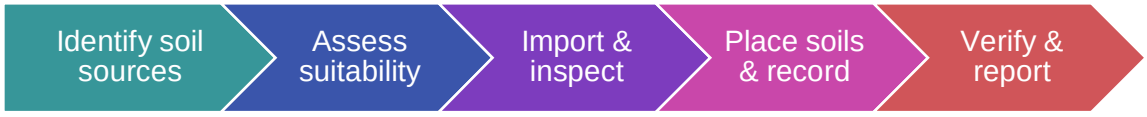
Title	*Details*		
Project	**Finchley Road (O2 Masterplan Site)**		
Report Title	**LCRM: Remediation - imported soil acceptability procedure**		
Prepared by/for	**Pell Frischmann**	*Prepared for*	**LS (Finchley Road) Limited**
Document ref.	**4602_001-PEF-XXX-XXX-RP-GG-600005**		
Date	**26 April 2023**		
Introduction	Pell Frischmann have been commissioned by LS (Finchley Road) Limited ('the client') to provide land contamination risk management (LCRM) services for the proposed Finchley Road development. This report summarises the LCRM '*soil import acceptability*' part of the Remediation Strategy for the proposed development. The Client will need to ensure that the landscape team (design and implementation) comply with relevant aspects of the Remediation Strategy and this soil import acceptability procedure.		
Aims and limitations	This document summarises the soil import acceptability process for assessing topsoil and subsoil suitability with respect to land contamination risk management, including: ➢ Soil import procedure flow chart, ➢ Soil Acceptability Criteria limit values, ➢ Soil sampling frequencies. The contractor will be responsible for identifying appropriate soil sources and ensuring that the imported soils meet the requirements set out in this document. This document is based on soils being imported from a supplier under delivery tickets, therefore End of Waste processes (for example DoWCoP Material Management Plans) are not included.		
Background	This document forms part of the Pell Frischmann *Remediation Strategy (ref. 4602_001-PEF-XXX-XXX-RP-GG-600004, April 2023*). The 'composite clean cover system' remediation includes the need to source, import, place and verify suitable/ clean topsoil and subsoil onsite. Remediation details including objectives, locations and depth of soil are provided in the Remediation Strategy and are not repeated here. In addition, topsoil and subsoil will be imported as part of the above ground soft landscaping design in podium and roof garden areas. These soils will need to be 'suitable for use' to prevent "new contamination" risks from being introduced to the site. Therefore, soil import acceptability criteria (SAC) and appropriate soil import acceptability procedures will also apply to these soils, as outlined in this document.		
Soil import acceptability procedure key steps	Figure 1 summarises the soil import acceptability sequence. **Figure 1 Soil import acceptability sequence** 		
Soil sources	Potential soil sources typically include (in order of likelihood): a. Topsoil/subsoil supplier (including manufactured soil) b. Natural uncontaminated soil (in-situ/unexcavated, at another construction site), c. Natural uncontaminated soils (excavated and stockpiled on another construction site) d. Soil from soil treatment/waste transfer station (stockpiled) The contractor should aim to identify soil that originates from sites with no particular history of potentially contaminative land-uses (e.g. greenfield sites not subject to past contaminative use), that is free from asbestos and where satisfactory information is available to confirm the provenance of the soil. If soils are being sourced from brownfield sites, only the natural soils can be considered and only when the natural soils have been extensively characterised and proven to be clean.		

Title	Details
Assess suitability prior to import	Soil from potential sources will need to undergo suitable sampling, analysis and assessment to characterise the soils and to assess whether the imported soils meet the remediation objectives and are 'suitable for use' (Figure 2). Soils must not be imported to site without an upfront assessment of suitability. **Figure 2 Sampling, analysis and assessment**  The geochemical composition of manufactured soils (a) is likely to be more variable than natural soils (b) and (c). Natural soils from brownfield sites require more detailed assessment compared to natural soils from 'greenfield sites'. Manufactured soils from a soil treatment/waste transfer stations (d) can be highly variable (d). Therefore, higher sampling frequency is recommended for soils sourced from brownfield sites and manufactured soil suppliers.
Soil acceptability criteria	The land contamination risk assessment report included a generic quantitative risk assessment (GQRA) which referenced published generic assessment criteria (GACs) based on the Category 4 Screening Levels (C4SLs) and Suitable 4 Use Levels (S4ULs) published by Defra and Land Quality Management (LQM)/ Chartered Institute of Environmental Health (CIEH) respectively. GACs have been published for several land use scenarios. Potential landscaping/soil placement for the site will be in areas of shared Public Open Space (POS) near to residential properties therefore the GACs for POS_{Resi} have been referenced in the first instance as the basis of Soil Acceptability Criteria for imported soil. Other factors such as soil saturation limits, hazardous properties and topsoil specifications have also been considered. Hence, in some circumstances the specified SAC may be lower than published GAC. Soil Acceptability Criteria (SAC) for the Finchley Road remediation are summarised in Table 3.
Soil screening values (SSV)	Table 3 also includes conservative soil screening values (SSVs) for total polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH) and sum of BTEX (Benzene, Toluene, Ethylbenzene and Xylene) which can be used as part of an initial screening assessment for soil suitability as follows: ➢ where the geochemical results for a soil sample exceed these SSVs the soils should not be considered suitable for use. ➢ Where the SSVs are met the soils can then be assessed in more details against the SAC for the specified speciated PAH, TPH and BTEX components. Where there is any doubt about the suitability of a soil source or individual soil samples, specialist advice should be sought from a suitably experienced land contamination consultant.
Topsoil and subsoil	The overall soil specification is likely to be determined by the landscape team for the development and will include reference to the British Standards BS3882:2015 Specification for Topsoil. BS3882:2015 includes geochemical thresholds for the potentially phytotoxic elements zinc (Zn), copper (Cu) and Nickel (Ni) only, and pH, as summarised in Table 1. **Table 1 BS3882:2015 Table 1 (extract) Potentially phytotoxic elements (by soil pH)** **Substance** / **Threshold concentration (mg/kg)** Soil pH <6.0 / Soil pH 6.0 – 7.0 / Soil pH >7-8.0 Copper, Cu (Nitric acid extractable) <100 / <135 / <200 Nickel, Ni (Nitric acid extractable) <60 / <75 / <110 Zinc, Zn (Nitric acid extractable) <200 / <200 / <300 pH 5.5 – 8.5 pH The thresholds included in BS3882:2015 are intended to ensure soils will not present adverse risks to plants and are not a substitute for SAC which are specified to be protective of human health in the context of land contamination risk assessment or remediation.

<table>
<tr><th>Title</th><th>Details</th></tr>
<tr><td>Soil sources and verification sampling frequency</td><td>Geochemical data for each and any potential topsoil and subsoil source should be reviewed prior to import. It is anticipated that the sample data will be provided by the soil supplier.

If the supplier is unable to provide suitable data, then the contractor will need to arrange for appropriate soil samples to be collected (at source where possible) and analysed. The minimum number of soil samples required are summarised in Table 2.

Table 2 Soil import: sampling and analysis frequency (minimum)
<table>
<tr><th>Sampling type and timing</th><th>Number of samples collected (minimum)</th><th>Samples analysed (minimum)</th></tr>
<tr><td>Potential soil source</td><td>5 (min)</td><td>3 (min)</td></tr>
<tr><td>Verification sampling for imported soils or a preferred soil source</td><td>5 (min) or 1 per 50m^3 *</td><td>3 (min) or 1 per 50m^3 *</td></tr>
<tr><td colspan="3">* whichever frequency is greater</td></tr>
</table>
Once a preferred soil source (or sources) has been identified, additional verification sampling and analysis must be undertaken to ensure compliance with the soil acceptability criteria (SAC) and soil screening values (SSVs).

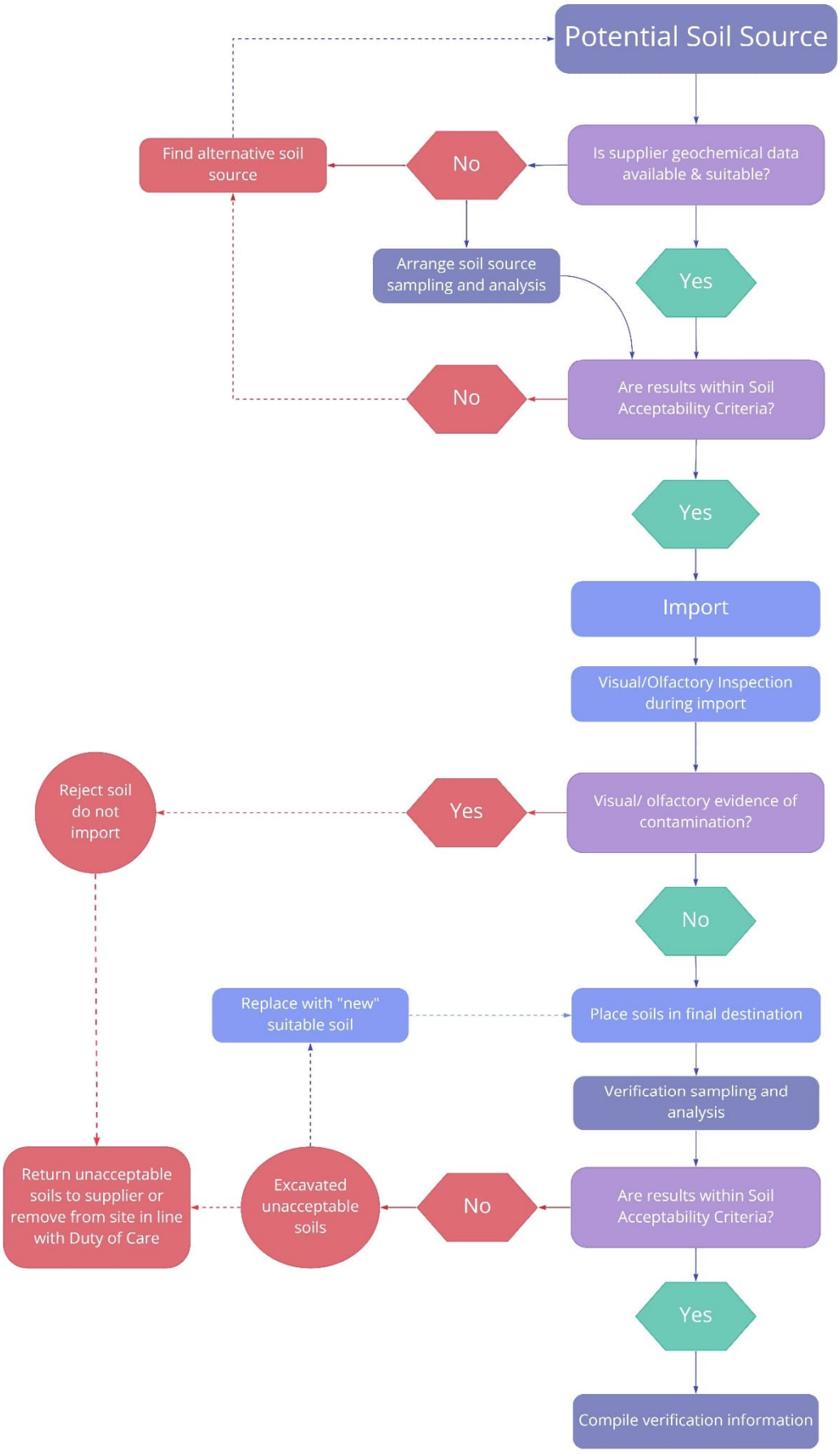
Verification sampling typically takes place once soil has been imported to site. Samples can be collected from stockpiles prior to placement or after the soil has been placed. The Contractor will need to allow sufficient time for sampling, analysis, reporting and assessment.</td></tr>
<tr><td>Inspection</td><td>Visual/olfactory inspection shall be undertaken to screen for the presence of any of the following as imported soil is delivered/unloaded onto site:
1. Black staining
2. Hydrocarbon (fuel/oil type) staining/odours
3. Man-made objects (greater that 10mm diameter)
4. Fibrous materials and/or cement bonded materials
5. Other deleterious materials including refuse, plastic, metal, fabric, tarmacadam etc .

Soils containing any of the should be consider unsuitable and must not be accepted or used onsite. Suitable arrangements will need to be made to reject and return unacceptable soils.</td></tr>
<tr><td>Out of specification materials</td><td>Any ‘out of specification’ material (either by visual inspection or laboratory analysis) must be segregated and removed from site.

Stockpile management must be implemented to ensure that all soils excavated on site are kept separate from imported soils.</td></tr>
<tr><td>Records</td><td>The following records shall be collected and summarised in the remediation Verification Report’:

1. Soil source – site name and location and supplier details (name and address),
2. Pre-import geochemical data,
3. Import – delivery tickets including date and volume,
4. Post import:
a. Photographic records and sample location plans
b. Geochemical laboratory analysis data
c. Soil acceptability screening outcomes
d. Records of any out of specification materials and actions taken to demonstrate that unsuitable soils were removed from site and replaced with suitable soils</td></tr>
</table>

Soil import flow chart



Soil Acceptability Criteria (SAC) and Soil Screening Values (SSVs)

Determinant	Soil Screening Values	Soil Acceptability Criteria
Metals and metalloids	mg/kg	mg/kg
Arsenic		79
Boron (w/s)		21,000
Cadmium		120
Chromium III		1,500
Chromium VI		23
Copper (BS3882:2015)		200
Lead		630
Mercury		16
Nickel (BS3882:2015)		<80 or <110
Selenium		1,100
Vanadium		2,000
Zinc (BS3882:2015)		300
Polycyclic Aromatic Hydrocarbons (PAHs) (USEPA16)		
Total PAHs screening value	≤100	
Benzo(a)anthracene		29
Benzo(a)pyrene		10
Benzo(b)fluoranthene		7.1
Chrysene		57
Dibenz[ah]anthracene		0.57
Indeno[123-cd]pyrene		82
Total Petroleum Hydrocarbons (TPH CWG)		
TPH		999
BTEX		
BTEX soil screen value (SSV)	<6	
Benzene		140
Other		
Asbestos		No asbestos in soils (Not Detected)
pH value		5.5 to 8.5 pH

Note 1. All values represent SAC unless these are listed as screening values

Note 2. The SACs listed for copper, nickel and zinc consider BS3882:2015 which typically specifies lower thresholds (compared to POSresi GAC).

Note 3. All values are in mg/kg unless stated otherwise.

Report Ref.	**4602_001-PEF-XXX-XXX-RP-GG-600005_P01 LCRS Soil Requirements Inc SAC Finchley Road Wip03**
File Path	https://pellf.sharepoint.com/sites/104878/Shared Documents/General/01 - WIP/Documents/GG Geoenv + geotech/01 Reports/05 LCRS/4602_001-PEF-XXX-XXX-RP-GG-600005_P01 LCRS Soil requirements inc SAC Finchley Road wip03.docx

Rev	Suit	Description	Date	Originator	Checker	Approver
P01	S2	Initial issue. S2 Suitable for information	26-Apr-2023	V Ojambati	A Boucher	A Boucher

Ref. reference. Rev revision. Suit suitability.