Stonestreet Green Solar

Environmental Statement
Volume 4: Appendices
Chapter 11: Land Contamination
Appendix 11.4: Revised Conceptual Site Model

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APFP Regulation 5(2)(a)
Planning Act 2008
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Appendix 11.4: Revised Conceptual Site Model

1 INTRODUCTION

1.1 This Revised Conceptual Site Model has been prepared on behalf of EPL 001 Limited ('the Applicant') to summarise the findings of the **ES Volume 4, Appendix 11.2:** Phase I Geoenvironmental and Geotechnical Desk Study **(Doc Ref 5.4)** and the **ES Volume 4, Appendix 11.3:** Ground Investigation Report **(Doc Ref 5.4)** in relation to potential contaminated land risk posed to the Development Consent Order ('DCO') application for Stonestreet Green Solar ('the Project').

1.2 The Project

1.2 The Project comprises the construction, operation, maintenance, and decommissioning of solar photovoltaic ('PV') arrays and energy storage, together with associated infrastructure and an underground cable connection to the existing Sellindge Substation.

1.3 The Project will include a generating station (incorporating solar arrays) with a total capacity exceeding 50 megawatts ('MW'). The agreed grid connection for the Project will allow the export and import of up to 99.9 MW of electricity to the grid. The Project will connect to the existing National Grid Sellindge Substation via a new 132 kilovolt ('kV') substation constructed as part of the Project and cable connection under the Network Rail and High Speed 1 ('HS1') railway.

1.4 The location of the Project is shown on **ES Volume 3, Figure 1.1: Site Location Plan (Doc Ref. 5.3)**. The Project will be located within the Order limits (the land shown on the **Works Plans (Doc Ref. 2.3)** within which the Project can be carried out). The Order limits plan is provided as **ES Volume 3, Figure 1.2: Order Limits (Doc Ref. 5.3)**. Land within the Order limits is known as the 'Site'.

1.3 Purpose

1.5 This Revised Conceptual Site Model is based upon the Initial Conceptual Site Model presented in the **ES Volume 4, Appendix 11.2: Phase I Geoenvironmental and Geotechnical Desk Study (Doc Ref 5.4)** and has been revised following the findings of the intrusive ground investigation works presented in **ES Volume 4, Appendix 11.3: Ground Investigation Report (Doc Ref 5.4)**.

1.6 This Revised Conceptual Site Model forms the basis for the assessment provided in the **ES Volume 2, Chapter 11: Land Contamination (Doc Ref 5.2)**.

1.7 In support of the proposed DCO application, the **ES Volume 4, Appendix 11.2: Phase 1 Geoenvironmental and Geotechnical Desk Study (Doc Ref. 5.4)** was included as part of the EIA Scoping Report (**ES Volume 4, Appendix 1.1 (Doc Ref. 5.4)**). Whilst the Planning Inspectorate agreed that contamination is unlikely to be significant, given there is potential for Made Ground across the Site, further assessment in the form of intrusive ground investigation works was required to confirm the risks were very low to low.

1.8 The primary purpose of the intrusive ground investigation works was to investigate the potential presence of Made Ground beneath the Site identified in the **ES Volume 4, Appendix 11.2**: **Phase 1 Geoenvironmental and Geotechnical Desk Study (Doc Ref. 5.4)** and provide an assessment of the geo-environmental suitability of the ground conditions.

1.9 In the UK, contaminated land is regulated by the planning and development control system and the contaminated land regime set out in Part 2A of the Environmental Protection Act (EPA) 1990[1].

1.10 Environment Agency guidance 'Land Contamination Risk Assessment (LCRM)[2]' provides advice on the approach for the investigation and assessment of contamination on a site. This approach includes the production of a conceptual site model depicting the environmental processes that occur on and in the vicinity of the site and identifying the potential pollution linkages. The assessment of the significance of these pollution linkages can then be carried out through the risk assessment process.

2 GROUND INVESTIGATION WORKS SUMMARY

2.1 The ground investigation works were undertaken between the 15th and 17th February 2023, and comprised the following:

- 5 No. Trial pits (TP) were excavated across the Site excavated to a maximum depth of 2.30 mbgl.
- 11 No. windowless sampler boreholes (WS) were drilled to a maximum depth of 5.00 mbgl.
- 32no. solid soil samples were subject to laboratory chemical analysis. The following suite of laboratory chemical testing was undertaken:
  - Heavy Metals (Arsenic, Boron, Cadmium, Copper, Chromium III, Chromium VI, Lead, Mercury, Nickel, Selenium, and Zinc);
  - Total Organic Carbon (TOC);
  - Soil Organic Matter (SOM);
  - Water Soluble Sulphate;
  - pH;
  - USEPA 16 Polycyclic Aromatic Hydrocarbons (PAH's);
  - Total Petroleum Hydrocarbons (TPH's) (TPH total >C6-C40); and
  - Asbestos identification.

2.2 Human Health

2.2 The significance of the recorded concentrations has been determined through a comparison with published Generic Assessment Criteria (GACs).

2.3 GACs are derived based on generic conceptual site models for a number of land-uses and making generic assumptions about receptor type and behaviour and building and soil properties.

2.4 The land uses included under the GAC include residential development, with and without the consumption of homegrown vegetables, allotments, commercial and industrial, open space and parks and playing fields. The assessment for this development i.e., construction of a solar farm, infrastructure and associated switch & storage rooms, will therefore be undertaken using the values for "Commercial" land use. It is also assumed that the future site users will be involved only in the operation and maintenance and decommissioning of the Site, and there will be no full-time occupation of any Site buildings.

2.5 There is no one source that publishes values for all contaminants and so the following sources have been used in the following order of preference.

Results that are reported lower than the limit of detection have been discounted.

Category 4 Screening Levels (C4SL)

2.6 In March 2014, the Department for Environment, Food and Rural Affairs published six Category 4 Screening Levels within their report *"Development of Category 2 Screening Levels for Assessment of Land Affected by Contamination"*[3]. These GACs are generated using the CLEA model, although the toxicology and exposure parameters have been modified so that the values represent "*a more pragmatic approach to contaminated land risk assessment (albeit still strongly precautionary)*". DEFRA state that the Category 4 Screening Levels will be used as generic screening criteria.

Suitable For Use Levels (S4UL)

2.7 Land Quality Management (LQM) and Chartered Institute of Environmental Health (CIEH) have published Suitable For Use Levels (S4UL's) for 82 substances. These values, contained within the publications "*LQM/CIEH S4ULs for Human Health Risk Assessment*" (2015)[4], replace the previous values contained within "*Generic Assessment Criteria for Human Health Risk Assessment (2nd Edition)*" dated 2009, and reflect the greater knowledge of relevant toxicology and further consideration of exposure scenarios.

2.8 Separate S4UL values have been published for three soil organic matter (SOM) contents (i.e. 1%, 2.5% and 6%). The SOM across the site ranged from 0.1% to 3.9%. Due to the variable nature of the SOM a value of 1% has been chosen for the initial screen as it is the most conservative approach.

Laboratory Chemical Analysis

2.9 The comparison of the results of the solid laboratory chemical testing with the GACs discussed above showed no exceedances against the relevant screening criteria.

Asbestos

2.10 During the ground investigation works, no asbestos or asbestos containing material (ACMs) were recorded.

2.11 Asbestos identification analysis was undertaken on 32no. samples taken from across the Site and asbestos was not detected within any of these samples, therefore the risk from asbestos is considered to be low.

2.12 Prior to any excavation taking place all workers should be informed by a toolbox talk of the potential for ACMs to be present and what to do if encountered. During the construction phase, construction workers shall remain vigilant to the possible risk of encountering isolated areas of contaminated material. Should potentially contaminated material be encountered, works in this area will immediately cease and the procedure set out in the **Outline CEMP (Doc. Ref. 7.8)** will be followed.

2.3 Controlled Waters Risk Assessment

2.13 The Phase I Desk Study (**ES Volume 4, Appendix 11.2 (Doc Ref. 5.4**)) indicates that the Site is predominantly underlain by the Atherfield and Weald Clay Formations, covering approximately 17.3% and 68.3% respectively, which are both classified as Unproductive groundwater aquifers. The Hythe Formation, which constitutes the remaining 14.4% of bedrock geology covering the Site, is classified as a Principal Aquifer; however, no source protection zones, or abstraction licences were identified across or within 250m of the Site. The Alluvium superficial deposits are present across the northern fields of the Site (Fields 25-29) and cover approximately 19.8% of the Site area. The Alluvium deposits are associated with the East Stour River and are classified as a Secondary A aquifer.

2.14 The Ground Investigation Report (**ES Volume 4, Appendix 11.3 (Doc Ref. 5.4**) has proven the near surface deposits are relatively low permeability in nature (clay) which consequently reduces the hydraulic conductivity of potential contaminants present beneath the Site and therefore unlikely to support the infiltration and migration of groundwater. In addition, the results of the solid analysis concluded that there were no exceedances of GACs for commercial land use and this indicates that the reservoir of contaminants present beneath the Site is low.

2.15 Given that the materials tested were first generation material with no definable made ground having been encountered, the low permeability nature of the near surface deposits and the reservoir of contaminants being low, the overall risk to controlled waters is concluded to be low.

2.16 It is recommended that the main area of focus for the protection of controlled waters receptors is through ensuring environmental best practice throughout the lifespan of the Project but primarily during earthworks associated with construction and decommissioning phase works. The use of environmental best practice (e.g control of run off, stockpiling etc.) is detailed in the **Outline CEMP** and **Outline DEMP** (**Doc Ref. 7.8 and Doc Ref. 7.12**).

2.4 Preliminary Ground Gas Risk Assessment

2.17 The records of the environmental monitoring visit undertaken on 6th April 2023 indicate that the majority of the Site would provisionally be classified as Gas Characteristic Situation (CS) 2, as per CIRIA C665[5]. This is due to elevated carbon dioxide concentrations of > 1% v/v (WS01, WS07 and WS09) or gas screening value of greater than 0.07l/hour (WS06). The remaining two monitoring boreholes (WS05 and WS10) were classified as Gas CS1.

2.18 The Project Substation, and Intermediate Substations, are situated in Field 26. This is where WS10 and the Gas CS1 area is located, indicating that any proposed enclosed spaces across the area are unlikely to require ground gas protection measures.

2.19 The development proposed across the areas classified as Gas CS 2 comprise the PV Arrays, Inverter Stations (including BESS), Intermediate Substations, Project Substation and Sellindge Substation Extension.

2.20 As the PV Arrays are in the open-air with no confined areas for the potential accumulation of gases, this therefore removes the pathway for ground gas migration and accumulation.

2.21 All other infrastructure (e.g. Inverter Stations, Intermediate Substations, Project Substation and Sellindge Substation Extension) will be sited on concrete or skid foundations which will help to break the pollutant pathway between ground and containers.

2.22 It is understood that any works during the operational phase involving containerised Inverters, will be undertaken outside of the units in the open air therefore removing the potential for inhalation pathway by human health receptors.

2.23 The BESS, the Intermediate Substations and the Project Substation buildings will have active and/or passive ventilation systems installed thereby removing the potential for ground gas accumulation.

2.24 Additionally, the Project Substation buildings are expected to be raised to allow cable infrastructure to enter from beneath. The void space between the foundations and the Project Substation building will allow for dispersion and prevent potential accumulation of any ground gases.

2.25 It is considered unlikely that the proposed buildings located across the areas provisionally designated as Gas CS 2 would require any additional ground gas protection measures.

2.5 Ecological Receptors

2.26 The results of the solid laboratory chemical testing indicate that the preliminary risk assessment of Very Low to Low for ecological receptors (local fauna and flora) presented in the **ES Volume 4, Appendix 11.2**: **Phase 1 Geoenvironmental and Geotechnical Desk Study (Doc Ref. 5.4)** has been downgraded to Very Low.

REVISED CONCEPTUAL SITE MODEL & QUANTITATIVE RISK ASSESSMENT				
Source	**Pathway**	**Receptor**	**Risk**	**Commentary**
Human Health				
<u>On-Site Sources:</u> • Made Ground • Agricultural land • Historical landfill	• Ingestion of contaminated dust, soils and/or ground water. • Dermal contact with contaminated dust, soil and/or groundwater. • Inhalation of contaminated dust, and/or vapour.	**Human health - Adjacent site users** (Moderate sensitivity receptor) **Human health - Operational and Decommissioning Workers** (Moderate sensitivity receptors)	Consequence: Mild Probability: Unlikely **Risk: Very Low**	No visual or olfactory evidence of contamination associated with the onsite sources was recorded during the ground investigation works. The geochemical testing of collected soil samples identified no metal, organic compound, asbestos, total petroleum, or polycyclic aromatic hydrocarbons in exceedance of human health generic assessment criteria. Therefore, the probability of contamination at the Site can be reduced to unlikely. Additionally, any earthworks activities undertaken across the Site will be progressed in accordance with the environmental best practice set out in the **Outline CEMP** (**Doc Ref. 7.8**), **Outline OMP** (**Doc Ref. 7.11**) and **Outline DEMP** (**Doc Ref. 7.12**) such as dust suppression and PPE for workers.

REVISED CONCEPTUAL SITE MODEL & QUANTITATIVE RISK ASSESSMENT				
Source	**Pathway**	**Receptor**	**Risk**	**Commentary**
		Human health - Construction workers (High receptor sensitivity)	Consequence: Mild Probability: Low Likelihood **Risk: Low**	No visual or olfactory evidence of contamination associated with the onsite sources was recorded during the ground investigation works. The geochemical testing of collected soil samples identified no metal, organic compound, asbestos, total petroleum or polycyclic aromatic hydrocarbons in exceedance of human health generic assessment criteria. Therefore, the probability of contamination at the Site is considered to be low. Any construction works are expected to be undertaken in accordance with the **Outline CEMP** (**Doc Ref. 7.8**) with earthworks activities progressed by suitably qualified workers provided with task-appropriate PPE under safe working procedures to mitigate the contamination risk.

REVISED CONCEPTUAL SITE MODEL & QUANTITATIVE RISK ASSESSMENT				
Source	**Pathway**	**Receptor**	**Risk**	**Commentary**
Off-Site Sources: • Tanks • Waste material • Electrical substation • Historical landfill and waste sites • Railway sidings • Agricultural land and pastureland • Sewage pumping sewage • Infilled ponds • Industrial land use • Historical quarries	• Ingestion of contaminated dust, soils and/or ground water. • Dermal contact with contaminated dust, soil and/or groundwater. • Inhalation of contaminated dust, and/or vapour.	**Human health – Operational and Decommissioning Workers** (Moderate sensitivity receptors)	Consequence: Mild Probability: Unlikely **Risk: Very Low**	No visual or olfactory evidence of contamination associated with the off-site sources was recorded during the ground investigation works. As such the off-site migration of contaminated dust, soils and/or groundwater is considered unlikely. The geochemical testing of collected soil samples identified no metal, organic compound, asbestos, total petroleum or polycyclic aromatic hydrocarbons in exceedance of human health generic assessment criteria.
		Human health – Construction workers (High receptor sensitivity)	Consequence: Mild Probability: Unlikely **Risk: Very Low**	

REVISED CONCEPTUAL SITE MODEL & QUANTITATIVE RISK ASSESSMENT				
Source	**Pathway**	**Receptor**	**Risk**	**Commentary**
<u>On-Site Sources:</u> • Made Ground • Agricultural land • Historical landfill **<u>Off-Site Sources:</u>** • Tanks • Waste material • Electrical substation • Historical landfill and waste sites • Railway sidings • Agricultural land and pastureland • Sewage pumping sewage • Infilled ponds • Industrial land use	• Ground gas generation and migration (Inhalation/Asphyxiation Risk).	**Human health – Operational and Decommissioning Workers** (Moderate sensitivity receptors)	Consequence: Mild Probability: Unlikely **Risk: Very Low**	The ground investigation works have identified the potential ground gas across the Site. A preliminary ground gas risk assessment has designated the majority of the Site as Characteristic Situation 2. The proposed location of the Project Substation (Field 26) was designated as CS1. Associated risks to future operational and decommissioning workers can be mitigated through the use of standard Personal Protection Equipment (PPE) as well as respiratory protection equipment and monitoring equipment for workers entering excavations and trenches, as detailed in the **Outline OMP** (**Doc Ref. 7.11**) and **Outline DEMP** (**Doc Ref. 7.12**). The Project buildings located across CS2 areas, such as Inverter Stations and BESS, are to be sited on concrete foundations with active and or passive ventilation systems that would prevent the migration and accumulation of ground gases within Project buildings.

REVISED CONCEPTUAL SITE MODEL & QUANTITATIVE RISK ASSESSMENT				
Source	**Pathway**	**Receptor**	**Risk**	**Commentary**
		Human health - Construction workers (High receptor sensitivity)	Consequence: Mild Probability: Low Likelihood **Risk: Low**	The ground investigation works have identified the potential ground gas across the Site. A preliminary ground gas risk assessment has designated the majority of the Site as Characteristic Situation 2. The proposed location of the Project Substation (Field 26) was designated as CS1. Associated risks to construction workers can be mitigated through the use of standard Personal Protection Equipment (PPE) as well as respiratory protection equipment and monitoring equipment for workers entering excavations and trenches, as detailed in the **Outline CEMP** (**Doc Ref. 7.8**).

REVISED CONCEPTUAL SITE MODEL & QUANTITATIVE RISK ASSESSMENT				
Source	**Pathway**	**Receptor**	**Risk**	**Commentary**
Controlled Waters				
<u>On-Site Sources:</u> • Agricultural land • Made Ground • Historical landfill • Cable HDD for watercourse crossings	• Vertical migration of contaminated leachate and surface water run-off. • Spills and leakages from plant, machinery & infrastructure during Project construction, operation, and decommissioning	**Groundwater - (Principal bedrock Aquifer)** (Moderate sensitivity receptor)	Consequence: Mild Probability: Low Likelihood **Risk: Low**	The ground investigation works identified relatively low permeability material underlying the Site which reduces the hydraulic conductivity and vertical migration of potential contaminants into the groundwater aquifers beneath the Site. Furthermore, the soil results display no exceedances of contaminants, and groundwater was not recorded within the shallow ground. The horizontal directional drilling to be undertaken to lay the cables beneath the watercourses across the Site will be progressed using best industry practice and guidance in order to avoid the migration of drilling fluids, oil, greases and fuels into the groundwater. This best industry practice is detailed in the **Outline CEMP** (**Doc Ref. 7.8**). Vertical migration of contaminated leachate and surface run-off, and prevention of spillages and leakages will be prevented by ensuring environmental best practice during the construction, operation, and decommissioning phases
		Groundwater - (Secondary A Superficial Aquifers) (Low sensitivity receptor)	Consequence: Minor Probability: Unlikely **Risk: Very Low**	
		Groundwater - (Unproductive Bedrock Aquifers) (Very low sensitivity receptors)	Consequence: Minor Probability: Unlikely **Risk: Very Low**	

REVISED CONCEPTUAL SITE MODEL & QUANTITATIVE RISK ASSESSMENT				
Source	**Pathway**	**Receptor**	**Risk**	**Commentary**
				of the Project. The environmental best practice, safe working method and procedures, and emergency spill plans are set out in the **Outline CEMP** (**Doc Ref. 7.8**), **Outline OMP** (**Doc Ref. 7.11**) and **Outline DEMP** (**Doc Ref. 7.12**).
Surface Water				
<u>On-Site Sources:</u> • Agricultural land • Made Ground • Historical landfill • Cable HDD for watercourse crossings	• Lateral migration of contaminated leachate and surface water run-off. • Spills and leakages from plant, machinery & infrastructure during Project construction, operation, and decommissioning	**Surface Water - (East Stour River)** (Moderate sensitivity receptor)	Consequence: Mild Probability: Low Likelihood **Risk: Low**	No Made Ground deposits or contaminant exceedances were identified within shallow ground during the ground investigation works. The horizontal directional drilling to be undertaken to lay the cables beneath the watercourses at locations across the Site will be progressed using best industry practice and guidance in order to avoid the migration of drilling fluids, oil, greases and fuels into the surface water features. This best industry practice is detailed in the **Outline CEMP** (**Doc Ref. 7.8**). Lateral migration of contaminated leachate and surface run-off, and prevention of spillages and leakages will be prevented by ensuring environmental best practice during the construction,

REVISED CONCEPTUAL SITE MODEL & QUANTITATIVE RISK ASSESSMENT				
Source	**Pathway**	**Receptor**	**Risk**	**Commentary**
				operation, and decommissioning phases of the Project. The environmental best practice, safe working method and procedures, and emergency spill plans are set out in the **Outline CEMP** (**Doc Ref. 7.8**), **Outline OMP** (**Doc Ref. 7.11**) and **Outline DEMP** (**Doc Ref. 7.12**).
Built Environment				
<u>On-Site Sources:</u> • Agricultural land • Made Ground • Historical landfill	• Vertical migration of any gas generated on-Site. • Lateral gas migration through natural strata.	**Built Environment –** **(Project Buildings & Infrastructure)** (Low sensitivity receptor)	Consequence: Minor Probability: Unlikely **Risk: Very Low**	The ground investigation works have identified the potential ground gas across the Site. A preliminary ground gas risk assessment has designated the majority of the Site as Characteristic Situation 2. The proposed location of the Project Substation (Field 26) was designated as CS1. The Project buildings located across CS2 areas such as Inverter Stations and BESS are to be sited on concrete foundations with active and or passive ventilation systems that would prevent the migration and accumulation of ground gases within Project buildings.

REVISED CONCEPTUAL SITE MODEL & QUANTITATIVE RISK ASSESSMENT				
Source	**Pathway**	**Receptor**	**Risk**	**Commentary**
	• Aggressive Ground Conditions • Chemical attack on sub-surface concrete structures	**Built Environment – (Project Buildings & Infrastructure)** (Low sensitivity receptor)	Consequence: Minor Probability: Unlikely **Risk: Very Low**	Construction materials will be of a specification to mitigate the potential for chemical attack to sub-surface concrete structure due to aggressive ground conditions. The use of the specified concrete compositions as detailed in the BRE Special Digest 1[6] for a site designated as ACEC AC-1s will ensure that any sub-surface concrete structures should not be adversely affected by potentially aggressive ground conditions.
Ecosystem				
On-Site Sources: • Made Ground • Agricultural land • Historical landfill	On-Site • Direct uptake from soil. • Plant uptake. Off-Site • Direct & plant via airborne transmission	**Ecosystem – Flora and Fauna** (Very Low receptor sensitivity)	Consequence: Minor Probability: Unlikely **Risk: Very Low**	The findings of the ground investigation indicate no gross contamination of soils across the Site. Therefore, the risk of contamination to flora and fauna onsite is considered very low.

References

[1] HM Government (1990). Environmental Protection Act (EPA) 1990. *Accessed May 2023.* Available at https://www.legislation.gov.uk/ukpga/1990/43

[2] Environment Agency (2020). Land Contamination Risk Management. *Accessed May 2023*. Available at: https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm.

[3] Department for Environment Food and Rural Affairs (2014). Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. *Accessed May 2023*. Available at: https://randd.defra.gov.uk/ProjectDetails?ProjectID=18341

[4] Land Quality Management Ltd, Chartered Institute of Environmental Health (2015). *The LQM/CIEH S4UL's for Human Health Risk Assessment*. Copyright Land Quality Management Limited and reproduced with permission under Publication Number S4UL3056. ISBN 978-0-9931084-0-2. *Accessed May 2023*.

[5] CIRIA (2007). C665 Assessing risks posed by hazardous ground gases to buildings. *Accessed May 2023.*

[6] British Research Establishment (2005). Special Digest 1: Concrete in aggressive ground. *Accessed May 2023*.