
**LAND OFF GREVATT'S LANE WEST
WEST SUSSEX**

SOIL RESOURCE PLAN

Prepared on behalf of:

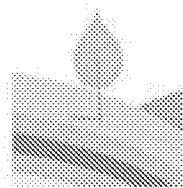
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1. INTRODUCTION

1.1 Background

- 1.1.1 it is proposed to construct a new crematorium on this Greenfield site (as indicated by the 'red line boundary' on the supplied site plan (*Haverstock LLP, Existing Site Boundary Plan, Ref. 1176 1001*- shown as Appendix 1).
- 1.1.2 The site was undisturbed at the time of the site visit. It is the intention to strip and store the existing topsoil before it is re-used for the landscape areas of the development.

1.2 Reference Material

- 1.2.1 The following information should be reviewed in conjunction with this *Soil Resource Plan*.
- Tim O'Hare Associates – *Soil Resource Survey Report: Land off Grevatt's Lane West, West Sussex* (dated July 2019, referenced TOHA/19/6507/ML).
 - Plincke Landscape Limited, *Design and Access Statement*, Arun Crematorium (Plincke Ref: 1176_D001 - Design and Access Statement 21.12.2018);
 - Plincke Landscape Limited, *Proposed Site Plan*, Arun Crematorium (Plincke Ref: 0524-DR-100).

1.3 Report Purpose and Limitations

- 1.3.1 The purpose of the *Soil Management Plan* is to set out the correct procedures for topsoil respreading and amelioration, as well as treatments to the subsoil, to ensure that a suitable soil profile is produced for plant establishment.
- 1.3.2 Matters relating to geotechnical and geo-environmental issues are outside the scope of this document.

2. SITE SOIL RESOURCES

2.1 Site Topsoil

2.1.1 The Soil Resource Survey characterized the topsoil on this site as summarised below .

- Slightly acid in reaction
- Non calcareous to slightly calcareous;
- Non saline;
- Silty Clay Loam to Medium Clay Loam (silt influenced and moisture retentive);
- Weak soil structures
- Slightly stony with occasional sub-angular/angular flints up to 90mm diameter;
- Moderately high extractable phosphorus and extractable magnesium;
- Slightly low organic matter, total nitrogen and extractable potassium.

2.1.2 The topsoil is not considered suitable for plant species that require light or free-draining soil, or for use as backfill for rootballed trees.

2.1.3 The low levels of organic matter should be addressed by an appropriate application of 'bulky' organic matter (e.g. PAS 100 compost or well rotted farm manure)

2.1.4 The deficiencies in extractable potassium and total nitrogen should be addressed by appropriate fertiliser applications for planting and seeding purposes.

2.2 Site Subsoil

2.2.1 The site subsoil has a 'silty' soil texture, with a weak soil structure. This soil type is moisture retentive and any damage to the structure of this soil (e.g. by compaction) will reduce its drainage properties.

2.2.2 Following earthworks and construction activities, the subsoil will require decompaction as part of the ground preparation work.

2.3 Drainage Considerations

2.3.1 The texture of the topsoil is strongly influenced by silt and clay sized particles which makes it particularly vulnerable to damage during the topsoil strip and storage phases. The damage caused by intensive soil handling will reduce its quality and potential for re-use.

2.3.2 In view of these conditions, the site soils would be best suited to plants which are tolerant of moisture retentive soils. Planting types which demand free draining soils would not be suited to this site. Demanding planting types such as semi-mature trees will require improvements to their planting conditions (tree pits) to improve drainage, to prevent tree pits from acting as sumps and to reduce risk of prolonged waterlogging / stagnation within the rooting zone. An alternative source of topsoil and subsoil should be considered for such uses.

- 2.3.3 There are a number of options to mitigate the poor physical properties of these soils, including:
- 2.3.4 Localised mounding of topsoil. The topsoil may be mounded locally for vulnerable species and tree pits. This effectively 'lifts' the plants, and reduces the risk of harm from waterlogging and improves aeration within the rooting zone.
- 2.3.5 Installation of artificial drainage / water attenuation layers. Drainage may be installed at key locations (e.g. base of slopes) or specifically for particularly vulnerable planting types. The type, design and depth of the drainage should be suitable to the proposed application. Such drainage would require a suitable outfall / discharge point. Water attenuation layers should be included at the base of tree pits.

3. IMPACTS ON SOIL QUALITY BY CONSTRUCTION ACTIVITY

3.1 Degradation of Soils

- 3.1.1 Soil is a vulnerable and non-renewable resource and therefore care must be taken throughout all handling, transporting and stockpiling activities to ensure that the soil resources of the site are protected and conserved. Findings from the Soil Resource Survey for this site indicate that the site soils display broad or clay based particle size distributions which will be also particularly vulnerable to physical degradation during intensive soil handling operations such as stripping, storage and respreading. Damage to the soil structure would reduce aeration and drainage characteristics and increase the risk of waterlogging and anaerobism (oxygen depletion).
- 3.1.2 Many general construction activities have the potential to damage soils. These include: compacting soils through trafficking of plant or vehicles, mixing soil with construction materials such as cement or aggregate, lime-stabilisation, or mixing different qualities of soil during handling and storage, including subsoil with topsoil.

3.2 The Potential Impacts of Soil Degradation

- 3.2.1 Failure to protect soils during disturbance can lead to their degradation with consequential environmental impacts both on-site and off-site, such as:
- soil erosion;
 - loss of soil organic matter leading to loss of nutrients and a decline in soil fertility;
 - soil compaction leading to loss of soil structure and permeability to water (waterlogging) and restricted aeration and rooting potential;
 - loss of soil biological activity;
 - poor re-establishment of vegetation;
 - visual impact of slope failure or soil erosion (bare soil surfaces).
- 3.2.2 Measures are provided in this *Soil Management Plan* to ensure, as far as is practicable, that soils on site will be stripped, handled and stored appropriately so that they can be re-used for landscape construction purposes.

4. SOIL MANAGEMENT PRACTICES

4.1 Background Reference

- 4.1.1 This section highlights the sequential treatments for the re-use of the existing soils. These practices are based on the DEFRA *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites* (2009).

4.2 General Soil Handling

- 4.2.1 It is important to avoid soil physical degradation during all phases of soil handling (e.g. stripping, storage, respreading and amelioration). Soil handling operations should ideally be carried out when the soil is reasonably dry and non-plastic (friable) in consistency.
- 4.2.2 The soils (topsoil and subsoil) should not be unnecessarily compacted by trampling or trafficking by site machinery.
- 4.2.3 If, during the course of the earthworks, the soil is structurally damaged, it should be suitably cultivated to relieve the compaction and restore the structure prior to any planting, seeding or turfing.

4.3 Pre-treatment of Existing Vegetation

- 4.3.1 It is good practice to minimise the quantity of vegetation entering the storage stockpiles in order to minimise the formation of anaerobic conditions during storage. As such, in advance of soil stripping (in-situ areas), the topsoil should be cleared of surface vegetation by a method suited to the vegetation type present.
- 4.3.2 The following treatment should also be used to reduce vegetation prior to stripping the site topsoil.
- 4.3.3 All existing vegetation should be close mown (< 100mm) and the cuttings collected where necessary for removal to a suitable green-waste recycling facility.
- 4.3.4 To minimise anaerobism during storage and preserve the quality of the topsoil as a growing medium, coarse woody materials should not be incorporated with the soils during stripping. This includes any chippings left on the surface after clearance of trees/hedgerows.

4.4 Topsoil Stripping

- 4.4.1 The loose tip method, using dump trucks and hydraulic excavators, should be used to strip, transport and stockpile the topsoil.
- 4.4.2 The loose-tipping method involves the use of a tracked hydraulic excavator, fitted with a flat edged grading bucket to strip the topsoil and load it into a dump truck.
- 4.4.3 The dump truck, running along a pre-designated route, then transports the topsoil to the desired stockpile location.

- 4.4.4 This operation should be monitored to ensure that the topsoil is recovered without the inclusion of other soils (subsoil) or wastes. Cross contamination with other soil could significantly degrade the quality of the topsoil.
- 4.4.5 Any stones, waste or non-topsoil materials (>50mm) should be removed from areas to be stripped prior to topsoil stripping.
- 4.4.6 Stripping should ideally be carried out whilst the soil is reasonably dry and friable. However, if due to construction programme constraints topsoil stripping needs to be carried out whilst the topsoil is wet, an alternative method for topsoil stockpiling will be used (Figure 2).

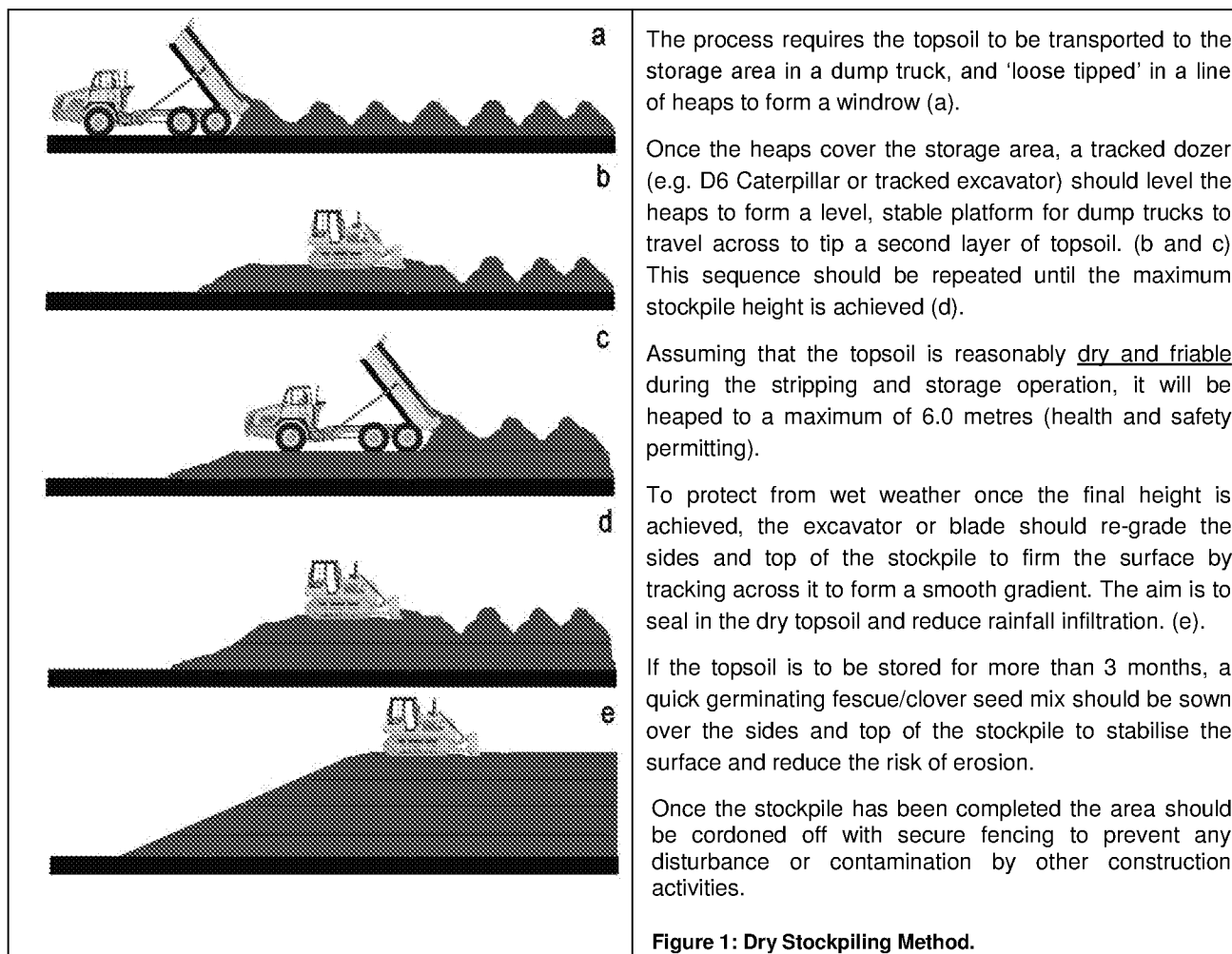
4.5 Depth of Topsoil Strip

- 4.5.1 The depth of strip should be set at **320mm** to enable the majority of the topsoil to be recovered without the inclusion of significant quantities of subsoil.
- 4.5.2 When using an excavator to strip the topsoil, the colour differences between the topsoil and subsoil can be seen by the machine operator carrying out the soil strip so that some discretion can be made.

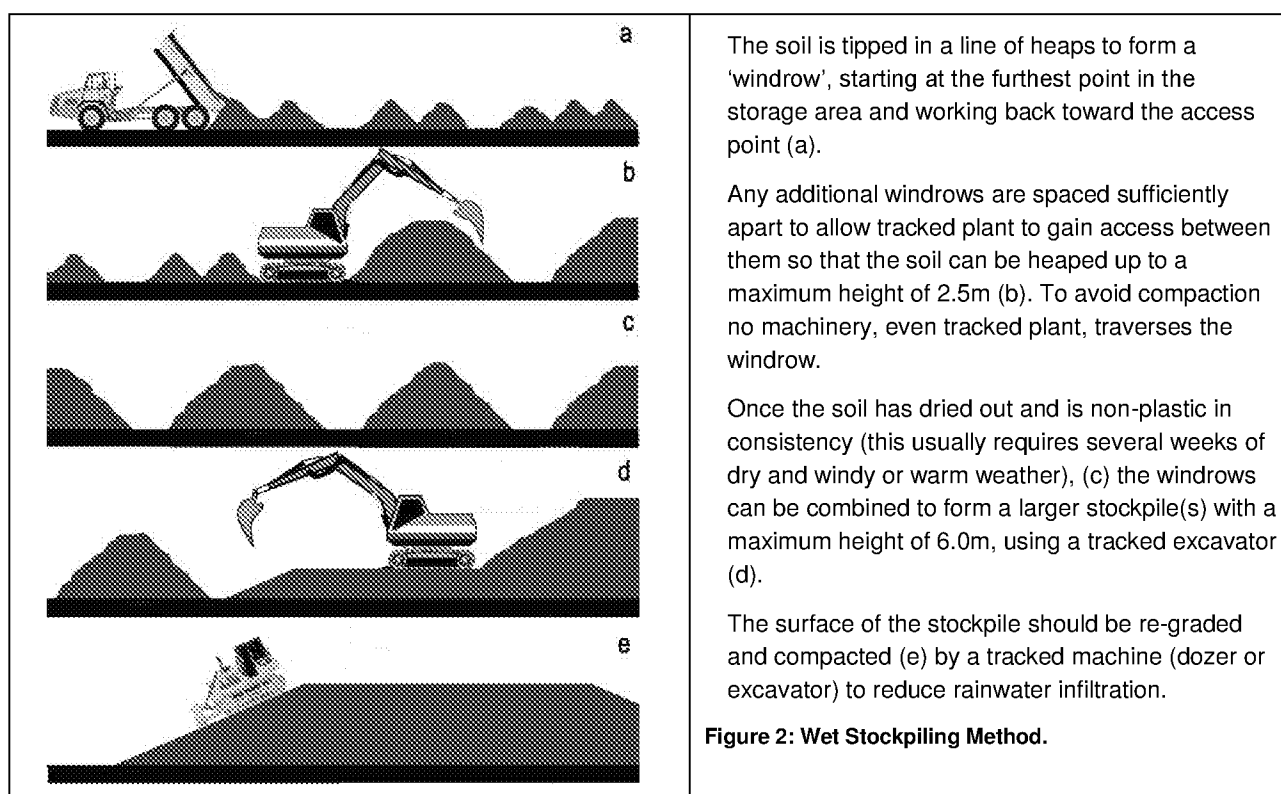
4.6 Topsoil Stockpiling

- 4.6.1 The topsoil should be stockpiled prior to re-spreading into the new landscape areas when they become available.
- 4.6.2 The topsoil should be stored in an area of the site where it will not interfere with other site operations so that it can be left undisturbed during other construction activities. The area that is to be used for storing the topsoil should be cleared of vegetation, in-situ topsoil and any waste arising from the development e.g. building rubble and fill materials.
- 4.6.3 The topsoil should be transported to the storage area in a dump truck and be 'loose tipped' in a series of heaps, starting at the furthest point and working back towards the storage area access.
- 4.6.4 There are two options for stockpiling the topsoil depending on the **moisture content** and **plasticity**. These are referred to here as *dry soil stockpiling* and *wet soil stockpiling*.

4.6.5 The dry stockpiling method is illustrated below (*Figure 1*).



4.6.6 The wet stockpiling method is illustrated below (*Figure 2*); the wet soils are tipped for temporary storage as windrows until the topsoil has dried out. This technique minimises the amount of compaction caused by stockpiling as well as maximising the surface area of the stockpile to enable to soil to dry out. The reconditioning operation would ideally be timed during the summer months (May to September), to allow enough time for the topsoil to dry out effectively.



4.7 Subsoil Depths and Grading

4.7.1 Subsoil should be placed in accordance with the Engineer's requirements and to provide the minimum depths shown in the table below

Landscape Type	Subsoil Depth /mm	Soil Type
Semi-mature tree planting Extra heavy standard tree planting	--	See tree pit design detail
Heavy standard tree planting Standard tree planting	700	Site Subsoil with shallow sand layer to support the rootball
Ornamental planting	300	Site Subsoil
Native planting belts	700	Site Subsoil
Native hedges	700	Site Subsoil
Wildflower meadow	150	Site Subsoil
Amenity grass (low foot traffic and high foot traffic)	150	Site Subsoil

4.7.2 Grade to smooth flowing contours to achieve the desired formation levels and falls and the specified finished levels of topsoil.

4.8 Subsoil Depths and Grading

- 4.8.1 Prior to any subsoil preparation operation, remove any foreign objects (construction related materials), debris, or large stones (>75mm) from the subsoil surface. If not to be re-used on site, these should be removed off-site to a suitably licensed waste recycling facility.
- 4.8.2 It is likely that the subsoil will have been heavily compacted following the construction period. Therefore, the subsoil should be loosened to a depth of at least **400mm at 500mm centres** to break up any panning.
- 4.8.3 For smaller, inaccessible areas (field boundaries, corners of the site, steep slopes or adjacent to roads and pathways), a tracked excavator, fitted with a single tine ripper attachment (ripper tooth) should be used to loosen the subsoil. A toothed bucket is not an acceptable alternative.

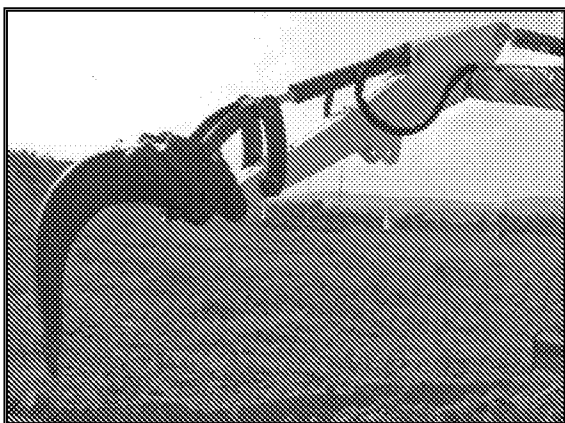


Plate 1: Excavator arm fitted with a Single Tine Ripper Attachment



Plate 2: Single Tine Ripper working

- 4.8.4 On the larger areas a wing-tined subsoiler mounted on either a tracked dozer or large tractor should be used.

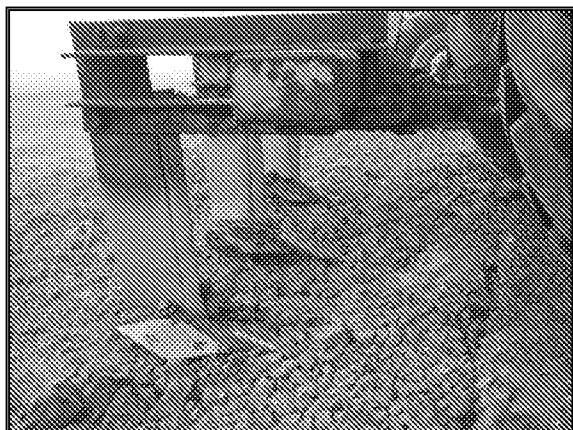


Plate 3 : Wing-tined subsoiler



Plate 4 : Tractor drawn subsoiler

- 4.8.5 Repeated passes may be needed to break up the subsoil sufficiently. This will be largely dependent on the strength of the soil and its resistance to cultivation at the time of the operation.

- 4.8.6 Any large stones and other debris brought to the subsoil surface by this cultivation should be stone picked or raked and removed. The stones (and other debris) should be removed off-site to a suitably licensed waste recycling facility.
- 4.8.7 Any large stones and other debris larger than 75mm brought to the surface during subsoil spreading should be stone picked or raked and removed. The stones should either be re-used on site or they should be removed off-site to a suitably licensed waste facility.

4.9 Topsoil Respreading

- 4.9.1 Prior to topsoil respreading, any existing vegetation should be removed from the surface of the topsoil stockpile(s).
- 4.9.2 A hydraulic excavator fitted with a toothed-bucket should be used to load the topsoil from the stockpile into a dump truck.
- 4.9.3 The topsoil should be respread using the 'peninsular method' (see below and Figure 3).
- 4.9.4 The dump truck should transport the topsoil to the nearest access point to the desired spreading area and loose tip onto the prepared subsoil.
- 4.9.5 A tracked dozer should then push the topsoil out over the subsoil to the required depth.
- 4.9.6 As the dozer pushes the topsoil further out, the dump truck should then loose tip subsequent loads of topsoil at the edge of the respread topsoil. Gradually the respread topsoil will 'fan out' from the original access point, hence the term 'peninsular' used to refer to this method.
- 4.9.7 Both the dump truck and dozer will work on the topsoil layer only.

4.10 Topsoil Depths

- 4.10.1 Topsoil depths (after settlement) should be:

Landscape Type	Topsoil Depth /mm	Soil Type
Semi-mature tree planting Extra heavy standard tree planting	--	See tree pit design detail
Heavy standard tree planting Standard tree planting	300	Site Topsoil
Ornamental planting	300	Site Topsoil
Native planting belts	300	Site Topsoil
Native hedges	300	Site Topsoil
Wildflower meadow	150	Site Topsoil or Site Subsoil
Amenity grass (low foot traffic)	150	Site Topsoil
Amenity grass (high foot traffic)	300	Site Topsoil (sand ameliorated)

4.9.2 If surplus topsoil needs to be re-used on site, the topsoil depths for amenity grass (low foot traffic) could be increased up to a maximum depth of 300mm.

4.10 Decompaction of the Soil Profile (following topsoil placement)

4.10.1 Following topsoil resspreading, the soil profile should be decompacted (ripped) to a minimum depth of 400mm and at 500mm centres using appropriate equipment (see section 4.8 above).

4.11 Topsoil Cultivation

4.11.1 After resspreading topsoil, any large, compacted lumps should be broken down using suitable tillage equipment (e.g. shakerator or power harrow attachment) to break down larger clods and produce a fine tilth suitable for planting (<40mm), turfing and seeding (<10mm).

4.11.2 Small less accessible areas should be cultivated by hydraulic excavator fitted with a landscape rake attachment or similar and approved.



Plate 5: Example of power harrow



Plate 6 : Example of shakerator

4.11.3 Smaller confined areas such as individual planting beds, examples of appropriate equipment to use for this cultivation include *pedestrian rotovator or hand tiller, or a landscape rake attachment*.



Plate 7: Pedestrian rotovator

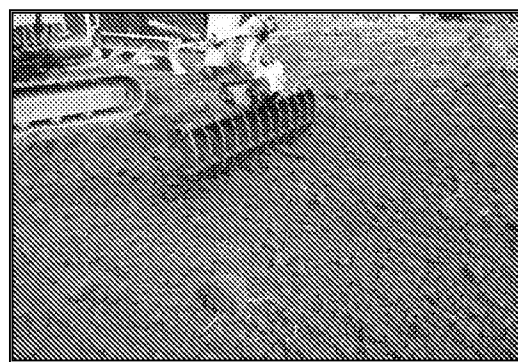


Plate 8 : Example of landscape rake attachment

4.11.4 Within each area, cultivation should begin at the point farthest from the plot access, working backwards. Once the topsoil has been cultivated, **no further machinery should traffic over the soil surface**. Unnecessary foot trafficking must also be minimised.

4.11.5 Any undesirable material brought to the surface during this exercise should be removed by picking or hand raking. For example, fill materials and stones larger than 50mm in any dimension.

4.12 Compost Application for Planting Areas and Wildflower Meadows

- 4.12.1 Where the Topsoil is used for planting purposes a suitable compost (e.g. PAS100:2011 /Landscape Institute/WRAP grade (10mm screened) green compost) should be applied and incorporated into the upper 200mm of topsoil. The compost should be applied at a rate of **15 %**, which roughly equates to a layer 30mm thick.
- 4.12.2 Where Subsoil is used for wildflower meadows a suitable compost (e.g. PAS100:2011 /Landscape Institute/WRAP grade (10mm screened) green compost, or good quality, mature farm manure) should be applied and incorporated into the upper 100mm of subsoil. The compost should be applied at a rate of **10 %**, which roughly equates to a layer 10mm thick.
- 4.12.3 Compost incorporation should be done using suitable and approved tillage equipment. Organic matter should only be incorporated when the soils are dry and friable. This is to enable even incorporation and avoid encouraging the development of anaerobic conditions (oxygen depleted).

4.13 Fertiliser Application for Planting Areas and Amenity Grass

- 4.13.1 To address the nutrient deficiencies and to help promote effective plant establishment, we recommend applying and incorporating the compound, controlled release fertiliser *ICL Osmocote PrePlant* (17%N:9%P₂O₅:10%K₂O:2%MgO+TE) at a rate of 70 g/m² for planting beds and/or 180 g/tree pit, and to a depth of 200mm.
- 4.13.2 To address the nutrient deficiencies and to help promote effective grass establishment, we recommend applying and incorporating the pre-seeding grass fertiliser *ICL Sportsmaster Pre-seeder* (8%N:12%P₂O₅:8%K₂O+3%MgO) prior to seeding or turfing at a rate of 35 g/m² and to a depth of 100mm.

4.14 Sand Amelioration for Amenity Grass (High Foot Traffic)

- 4.14.1 For areas of amenity grass anticipated to receive high level of foot traffic, a 25mm layer of **Washed Sand** (see attached specification in Appendix 1) should be spread over the surface of the topsoil. This should be lightly raked or cultivated into the upper 50mm of topsoil.

4.15 Aftercare

- 4.15.1 Planting work will inevitably cause some surface compaction and panning. Therefore, following ornamental planting the topsoil shall be loosened by spiking between the plants using a hand fork (plate 9 and plate 10). Spiking shall be done to a **depth of 250mm and at 300mm centres**. Operatives shall work back on themselves and not walk over decompacted soil.
- 4.15.2 The spiking operation shall be repeated at least once during the establishment period in order to optimise the soil's physical condition and maintain its soil structure.



Plate 9: Example of spiking with hand fork



Plate 10: Example of spiking with hand fork

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Qualifications

This Soil Resource Plan considers the re-use of the site won topsoil and subsoil for the soft landscape proposals at the Land Off Grevatt's Lane West, West Sussex. It will not therefore be relied on for alternative end-uses or for other schemes. This report has been prepared solely for the benefit of our client Landlinks Estates Limited. No warranty is provided to any third party and no responsibility or liability will be accepted for any loss or damage in the event that this report is relied upon by a third party or is used in circumstances for which it was not originally intended.

Appendix 1

Specification for Washed Sand

WASHED SAND REQUIREMENTS

The *washed sand* that is to be applied to the topsoil prior to turfing should not be a *recycled sand* (not sourced from a soil washing plant or waste transfer station for example).

The washed sand should comply with the following lower and upper limits:

Parameter	Unit	Lower Limit	Upper Limit
Clay & Silt (less than 0.05mm)	%	0	5
Very Fine Sand (0.05 – 0.15mm)	%	0	5
Fine Sand (0.15 – 0.25mm)	%	5	25
Medium Sand (0.25 – 0.50mm)	%	40	75
Coarse Sand (0.50 – 1.0mm)	%	25	45
Very Coarse Sand (1.0 – 2.0mm)	%	0	10
Stones (2-10mm)	%DW	0	10
Stones (>10mm)	%DW	0	0
Calcium Carbonate (expressed as CaCO ₃)	%	0	2.0
pH Value	Unit	5.0	8.5

WASHED SAND TESTING

A representative sample of the proposed *Washed Sand* shall be tested prior to approval by the project Soil Scientist and prior to importation to site.

The following parameters shall be tested (methods in accordance with BS3882:2015 or as indicated):

1. Visual examination to record the presence of any deleterious materials (eg. brick, glass)
2. pH Value (1:2.5 soil/water extract)
3. Particle Size Analysis (clay, silt, 5 sands – ASTM sieve sizes)
4. Stone Content by % weight (>2mm, >10mm)
5. Calcium Carbonate (% - BS7755:3:10:1995)