200 Metres

| Rev | Date | Description of Revisions | Dsnd | Chkd | Appr |
|---|---|---|---|---|---|
| | | | | | |

Status: WIP - APPROVE

Suitability: S0

EWR Alliance
Connecting People

Project
EAST WEST RAIL WESTERN SECTION
PHASE 2

Drawing Title
SOIL RESOURCES
SECTION 2A - SUBSECTION 2A1

| | | | |
|---|---|---|---|
| Designed | Paul Taylor | Signed | Date 31/05/2019 |
| Drawn | Paul Taylor | Signed | Date 31/05/2019 |
| Checked | Rosemary Peel | Signed | Date 31/05/2019 |
| Approved | | Signed | Date |

Scale(s): 1:7,500

ELR & Project Chainage: N/A

Design Package Risk Classification: NORMAL

Sheet: 1 of 15

Alternative Reference

Revision: P01

Drawing Number

Sheet Size A3 297 x 420

# Appendix C. Soil Descriptions

## Subsection A1

**Schedule of Auger Borings and Soil Pit**

**Soil Pit at auger point 186**

| Compound | Grid references / horizon depth (mm) | Soil descriptions |
|---|---|---|
| **A1** | 460311, 223151 | **Land use:** Grass. **Land ID: 6862** |
| | 0-200 | Dark greyish brown medium clay loam with common rusty root mottles. |
| | 200-470 | Yellowish brown heavy clay loam with common ochreous mottles. Very compact. |
| | 470-620 | Yellowish brown sandy clay loam with common ochreous mottles. Firm – impossible to structure. |
| Comments: | | |

**Auger borings**

| Profile number | Horizon depth (mm) | Soil descriptions |
|---|---|---|
| Field A | | |
| 1 | | **Land use:** Grass (pp). **Land ID:** 6890 |
| | 0-250 | Dark brown medium clay loam. |
| | 250-390 | Dark yellowish brown heavy clay loam with common ochreous mottles, few manganese concretions and occasional limestone fragments. |
| | 390-1000 | Dark olive brown clay with common ochreous mottles, and occasional limestone fragments. Very few small stones. |
| Comments: | | |
| 1A | | **Land use:** Grass (pp). **Land ID:** 6890 |
| | 0-230 | Dark brown medium clay loam. |
| | 230-350 | Dark yellowish brown heavy clay loam with common ochreous mottles and manganese concretions. |
| | 350-810 | Dark olive grey clay with common ochreous mottles. |
| Comments: | | |
| Field B | | |
| 2 | | **Land use:** Grass (pp). **Land ID:** 6861 |
| | 0-150 | Very dark brown heavy clay loam. |
| | 150-470 | Very dark greyish brown heavy clay loam, slightly stony. |
| | 470-1000 | Dark greyish brown clay, gleyed. |
| Comments: | | |

| Profile number | Horizon depth (mm) | Soil descriptions |
|---|---|---|
| Field C | | |
| 352 | | **Land use:** Grass (pp). **Land ID:** 6865 |
| | 0-220 | Dark greyish brown medium clay loam. |
| | 220-510 | Brown heavy clay loam with few ochreous mottles. |
| | 510-760 | Greyish brown clay with common ochreous mottles and manganese concretions. |
| Comments: | | |
| 353 | | Land use: Grass (pp). Land ID: 6865 |
| | 0-190 | Dark greyish brown medium clay loam. |
| | 190-1000 | Grey clay with abundant ochreous mottles. |
| Comments: Possibly disturbed | | |
| 6 | | Land use: Grass (pp). Land ID: 6860 |
| | 0-120 | Dark brown heavy clay loam / clay. |
| | 120-660 | Dark greyish brown clay with abundant ochreous mottles. |
| | 660-1000 | Grey clay with abundant ochreous mottles. |
| Comments: | | |
| 354 | | Land use: Grass (sheep). Land ID: 6865 |
| | 0-140 | Very dark brown heavy clay loam, calcareous. |
| | 140-390 | Brown clay, calcareous, gleyed. |
| | 390-1000 | Grey and strong brown clay, gleyed. |
| Comments: | | |
| 355 | | Land use: Grass (sheep). Land ID: 6865 |
| | 0-150 | Very dark greyish brown clay, calcareous. |
| | 150-450 | Dark greyish brown clay, calcareous, gleyed. |
| | 450-550 | Yellowish brown clay and sand & gravel. |
| | 550-1000 | Grey clay, gleyed. |
| Field D | | |
| 356 | | Land use: Allotments. Land ID: 6865 |
| | 0-330 | Very dark greyish brown medium clay loam. |
| | 330-900+ | Grey and strong brown clay, gleyed. |
| Comments: | | |
| 357 | | Land use: Allotments. Land ID: 6865 |
| | 0-210 | Dark greyish brown medium clay loam. |
| | 210-360 | Dark grey medium sandy loam with common ochreous mottles. |
| | 360-790 | Greyish brown sandy clay with abundant ochreous mottles. |
| | 790-1000 | Grey clay with abundant ochreous mottles. |
| Comments: | | |

| Profile number | Horizon depth (mm) | Soil descriptions |
|---|---|---|
| Field E | | |
| 358 | | Land use: Grass verge. Land ID: 6865 |
| | 0-200 | Very dark grey medium clay loam. |
| | 200-510 | Light brownish grey heavy clay loam, gleyed. |
| | 510-1000 | Greyish brown and strong brown heavy clay loam, gleyed. |
| Comments: | | |
| Field F | | |
| 185 | | Land use: Grass (pp). Land ID: 6865 |
| | 0-220 | Dark greyish brown medium clay loam. |
| | 220-550 | Greyish brown heavy clay loam with common ochreous mottles. |
| | 550-1000 | Grey clay with abundant ochreous mottles and gleyed ped faces. |
| Comments: Compound A1 | | |
| 186 | | Land use: Grass (pp). Land ID: 6865 |
| | 0-200 | Dark greyish brown medium clay loam with rusty root mottles. |
| | 200-470 | Yellowish brown heavy clay loam with common ochreous mottles. |
| | 470-750 | Yellowish brown sandy clay loam with common ochreous mottles. |
| | 750-1000 | Grey clay with abundant ochreous mottles and gleyed ped faces. |
| Comments: Compound A1 | | |
| 187 | | Land use: Grass (pp). Land ID: 6865 |
| | 0-220 | Dark grey medium clay loam. |
| | 220-310 | Brown medium clay loam with common ochreous mottles. |
| | 310+ | Impenetrable – too firm. |
| Comments: Compound A1 | | |
| 189 | | Land use: Grass (pp). Land ID: 6865 |
| | 0-260 | Dark greyish brown medium clay loam. |
| | 260-560 | Brown medium clay loam with few ochreous mottles. |
| | 560-700 | Brown heavy clay loam with common ochreous mottles and common manganese concretions. |
| | 700-820 | Yellowish brown heavy clay loam/ sandy clay loam with common ochreous mottles and few small stones. |
| | 820-1000 | Grey clay with abundant ochreous mottles. |
| Comments: Compound A1 | | |
| 191 | | Land use: Grass (pp). Land ID: 6862 |
| | 0-190 | Dark brown medium clay loam. |
| | 190-380 | Brown medium clay loam with few ochreous mottles. |

| Profile number | Horizon depth (mm) | Soil descriptions |
|---|---|---|
| | 380-550 | Brown heavy clay loam with common ochreous mottles and common manganese concretions. |
| | 550-1000 | Grey clay with abundant ochreous mottles and gleyed ped faces. |
| Comments: Compound A1 | | |
| 192 | | Land use: Grass (pp). Land ID: 6862 |
| | 0-210 | Dark greyish brown medium clay loam (very organic). |
| | 210-300 | Yellowish brown medium clay loam with common ochreous mottles. Very dry. |
| | 300+ | Impenetrable – too firm. |
| Comments: Compound A1 | | |
| 193 | | Land use: Grass (pp). Land ID: 6862 |
| | 0-200 | Dark greyish brown medium clay loam with few rusty root mottles. |
| | 200-530 | Brown medium clay loam with common ochreous mottles. |
| | 530-670 | Brown heavy clay loam with common ochreous mottles. |
| | 670-1000 | Grey clay with abundant ochreous mottles. |
| Comments: Compound A1 | | |
| Field G | | |
| 368 | | Land use: Arable (cereal). Land ID: 6862 |
| | 0-300 | Very dark greyish brown heavy clay loam. |
| | 300-600 | Greyish brown and light yellowish brown heavy clay loam. |
| | 600-850 | Greyish brown and strong brown heavy clay loam, slightly stony, gleyed. |
| | 850+ | Stopped, stones. |
| Comments: | | |
| 369 | | Land use: Arable (cereal). Land ID: 6862 |
| | 0-250 | Very dark greyish brown heavy clay loam. |
| | 250-400 | Dark grey clay, gleyed. |
| | 400-1000 | Grey and strong brown clay, gleyed. |
| Comments: | | |
| 370 | | Land use: Arable (cereal). Land ID: 6862 |
| | 0-260 | Dark greyish brown heavy clay loam. |
| | 260-800 | Strong brown clay with common ochreous mottles. |
| | 800-1000 | Grey clay with common ochreous mottles. |
| Comments: | | |
| Field H | | |
| 410 | | Land use: Grass (pp). Land ID: 6862 |

| Profile number | Horizon depth (mm) | Soil descriptions |
|---|---|---|
| | 0-170 | Very dark greyish brown medium clay loam. High organic matter content. |
| | 170-370 | Dark greyish brown heavy clay loam with common ochreous mottles. |
| | 370-770 | Greyish brown clay with common ochreous mottles. |
| | 770-1000 | Grey clay loam with common ochreous mottles. |
| Comments: | | |
| 411 | | Land use: Grass. Land ID: 6862 |
| | 0-180 | Very dark greyish brown medium to heavy clay loam. |
| | 180-360 | Greyish brown and yellowish brown heavy clay loam, gleyed. |
| | 360-1000 | Grey clay, gleyed. |
| Comments: | | |
| 412 | | Land use: Grass (pp). Land ID: 6862 |
| | 0-170 | Dark greyish brown medium clay loam. |
| | 170-530 | Brown heavy clay loam with common ochreous mottles. |
| | 530-1000 | Grey clay loam with abundant ochreous mottles. |
| Comments: | | |
| Field I | | |
| 371 | | Land use: Arable (cereal). Land ID: 6862 |
| | 0-180 | Very dark greyish brown clay. |
| | 180-360 | Greyish brown clay, gleyed. |
| | 360-1000 | Grey and strong brown clay, gleyed. |
| Comments: | | |
| 372 | | Land use: Arable (cereal). Land ID: 6862 |
| | 0-240 | Dark grey heavy clay loam. |
| | 240-500 | Grey heavy clay loam, gleyed. |
| | 500-1000 | Grey and strong brown clay, gleyed. |
| Comments: | | |
| 373 | | Land use: Arable (cereal). Land ID: 6862 |
| | 0-170 | Very dark greyish brown heavy clay loam to clay. |
| | 170-450 | Greyish brown and yellowish brown clay, gleyed. |
| | 450-1000 | Grey and strong brown clay, gleyed. |
| Comments: | | |
| Field J | | |
| 374 | | Land use: Arable (cereal) Land ID: 6862 |
| | 0-240 | Dark greyish brown medium clay loam with few ochreous mottles. |
| | 240-500 | Greyish brown clay with abundant ochreous mottles. |

| Profile number | Horizon depth (mm) | Soil descriptions |
|---|---|---|
| | 500-1000 | Grey clay with abundant ochreous mottles. |
| Comments: | | |
| 375 | | Land use: Arable (cereal). Land ID: 6862 |
| | 0-200 | Very dark greyish brown heavy clay loam. |
| | 200-440 | Greyish brown heavy clay loam, gleyed. |
| | 440-1000 | Light brownish grey and strong brown clay, gleyed. |
| Comments: | | |
| 376 | | Land use: Arable (cereal). Land ID: 6862 |
| | 0-200 | Very dark greyish brown medium clay loam. |
| | 200-520 | Greyish brown clay with common ochreous mottles. |
| | 520-790 | Greyish brown clay with abundant ochreous mottles. |
| | 790-1000 | Grey sandy clay loam with abundant ochreous mottles. |
| Comments: | | |
| Field K | | |
| 379 | | Land use: Grass. Land ID: 6912 |
| | 0-220 | Very dark greyish brown heavy clay loam. |
| | 220-450 | Dark greyish brown heavy clay loam, gleyed. |
| | 450-1000 | Grey and strong brown clay, gleyed. |
| Comments: | | |
| 380 | | Land use: Grass. Land ID: 6912 |
| | 0-250 | Dark brown heavy clay loam. |
| | 250-500 | Dark greyish brown heavy clay loam to clay, gleyed. |
| | 500-1000 | Grey and strong brown clay, gleyed. |
| Comments: | | |
| Field L | | |
| 373A | | Land use: Grass, horses. Land ID: 3014 |
| | 0-280 | Dark grey heavy clay loam |
| | 280-1000+ | Grey clay, gleyed. |
| Comments: | | |
| 379A | | Land use: Grass, horses. Land ID: 3014 |
| | 0-350 | Dark grey heavy clay loam |
| | 350-1000+ | Greyish brown and grey clay, gleyed. |
| Comments: | | |
| 379B | | Land use: Grass (pp). Land ID: 3014 |
| | 0-110 | Very dark grey medium clay loam. |
| | 110-400 | Dark grey heavy clay loam with common ochreous mottles. |
| | 400-620 | Greyish brown clay with abundant ochreous mottles. Gleyed. |

| Profile number | Horizon depth (mm) | Soil descriptions |
|---|---|---|
| | 620-1000 | Yellowish brown clay with common ochreous mottles and a few small stones. Gleyed. |
| Comments: | | |
| Field M | | |
| 377 | | Land use: Grass. Land ID: 6912 |
| | 0-220 | Very dark grey heavy clay loam. |
| | 220-450 | Brown heavy clay loam to clay. |
| | 450-1000 | Grey and strong brown clay, gleyed. |
| Comments: | | |
| 378 | | Land use: Grass. Land ID: 6912 |
| | 0-140 | Dark brown medium to heavy clay loam. |
| | 140-400 | Greyish brown heavy clay loam, gleyed. |
| | 400-530 | Light brownish grey sandy clay loam, gleyed. |
| | 530-1000 | Grey and strong brown clay, gleyed. |
| Comments: | | |
| 391 | | Land use: Grass (pp). Land ID: 6912 |
| | 0-119 | Very dark greyish brown medium clay loam. |
| | 119-530 | Greyish brown clay with common ochreous mottles. |
| | 530-1000 | Grey clay with abundant ochreous mottles. |
| Comments: | | |
| 392 | | Land use: Grass (pp). Land ID: 6913 |
| | 0-111 | Very dark greyish brown medium clay loam. |
| | 110-290 | Dark greyish brown heavy clay loam with few ochreous mottles. |
| | 290-590 | Greyish brown clay with common ochreous mottles. |
| | 590-820 | Grey clay with abundant ochreous mottles and manganese concretions. |
| | 820-1000 | Grey clay with common ochreous mottles. |
| Comments: | | |
| Field M1 | | |
| 390 | | Land use: Woodland. Land ID: 6912 |
| | 0-118 | Very dark greyish brown medium clay loam. |
| | 118-550 | Dark greyish brown heavy clay loam with common ochreous mottles. |
| | 550-750 | Greyish brown clay with common ochreous mottles and few small hard stones. |
| | 750-1000 | Grey clay with abundant ochreous mottles. |
| Comments: | | |
| Field N | | |

| Profile number | Horizon depth (mm) | Soil descriptions |
|---|---|---|
| 393 | | Not surveyed. |
| Comments: Access denied | | |
| 394 | | Land use: Tree line along track. Land ID: 6912 |
| | 0-120 | Very dark greyish brown heavy clay loam. High organic matter. |
| | 120-480 | Dark greyish brown clay with common ochreous mottles. |
| | 480-1000 | Grey clay with abundant ochreous mottles. |
| Comments: | | |
| Field O | | |
| 365 | | Land use: Grass. Land ID: 6862 |
| | 0-260 | Dark greyish brown medium clay loam. |
| | 260-470 | Dark greyish brown heavy clay loam, gleyed. |
| | 470-800 | Greyish and yellowish brown clay, gleyed. |
| | 800-1000 | Grey clay with abundant ochreous mottles. |
| Comments: | | |
| 366 | | Land use: Grass (pp). Land ID: 6862 |
| | 0-280 | Dark greyish brown medium clay loam. |
| | 280-400 | Greyish brown heavy clay loam with common ochreous mottles. |
| | 400-680 | Greyish brown clay with abundant ochreous mottles. |
| | 680-1000 | Grey clay with abundant ochreous mottles. |
| Comments: | | |
| 367 | | Land use: Grass. Land ID: 6862 |
| | 0-260 | Dark greyish brown medium clay loam. |
| | 260-420 | Brown heavy clay loam, gleyed. |
| | 420-1000 | Grey and yellowish brown clay, gleyed. |
| Comments: | | |
| Field P | | |
| 7 | | Land use: On the edge of Launton Sports and Social club.<br>Land ID: 6917 |
| | 0-280 | Dark greyish brown medium clay loam. |
| | 280-700 | Dark greyish brown heavy clay loam with common ochreous mottles. |
| | 700-750 | Dark grey clay with common ochreous mottles and manganese concretions. |
| | 750-1000 | Greyish brown clay with many ochreous mottles. |
| Comments: | | |
| Field R | | |
| 361 | | Land use: Grass (pp). Land ID: 6862 |
| | 0-300 | Dark greyish brown medium clay loam. |

| Profile number | Horizon depth (mm) | Soil descriptions |
|---|---|---|
| | 300-590 | Greyish brown heavy clay loam with common ochreous mottles. Slightly calcareous. |
| | 590-750 | Brown clay with common ochreous mottles. Slightly calcareous. |
| | 750-1000 | Grey clay with common ochreous mottles. |
| Comments: | | |
| 362 | | Land use: Grass (pp). Land ID: 6862 |
| | 0-180 | Very dark greyish brown organic medium sandy loam. |
| | 180-510 | Dark greyish brown heavy clay loam with common ochreous mottles. |
| | 510-730 | Greyish brown sandy clay with abundant ochreous mottles and manganese concretions. |
| | 730-1000 | Grey clay with common ochreous mottles and manganese concretions. |
| Comments: | | |
| 363 | | Land use: Grass (pp). Land ID: 6862 |
| | 0-200 | Greyish brown medium clay loam. |
| | 200-470 | Greyish brown heavy clay loam with common ochreous mottles and few small hard stones. |
| | 470-750 | Greyish brown clay with abundant ochreous mottles. |
| | 750-1000 | Grey clay with abundant ochreous mottles. |
| Comments: | | |
| 364 | | Land use: Grass (pp). Land ID: 6862 |
| | 0-220 | Dark greyish brown medium clay loam. |
| | 220-600 | Dark greyish brown heavy clay loam with common ochreous mottles. Slightly calcareous. |
| | 600+ | Impenetrable – too firm. |
| Comments: | | |
| Field S | | |
| 359 | | Land use: Grass (pp). Land ID: 6862 |
| | 0-280 | Dark greyish brown medium clay loam. |
| | 280-550 | Greyish brown heavy clay loam with common ochreous mottles and manganese concretions. Slightly calcareous. |
| | 550-750 | Greyish brown clay with many ochreous mottles and manganese concretions. Slightly calcareous. |
| | 750+ | Impenetrable – too firm. |
| Comments: | | |
| 360 | | Land use: Grass (pp). Land ID: 6862 |
| | 0-280 | Dark greyish brown medium clay loam. |
| | 280-470 | Greyish brown heavy clay loam with common ochreous mottles. Slightly calcareous. |

| Profile number | Horizon depth (mm) | Soil descriptions |
|---|---|---|
| | 470-700 | Brown clay with common ochreous mottles. Slightly calcareous. |
| | 700-1000 | Grey clay with common ochreous mottles. Slightly calcareous. |
| Comments: | | |
| Field T | | |
| 356A | | Land use: Grass (pp). Land ID: 6867 |
| | 0-240 | Dark greyish brown heavy clay loam |
| | 240-350 | Light olive brown heavy clay loam, gleyed |
| | 350-1000+ | Greyish brown and grey clay, gleyed. |
| Comments: | | |
| Adjacent to Field T | | |
| 5 | | Land use: Grass bank. Land ID: 6843 |
| | 0-140 | Dark brown heavy clay loam. |
| | 140-800 | Olive brown clay with abundant ochreous mottles. |
| | 800-1000 | Dark brown/brown heavy clay loam with common ochreous mottles, few small stones and manganese concretions. |
| Comments: Disturbed bank adjacent to road | | |
| Field U | | |
| 4A | | Land use: Grass (pp). Land ID: 6867 |
| | 0-200 | Dark grey medium clay loam. |
| | 200-250 | Greyish brown heavy clay loam with common ochreous mottles. Gleyed. |
| | 250-770 | Greyish brown clay with common ochreous mottles – slightly sandy. Gleyed. |
| | 770-1000 | Greyish brown clay with abundant ochreous mottles. Gleyed. |
| Adjacent to Field V | | |
| 3 | | Land use: Grass bank. Land ID: 6843 |
| | 0-160 | Greyish brown medium (silty) clay loam. |
| | 160-500 | Brown medium (silty) clay loam. |
| | 500-1000 | Dark grey heavy clay loam, gleyed. |
| Comments: Bank adjacent to road | | |
| Adjacent to Field V | | |
| 4 | | Land use: Grass bank. Land ID: 6843 |
| | 0-180 | Brown medium clay loam. |
| | 180-500 | Grey heavy clay loam, slightly stony, gleyed. |
| | 500-1000 | Greyish brown sandy clay loam, gleyed. |
| Comments: Bank adjacent to road | | |

# Appendix D. Laboratory Analysis - Nutrients

Contact : SIMON MCMILLAN
RSK ADAS LTD
ALCESTER RD
STRATFORD-UPON-AVON
WARWICKSHIRE
CV37 9RQ
Tel. : 01789 416933

**K474**

Please quote the above code for all enquiries

Client : 1010266

Distributor : 1010266

Sample Matrix : Agricultural Soil

Laboratory Reference
Card Number 77890/18

Date Received 24-Sep-18
Date Reported 26-Sep-18

# SOIL ANALYSIS REPORT

| Laboratory Sample Reference | Field Details | | | Index | | | mg/l (Available) | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. | Name or O.S. Reference with Cropping Details | Soil pH | P | K | Mg | P | K | Mg |
| 536311/18 | 1 | **EWR-COMPOUND A1**<br>*No cropping details given* | **6.3** | **1** | **1** | **3** | **15.2** | **106** | **147** |

*If general fertiliser and lime recommendations have been requested, these are given on the following sheets.*
*The analytical methods used are as described in DEFRA Reference Book 427*
*The index values are determined from the DEFRA Fertiliser Recommendations RB209 9th Edition.*

Released by Joe Cherrie On behalf of NRM Ltd Date 26/09/18

**NRM** Coopers Bridge, Braziers Lane, Bracknell, Berkshire RG42 6NS
**Tel:** +44 (0) 1344 886338 **Fax:** +44 (0) 1344 890972 **Email:** enquiries@nrm.uk.com **www.**nrm.uk.com

| | |
|---|---|
| DATE | 26th September 2018 |
| SAMPLES FROM | 1010266 |
| SAMPLED BY | 1010266 |
| Report reference | 77890/18 |

SIMON MCMILLAN
RSK ADAS LTD
ALCESTER RD
STRATFORD-UPON-AVON
WARWICKSHIRE
CV37 9RQ
Tel: 01789 416933
Fax:

## Fertiliser Recommendations

The phosphate and potash recommendations shown below, are those required to replace the offtake and maintain target soil indices. The larger recommended applications for soils below target index will allow the soil to build up to this target index over a number of years. Not applying fertiliser to soils which are above target index will allow the soil to run down over a number of years to the target index.
The recommendation should be increased or decreased where yields are substantially more or less than that specified. The amount to apply can be calculated using the expected yield and values for the offtake of phosphate and potash per tonne of yield given in the RB209 9th edition.
All recommendations are given for the mid-point of each Index.
Where a soil analysis value (as given by the laboratory) is close to the range of an adjacent Index, the recommendation may be reduced or increased slightly taking account of the recommendation given for the adjacent Index. Small adjustments of less than 10 kg/ha are generally not justified.
Don't forget to deduct nutrients applied as organic manures.
For Nitrogen recommendations please refer to the RB209 9th edition or seek advice from an FACTS qualified adviser.
Target Indices:
Arable, Forage, Grassland and Potato Crops: P Index 2, K Index 2-
Vegetables and Bulbs: P Index 3, K Index 2-
Fruit Vines and Hops: P Index 2, K Index 2, Mg Index 2
(Note: Cider apples respond to K Index 3, Mg Index 3)
A lime recommendation is usually for a 20cm depth of cultivated soil or a 15cm depth of grassland soil. Where soil is acid below 20 cm and soils are ploughed for arable crops, a proportionately larger quantity of lime should be applied. However, if more than 10 t/ha is needed, half should be deeply cultivated into the soil and ploughed down, with the remainder applied to the surface and worked in.
For established grassland or other situations where there is no, or only minimal soil cultivation, no more than 7.5 t/ha of lime should be applied in one application.
In these situations, applications of lime change the pH below the surface very slowly. Consequently, the underlying soil should not be allowed to become too acidic because this will affect the root growth and thus limit nutrient and water uptake, which will adversely affect yield.

| *Field Name / Ref / Soil Type* | *Last Crop / Next Crop* | | *P2O5* | *K2O* | *MgO* | *Lime (Arable)* | | *(Grass)* |
|---|---|---|---|---|---|---|---|---|
| **EWR-COMPOUND A1** | **Not Given / Not Given** | *Units/Acre* | | | | *T/Ac* | **1.1** | **0** |
| **536311 /** | | *Kg/Ha* | | | | *Te/Ha* | **2.8** | **0** |

Fertiliser recommendations are based on **(Ninth Edition - 2017).** If a nutrient is deficient and no recommendation is given, either no recommendation is given in RB209 or we have insufficient data to give a recommendation. Apply Lime to the nearest half Ton / Tonne.
NRM is a UKAS accredited laboratory to ISO/IEC 17025:2005

# Appendix E. Laboratory Analysis - Baseline Geochemical Data

**Envirolab Job Number: 18/07655**

**Client Project Name: Drayton**

**Client Project Ref: EWR**

| Lab Sample ID | 18/07655/1 | 18/07655/2 | 18/07655/3 | 18/07655/4 | | | | | Units | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | A1-185 | A1-185 | A1-193 | A1-193 | | | | | | |
| Client Sample ID | EWR | EWR | EWR | EWR | | | | | | |
| Depth to Top | 0.10 | 0.50 | 0.10 | 0.50 | | | | | | |
| Depth To Bottom | 0.20 | 0.70 | 0.20 | 0.70 | | | | | | |
| Date Sampled | 18-Sep-18 | 18-Sep-18 | 18-Sep-18 | 18-Sep-18 | | | | | | |
| Sample Type | Soil | Soil | Soil | Soil | | | | | | |
| Sample Matrix Code | 4E | 5 | 4E | 5 | | | | | | |
| % Stones >10mm$_A$ | <0.1 | <0.1 | <0.1 | <0.1 | | | | | % w/w | A-T-044 |
| pH$_D$[M#] | 6.27 | 7.18 | 7.28 | 7.48 | | | | | pH | A-T-031s |
| Ammonium / Ammoniacal Nitrogen as NH4$_D$ | 7.22 | 0.77 | 6.64 | <0.26 | | | | | mg/kg | A-T-033s |
| Sulphate (acid soluble)$_D$[M#] | 960 | 350 | 840 | 310 | | | | | mg/kg | A-T-028s |
| Cyanide (free)$_A$[M#] | <1 | <1 | <1 | <1 | | | | | mg/kg | A-T-042sFCN |
| Cyanide (total)$_A$[M#] | <1 | <1 | <1 | <1 | | | | | mg/kg | A-T-042sTCN |
| Phenols - Total by HPLC$_A$ | <0.2 | <0.2 | <0.2 | <0.2 | | | | | mg/kg | A-T-050s |
| Sulphide$_A$ | <5 | <5 | <5 | 200 | | | | | mg/kg | A-T-S2-s |
| Loss on ignition (550degC)$_D$ | 10.9 | 7.5 | 9.3 | 5.0 | | | | | % w/w | A-T-030s |
| Fraction of organic carbon$_D$[#] | 0.0362 | 0.0046 | 0.0278 | 0.0049 | | | | | N/A | A-T-032 FOC |
| Arsenic$_D$[M#] | 4 | 4 | 3 | 6 | | | | | mg/kg | A-T-024s |
| Boron (water soluble)$_D$[M#] | 1.2 | <1.0 | <1.0 | 1.7 | | | | | mg/kg | A-T-027s |
| Cadmium$_D$[M#] | 0.8 | 0.8 | 0.7 | 1.2 | | | | | mg/kg | A-T-024s |
| Copper$_D$[M#] | 24 | 21 | 11 | 19 | | | | | mg/kg | A-T-024s |
| Chromium$_D$[M#] | 35 | 31 | 36 | 21 | | | | | mg/kg | A-T-024s |
| Chromium (hexavalent)$_D$ | <1 | <1 | <1 | <1 | | | | | mg/kg | A-T-040s |
| Lead$_D$[M#] | 65 | 18 | 21 | 11 | | | | | mg/kg | A-T-024s |
| Mercury$_D$ | <0.17 | 0.30 | 0.22 | <0.17 | | | | | mg/kg | A-T-024s |
| Nickel$_D$[M#] | 14 | 10 | 19 | 65 | | | | | mg/kg | A-T-024s |
| Selenium$_D$[#] | 2 | 2 | <1 | 1 | | | | | mg/kg | A-T-024s |
| Vanadium$_D$[M#] | 56 | 27 | 56 | 23 | | | | | mg/kg | A-T-024s |
| Zinc$_D$[M#] | 76 | 51 | 72 | 110 | | | | | mg/kg | A-T-024s |
| TPH total (>C6-C40)$_A$[M#] | 37 | <10 | 41 | <10 | | | | | mg/kg | A-T-007s |
| E-Coli (Faecal Coliforms)$_A$ | <10 | <10 | <10 | <10 | | | | | cfu/g | Subcon Mercian |
| Intestinal Enterococci (Faecal Streptococci/Faecal Enterococci)$_A$ | <10 | <10 | 10 | <10 | | | | | cfu/g | Subcon Mercian |
| | | | | | | | | | | |
| Asbestos in Soil (inc. matrix) ^ | | | | | | | | | | |
| Asbestos in soil$_A$[#] | NAD | NAD | NAD | NAD | | | | | | A-T-045 |
| Asbestos ACM - Suitable for Water Absorption Test? | N/A | N/A | N/A | N/A | | | | | | |

**Envirolab Job Number: 18/07655**

**Client Project Name: Drayton**

**Client Project Ref: EWR**

| Lab Sample ID | 18/07655/1 | 18/07655/2 | 18/07655/3 | 18/07655/4 | | | | | Units | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | A1-185 | A1-185 | A1-193 | A1-193 | | | | | | |
| Client Sample ID | EWR | EWR | EWR | EWR | | | | | | |
| Depth to Top | 0.10 | 0.50 | 0.10 | 0.50 | | | | | | |
| Depth To Bottom | 0.20 | 0.70 | 0.20 | 0.70 | | | | | | |
| Date Sampled | 18-Sep-18 | 18-Sep-18 | 18-Sep-18 | 18-Sep-18 | | | | | | |
| Sample Type | Soil | Soil | Soil | Soil | | | | | | |
| Sample Matrix Code | 4E | 5 | 4E | 5 | | | | | | |
| **PAH-16MS** | | | | | | | | | | |
| Acenaphthene$_A^{M\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | | mg/kg | A-T-019s |
| Acenaphthylene$_A^{M\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | | mg/kg | A-T-019s |
| Anthracene$_A^{M\#}$ | <0.02 | <0.02 | <0.02 | <0.02 | | | | | mg/kg | A-T-019s |
| Benzo(a)anthracene$_A^{M\#}$ | <0.04 | <0.04 | <0.04 | <0.04 | | | | | mg/kg | A-T-019s |
| Benzo(a)pyrene$_A^{M\#}$ | <0.04 | <0.04 | <0.04 | <0.04 | | | | | mg/kg | A-T-019s |
| Benzo(b)fluoranthene$_A^{M\#}$ | <0.05 | <0.05 | <0.05 | <0.05 | | | | | mg/kg | A-T-019s |
| Benzo(ghi)perylene$_A^{M\#}$ | <0.05 | <0.05 | <0.05 | <0.05 | | | | | mg/kg | A-T-019s |
| Benzo(k)fluoranthene$_A^{M\#}$ | <0.07 | <0.07 | <0.07 | <0.07 | | | | | mg/kg | A-T-019s |
| Chrysene$_A^{M\#}$ | <0.06 | <0.06 | <0.06 | <0.06 | | | | | mg/kg | A-T-019s |
| Dibenzo(ah)anthracene$_A^{M\#}$ | <0.04 | <0.04 | <0.04 | <0.04 | | | | | mg/kg | A-T-019s |
| Fluoranthene$_A^{M\#}$ | <0.08 | <0.08 | <0.08 | <0.08 | | | | | mg/kg | A-T-019s |
| Fluorene$_A^{M\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | | mg/kg | A-T-019s |
| Indeno(123-cd)pyrene$_A^{M\#}$ | <0.03 | <0.03 | <0.03 | <0.03 | | | | | mg/kg | A-T-019s |
| Naphthalene$_A^{M\#}$ | <0.03 | <0.03 | <0.03 | <0.03 | | | | | mg/kg | A-T-019s |
| Phenanthrene$_A^{M\#}$ | <0.03 | <0.03 | <0.03 | <0.03 | | | | | mg/kg | A-T-019s |
| Pyrene$_A^{M\#}$ | <0.07 | <0.07 | <0.07 | <0.07 | | | | | mg/kg | A-T-019s |
| Total PAH-16MS$_A^{M\#}$ | <0.08 | <0.08 | <0.08 | <0.08 | | | | | mg/kg | A-T-019s |

## REPORT NOTES

**General:**
This report shall not be reproduced, except in full, without written approval from Envirolab.
All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

**Soil chemical analysis:**
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

**TPH analysis of water by method A-T-007:**
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

**Electrical Conductivity of water by Method A-T-037:**
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

**Asbestos:**
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

**Predominant Matrix Codes:**
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
**Secondary Matrix Codes:**
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,
E = contains roots/twigs.

**Key:**
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

# Appendix F. Geochemical Testing Suite

**The material will be tested as a minimum in accordance with the following soil testing suites:**

- pH;
- Metals including:
  - Arsenic, Boron, Cadmium, Chromium (total), Chromium (VI), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc, Iron, Manganese;
- Inorganics including:
  - Total Sulphate as SO4;
  - Free Cyanide;
  - Ammonium as NH4;
- Hydrocarbons including:
  - Benzene, Toluene, Ethylbenzene and Xylene (BTEX);
  - TPH Carbon Working Group (CWG) aliphatic / aromatic split;
- Speciated 16 PAHs;
- Total Phenol; and
- Asbestos.

# Appendix G. Scheme Re-Use Criteria

**Final Derived Re-use Number**

| Inorganics | Level of assessment (Most conservative of EQS, DWS or Haz Threshold) | Soil Re-use Criteria (mg/kg) | Max Reported Soil Concentration (mg/kg)** | Leachate Re-use Criteria (mg/l) | Max reported Soil Leachate Concentration (mg/l) |
|---|---|---|---|---|---|
| Total Sulphate as SO4 | Level 2 (further assessment not required) | 230,117 | 200,000 | 11,543 | 3,800 |
| Ammonium as NH4 | Level 2 (EQS Only) | 127.9 | 51.00 | 18.0 | 10 |
| **Metals** | | | | | |
| Arsenic | Level 2 (hazardous substance) | 305 | 360.00 | 0.23 | 0.05 |
| Boron | Level 2 (further assessment not required) | 1,536 | 64.00 | 46.17 | 0.37 |
| Cadmium | Level 4 | 59.5 | 2.90 | 0.25 | ND |
| Chromium (hexavalent) | Level 2 (hazardous substance) | 8.10 | ND | 0.23 | ND |
| Chromium | Level 2 (further assessment not required) | 1,137.54 | 660.00 | 0.22 | 0.01 |
| Copper | Level 4 | 13,012 | 430.00 | 44.09 | 0.06 |
| Lead | Level 2 (hazardous substance) | 614 | 735.00 | 0.23 | 0.01 |
| Mercury | Level 2 (hazardous substance) | 0.99 | 0.90 | 0.00046 | ND |
| Nickel | Level 2 (further assessment not required) | 4,184 | 95.00 | 0.92 | 0.02 |
| Selenium | Level 3 | 8.53 | 18.00 | 0.89 | 0.02 |
| Vanadium | Level 3 | 501 | 150.00 | 3.55 | 0.01 |
| Zinc | Level 2 (further assessment not required) | 21,508 | 1,750.00 | 3 | 0.06 |
| Iron* | Level 2 (further assessment not required) | 7,481 | Not tested | 9.23 | 9.00 |
| Manganese* | Level 3 | 223 | Not tested | 4.43 | 2.10 |
| **Monoaromatics** | | | | | |
| Benzene | Level 2 (hazardous substance) | 0.05 | ND | 0.05 | Not tested |
| Toluene | Level 2 (hazardous substance) | 0.57 | ND | 0.18 | Not tested |
| Ethylbenzene | Level 2 (hazardous substance) | 0.12 | ND | 0.05 | Not tested |
| p & m-xylene | Level 2 (hazardous substance) | 0.88 | ND | 0.14 | Not tested |
| o-xylene | Level 2 (hazardous substance) | 1.01 | ND | 0.14 | Not tested |
| **Petroleum Hydrocarbons** | | | | | |
| TPH-CWG - Aliphatic >EC5 - EC6 | Level 2 (hazardous substance) | 8.07 | ND | 0.46 | Not tested |
| TPH-CWG - Aliphatic >EC6 - EC8 | Level 2 (hazardous substance) | 31.50 | ND | 0.46 | Not tested |
| TPH-CWG - Aromatic >EC5 - EC7 | Level 2 (hazardous substance) | 2.82 | ND | 0.46 | Not tested |
| TPH-CWG - Aromatic >EC7 - EC8 | Level 2 (hazardous substance) | 4.08 | ND | 0.46 | Not tested |
| TPH-CWG - Aromatic >EC8 - EC10 | Level 2 (hazardous substance) | 13.89 | ND | 0.46 | Not tested |
| TPH-CWG - Aromatic >EC10 - EC12 | Level 2 (hazardous substance) | 20.69 | 7.20 | 0.46 | Not tested |
| TPH-CWG - Aromatic >EC12 - EC16 | Level 2 (hazardous substance) | 39.07 | 64.00 | 0.46 | Not tested |
| Napthalene | Level 4 | 90.23 | 3.00 | 4.38 | Not tested |

***No existing soil data for these parameters**

****** Within Route Section 2A, 2B and 2C**

# Appendix H. Soil Strip and Store Record Cards

# East West Rail Phase 2 - Record of Soil Storage (Incl. Annual )

| Site: | Weather: | Date of visit: |
|---|---|---|

| | | | |
|---|---|---|---|
| **Location / grid ref / site ref** | | | |
| ***Bunds*** | | | |
| **Location of soil origin** | | | |
| **Machinery used for stockpiling** | | | |
| **Height of bund (m)[1]** | | | |
| **Width of bund (m)** | **At Base:** | **At Top:** | |
| **Length of bund (m)** | | | |
| **Surface formed to shed water?** | Yes / No (circle) | | |
| **Evidence of erosion / slumping?** | Yes / No (circle) | If Yes, record concerns below | |
| | | | |
| **Significant rainfall in last 24 hrs?** | Yes / No (circle) | Detail: | |
| **Vegetation type / cover / condition/nesting birds/drains[2]** | | | |
| ***Soils*** | | | |
| **Soil Unit recorded?** | Yes / No (circle) | | |
| **Soil Type recorded?** | Yes / No (circle) type - Topsoil / Upper Subsoil / Lower Subsoil | | |
| **Soil Volume recorded?** | Yes / No (circle) quantity if recorded: | | |
| **Protected from trafficking or dumping?** | Yes / No (circle) | If No, record concerns below | |
| | | | |
| ***Soil description*** | ***Topsoil*** | ***Subsoil*** | |
| **Age of soil store** | | | |
| **Soil texture (standard textures)** | | | |
| **Stones (% and type)** | | | |
| **Foreign objects (% and type)** | | | |
| **Evidence of anaerobism?[3]** | | | |
| ***Conclusion*** | | | |
| **Are bunds in an acceptable condition?** | Yes / No (circle) | If No, record concerns below and outline remedial work required | |
| | | | |
| **Approved:** | | **Signature:** | |

[1]This section is to be completed when the bund has been completed. 10% reduction should be applied to allow for settlement which shall take several months.

[2]Confirmation of grass seed establishment required, percentage cover to be included.

[3]To be confirmed during the final inspection prior to topsoil reinstatement. Two or 3 trial holes to be dug along the length of the bund, if materials are noted as being grey with a strong sulphurous odour the stockpiles shall require aeration. Advice to be sort from a soil scientist.

# East West Rail Phase 2 - Record of Soil Stripping

| Site: | Weather: | Date of visit: |
|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| **Location / grid ref / site ref** | | | | | | |
| **Area (Ha or $m^2$)** | | | | | | |
| **Location of stockpile(s)** | | | | | | |
| **Soil Unit(s) affected** | | | | | | |
| **Machinery used for stripping** | | | | | | |
| **Machinery used for carting** | | | | | | |
| **Type of alnd use - Grass / Arable etc. on-site (type and condition)** | | | | | | |
| **Significant rainfall in last 24 hrs?** | Yes / No (circle) | Detail: | | | | |
| | | | | | | |
| **Surface soil condition[1]** | Liquid | Plastic | Moist/friable | Moist/firm | Dry friable | Dry firm |
| **(tick)** | | | | | | |
| ***Soil description*** | ***Topsoil*** | | | ***Subsoil*** | | |
| **Depth of strip / horizon condition** (use descriptions above) | | | | | | |
| **Soil texture (standard textures)[2]** | | | | | | |
| **Stones (% and type)[3]** | | | | | | |
| **Foreign objects (% and type)[4]** | | | | | | |
| **Evidence of compaction?[5]** | | | | | | |
| **Root abundance and size** | | | | | | |
| **Condition for stripping** | acceptable / not acceptable | | | acceptable / not acceptable | | |
| ***Drains located Yes / No (circle)*** | | | | | | |
| ***Location grid ref.*** [6] | | | | | | |
| ***Flowing?*** | Yes / No (circle) | ***Approx. flow volume:*** | | **Direction:** | | |
| ***Size (diameter mm)*** | | ***Angle of pipe:*** | | | | |
| ***Type e.g. clay, plastic*** | plastic / clay - round / clay - horseshoe / stone | | | | | |
| ***Permeable fill present?*** | Yes / No (circle) | ***Depth below surface:*** | | ***Type:*** | | |
| ***Pipe integrity*** | intact / collapsed or broken | | | | | |
| ***Silt content*** | clear / < third / half / two thirds / full | | | | | |
| ***Can the work proceed?*** | Yes / No (circle) | ***Concerns:*** | | | | |
| **Approved:** | | **Signature:** | | | | |

[1]To be completed by the Materials Engineering Team. At or below the plastic limit on site? Samples to be taken to the lab for plasticity and moisture content analysis. Soil characteristics as defined by the Agricultural and Horticulutral Development Board.

[2]Soil texture as defined by the Agricultural and Horticultural Development Board.

[3]Based on visual inspection. Type of stone e.g. flint or quartz etc.

[4]Made ground or anthropogenic material e.g. tile, brick, pottery fragments etc.

[5]E.g. solid layers.This will be important at the restoration stage. Photos to be taken as evidence.

[6]Surveys currently being performed by the Materials Engineering Team.

**Address 1**
**Address 2**
**Address 3**
**Postcode**

**Tel. +44**
**Email**
**Web**