Ground Investigation Report

8 Pilgrims Lane
Hampstead
London NW3

Client	Mrs Aboia
Engineer	Brod Wight Architects

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Geotechnical & Environmental Associates

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EXECUTIVE SUMMARY

This executive summary contains an overview of the key findings and conclusions. No reliance should be placed on any part of the executive summary until the whole of the report has been read. Other sections of the report may contain information that puts into context the findings that are summarised in the executive summary.

BRIEF

This report describes the findings of a ground investigation carried out by Geotechnical and Environmental Associates Limited (GEA) on the instructions of Brod Wight Architects, on behalf of Mrs Abiola, with respect to alterations to the existing property, which will include the deepening of the existing basement to accommodate a swimming pool. The purpose of the investigation has been to determine the ground conditions, to investigate the existing foundations and to provide information to assist with the design of suitable foundations and retaining walls for the proposed development. A desk study has previously been carried out by GEA (report ref J10228, dated November 2010), and has been referred to where appropriate.

DESK STUDY FINDINGS

The previous desk study indicated that the site has been occupied by the existing two-storey house with basement since before 1871, the date of the earliest historical OS map studied. The adjacent property to the north (10 Pilgrims Lane) has been demolished and redeveloped on a number of occasions over its history.

GROUND CONDITIONS

The investigation encountered the expected ground conditions in that below a nominal thickness of made ground, the Claygate Member was encountered and is underlain by the London Clay.

The Claygate Member generally comprised firm light brown mottled grey fissured clay with orange-brown silt partings and selenite crystals and was found to extend to a depth of 6.9 m. The London Clay initially comprised firm becoming stiff grey fissured clay with rare pyrite nodules and was proved to the full depth investigated of 19.0 m.

Groundwater was not encountered within Borehole No 1 during drilling, although an overnight standing water level was recorded at a depth of 18.70 m on completion of the borehole. In Borehole No 4 groundwater was encountered during drilling within the Claygate Member at a depth of 1.15 m. A monitoring standpipe was installed at the base of the Claygate Member in Borehole No 1 to a depth of 6.00 m and Borehole No 4 was left open with a temporary cover to facilitate future monitoring. A single monitoring visit undertaken three weeks after installation recorded the water level at a depth of 2.32 m in Borehole No 1 and 1.15 m in Borehole No 4.

The desk study did not indicate any risk of contamination as a result of the site history, and site observations did not indicate the presence of any contamination. Testing for the presence of contamination has not therefore been carried out to date, but may be required in due course to allow the soil removed from the basement to be classified for waste disposal.

RECOMMENDATIONS

The excavation of the basement will result in formation level in the Claygate Member. It may be possible to adopt moderately loaded spread foundations bearing on the Claygate Member, with a net allowable bearing pressure of 120 kN/m² below the level of the proposed basement floor at 4.2 m. Excavations for the proposed basement structure will require temporary support to maintain stability and to prevent any excessive ground movements. The existing foundations will need to be underpinned prior to construction of the proposed basement or will need to be supported by new retaining walls. It is unlikely to be feasible to construct the basement without the requirement for some level of groundwater control and a secant piled wall may therefore be the most appropriate solution.

Part 1: INVESTIGATION REPORT

This section of the report details the objectives of the investigation, the work that has been carried out to meet these objectives and the results of the investigation. Interpretation of the findings is presented in Part 2.

1.0 INTRODUCTION

Geotechnical and Environmental Associates Limited (GEA) have been commissioned by Brod Wight Architects, on behalf of Mrs Abiola to carry out a ground investigation at 8 Pilgrims Lane, Hampstead, London, NW3 1SL. A desk study has previously been carried out at the site by GEA (report ref J10228, dated November 2010) and is referred to in this report as appropriate.

1.1 Proposed Development

It is understood that the current proposal is to lower the existing basement by about 600 mm and construct a new basement approximately 3.0 m deep under the ballroom and patio terrace, with a deepened area in the centre of the new basement to accommodate a swimming pool. This will extend 1.2 m deeper than the rest of the basement, such that the maximum depth of the basement will be 4.2 m. Planning permission has not yet been granted.

This report is specific to the proposed development and the advice herein should be reviewed once the development proposals have been finalised.

1.2 Purpose of Work

The principal technical objectives of the work carried out were as follows:

- to determine the ground conditions and their engineering properties;
- to investigate the existing foundations;
- to provide advice with respect to the design of the basement structure and assess the possible impact of the proposed development on the hydrogeology of the site; and
- to provide advice with respect to the design of suitable foundations and retaining walls.

1.3 Scope of Work

In order to meet the above objectives, the ground investigation comprised, in summary, the following activities:

- a single cable percussion borehole advanced to 19.0 m by means of a standard drilling rig;
- three window sampler boreholes advanced to a depth of 5.0 m
- standard penetration tests (SPTs) carried out at regular intervals in the cable percussion borehole, to provide additional quantitative data on the strength of the soils;

- installation of a standpipe piezometer in the cable percussion borehole and a single groundwater monitoring visit;
- five trial pits excavated by hand to investigate the existing foundations;
- laboratory testing of selected disturbed and undisturbed soil samples for geotechnical purposes; and
- provision of a report presenting and interpreting the above data, together with our advice and recommendations with respect to the proposed development.

1.4 Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the investigation. The results of the work should be viewed in the context of the range of data sources consulted, the number of locations where the ground was sampled and the number of soil, gas or groundwater samples tested; no liability can be accepted for information in other data sources or conditions not revealed by the sampling or testing. Any comments made on the basis of information obtained from the client or other third parties are given in good faith on the assumption that the information is accurate; no independent validation of such information has been made by GEA.

2.0 THE SITE

2.1 Site Description

The site lies to the south of Hampstead Heath and approximately 450 m to the west of Hampstead London Underground station. The site fronts onto Pilgrims Lane to the west and is bordered by adjoining terraced houses to the south. A modern two-storey house borders the site to the north which is linked to No 8 at first floor level, with the first floor extending over the driveway that provides access to the rear garden of the development site at ground floor level. The eastern part of the existing house adjoins Downshire Studios to the east. The site may be additionally located by National Grid Reference (NGR) 526860, 185630.

The site is roughly L-shaped, measuring approximately 40 m by 42 m in maximum dimensions. The site surface slopes down towards the east and is occupied by an existing 19th Century four-storey brick house with a single level basement, positioned in the south of the site. A terrace is present at basement level on the northern side of the house and leads to the rear garden which occupies the northern half of the site and is at approximately 1.2 m below current basement level. The garden consists of central lawn with flower and shrub borders. A birch tree roughly 8 m to10 m high is located approximately 2 m from the wall of the terrace patio.

2.2 Site History

The previous desk study indicated that the site has been occupied by the existing two-storey house with basement since before 1871, the date of the earliest historical OS map studied. The adjacent property to the north (10 Pilgrims Lane) has been demolished and redeveloped on a number of occasions over its history.

2.3 Other Information

The British Geological Survey (BGS) map of the area (Sheet 256) indicates that the site should be underlain by London Clay, although the Claygate Member overlies the London Clay on the higher ground just to the west of the site.

The desk study did not indicate any environmental risks that could affect the site and indicated that the site falls within an area where less than 1% of homes are affected by radon emissions and therefore radon protective measures will not be necessary.

2.4 Preliminary Risk Assessment

The desk study has not identified any potentially contaminative land uses on the site, having been occupied by the existing building for the entirety of its developed history and in a residential area. There is, therefore, assessed to be a VERY LOW to LOW RISK of contamination at this site. Contamination testing did not form part of the brief.

3.0 EXPLORATORY WORK

In order to meet the objectives described in Section 1.2, a single cable percussion borehole was advanced to a depth of 19.0 m by means of a standard drilling rig on the terraced patio area in the rear garden. Standard penetration tests (SPTs) were carried out at regular intervals in the cable percussion borehole to provide additional quantitative data on the strength of soils. This borehole was supplemented by three window sample boreholes, advanced to a maximum depth of 5.0 m in order to provide additional coverage. Disturbed and undisturbed samples were recovered for subsequent laboratory examination and geotechnical testing. A total of five hand dug trial pits was excavated to expose the foundations of the existing building.

The borehole and trial pit records and results of the laboratory testing are enclosed, together with a site plan indicating the borehole and trial pit locations.

3.1 Sampling Strategy

The borehole and trial pit locations were specified by the architects and positioned on site by GEA to provide optimum coverage of the site with due regard to the proposed development whilst avoiding the areas of known services.

A single standpipe piezometer was installed to a depth of 6.0 m in Borehole No 1, in order to facilitate future monitoring and has been monitored on a single occasion, approximately three weeks after installation.

Contamination testing has not been carried out to date, but samples have been retained should this be required.

4.0 GROUND CONDITIONS

The investigation has confirmed the expected ground conditions in that, below a nominal thickness of made ground, the Claygate Member was encountered to a depth of 6.9 m, whereupon London Clay was encountered and proved to the maximum depth of investigation of 19.0 m.

4.1 Made Ground

Beneath a surfacing covering of topsoil or paving slab the made ground was encountered to depths of between 0.5 m and 2.3 m and generally comprised grey clay with fine rootlets, gravel and fragments of brick, mortar and ash.

No visual or olfactory evidence of contamination was noted in the made ground.

4.2 Claygate Member

The Claygate Member generally comprised firm light brown mottled grey fissured clay with orange-brown silt partings and selenite crystals and was found to extend to a depth of 6.9 m in Borehole No 1. The base of this stratum was not reached in Borehole Nos 2, 3 and 4 and the clay extended to the maximum depth of investigation in these boreholes of 5.0 m.

Rootlets were encountered in Borehole Nos 1, 2, 3 and 4 and found to extend to a maximum depth of 4.4 m in Borehole No 1. The clay was noted to be desiccated in Borehole No 3 to a depth of about 4.0 m during site work; this borehole was located on the central grass lawn, 2.0 m from a coniferous tree along the eastern boundary of the rear garden.

Plasticity index tests have indicated the clay to be of medium to high volume change potential.

4.3 London Clay

The London Clay was encountered in Borehole No 1 only and found to comprise firm becoming stiff grey fissured clay with rare pyrite nodules and proved to the full depth investigated of 19.0 m;

Laboratory plasticity index tests have indicated the London Clay to be of high volume change potential.

The results of laboratory triaxial compression tests show a reduction in shear strength with depth, which is considered to be due to sampling disturbance as a result of the sandy and very silty zones within the clay. Greater reliance should therefore be placed on the results of the SPTs.

4.4 Groundwater

Groundwater was not encountered within Borehole No 1 during drilling. Overnight standing water levels were recorded at 18.70 m. In Borehole No 4 groundwater was encountered during drilling within the Claygate Member at a depth of 1.15 m. A standpipe was installed at the base of the Claygate Member to a depth of 6.00 m in Borehole No 1 and Borehole No 4 was left open with a temporary cover to facilitate future monitoring. A single monitoring visit undertaken three weeks after installation recorded the water level at a depth of 2.32 m in Borehole No 1 and 1.15 m in Borehole No 4.

4.5 Existing Foundations

The trial pits encountered what were apparently strip foundations bearing within the clay of the Claygate Member at depths of between 0.84 m and 1.07 m.

Trial Pit Nos 1 and 2, excavated against the external northern wall of the house, encountered three brick corbels on a rubbly base of concrete and brick bearing on firm light brown mottled grey clay at depths of 1.04 m and 1.38 m.

Trial Pit No 3, excavated against the garden wall of No 10, encountered a rubbly base of concrete and brick bearing on firm light brown mottled grey slightly silty clay with gravel and rootlets at a depth of 1.07 m

The 1.2 m high brick retaining wall separating the patio terrace and grass lawn was exposed in Trial Pit No 4 and 5 and was founded on two or three brick corbels on a rubbly base of concrete and brick bearing on firm light brown mottled orange-grey clay at a depth of 0.84 m.

Groundwater was not encountered in any of the trial pits.

The trial pit records and photographs are included in the appendix.

Part 2: DESIGN BASIS REPORT

This section of the report provides an interpretation of the findings detailed in Part 1, in the form of a ground model, and then provides advice and recommendations with respect to the basement excavation and the design of suitable foundations and retaining walls.

5.0 INTRODUCTION

It is understood that the current proposal is to lower the existing basement by about 600 mm and construct a new basement under the ball room which will extend beyond the footprint of the existing building to the edge of the patio terrace. The basement is expected to extend to a maximum depth of 4.2 m. Loads have not been provided to date but are expected to be relatively light.

6.0 GROUND MODEL

The desk study has not identified any potentially contaminative land uses on the site, having been occupied by the existing building for the entirety of its developed history and in a residential area. On the basis of the ground conditions at this site can be characterised as follows:

- beneath a surface covering of paving stone or topsoil, a nominal thickness of made ground is present, overlying the Claygate Member, which in turn is underlain by London Clay;
- the made ground was encountered to depths of between 0.6 m and 2.3 m and generally comprised grey clay with fine rootlets, gravel and fragments of brick, mortar and ash;
- the underlying Claygate Member generally comprised firm light brown mottled grey clay with orange-brown silty partings and selenite crystals and was found to extend to a depth of 6.9 m in Borehole No 1;
- the base of the Claygate Member was not reached in Borehole Nos 2, 3 and 4 and extended to the maximum depth of investigation at these locations of 5.0 m;
- rootlets were encountered within the Claygate Member in Borehole Nos 1, 2, 3 and 4 and found to extend to a maximum depth of 4.4 m in Borehole No 1;
- the Claygate Member was noted to be desiccated to a depth of 4 m in Borehole No 3, located 2 m from a conifer tree to a depth of 4 m;
- the Claygate Member was found to be fissured during laboratory analyses;
- the London Clay was encountered in Borehole No 1 and found to comprise firm becoming stiff grey fissured clay with rare pyrite nodules and proved to the full depth investigated of 19 m;
- groundwater was encountered during drilling within the Claygate Member at a depth of 1.15 m in Borehole No 4;

- groundwater was not encountered within Borehole No 1 during drilling; and
- a single monitoring visit undertaken three weeks after installation recorded the water level at a depth of 2.32 m in Borehole No 1 and 1.15 m in Borehole No 4.

7.0 ADVICE AND RECOMMENDATIONS

Excavations for the proposed basement structure will require temporary support to prevent any excessive ground movements and it is unlikely to be feasible to construct the new basement without some level of groundwater control. The existing foundations will need to be underpinned prior to construction of the proposed new basement, or will need to be supported by new retaining walls.

Formation level for the proposed basement is likely to be within the firm clay of the Claygate Member, which should provide an eminently suitable bearing stratum for spread foundations. However, if significant groundwater inflows are encountered, such that spread foundations become impractical or uneconomic, piled foundations would provide a suitable solution.

7.1 Basement Design

It is understood that it is proposed to lower the existing basement level by 600 mm and construct a new basement to accommodate a swimming pool. This will require excavations of up to 4.2 m deep below existing basement level. Therefore formation level is likely to be within the firm clay of the Claygate Member

Groundwater was encountered at shallow depth during drilling in Borehole No 4, probably from within silt partings of the Claygate Member and monitoring has indicated a groundwater level at a depth of 2.32 m in Borehole No 1 and 1.15 m in Borehole No 4. On this basis groundwater is likely to be encountered within the basement excavation, although further monitoring should be carried out to establish equilibrium levels and the extent of any seasonal fluctuations.

Whilst monitoring should be continued, it is not possible to draw entirely meaningful conclusions from the measurements made in the standpipes, as the level of the water table is not necessarily as significant as the volume of water that may flow into the excavation. The Claygate Member includes layers and pockets of sand and the occurrence of groundwater into the basement will to a large extent be determined by the presence of these more highly permeable materials. Shallow inflows of perched water may also be encountered from within the made ground, particularly within the vicinity of existing foundations. It would therefore be prudent to carry out a number of trial excavations, to depths as close to the full basement depth as possible, to provide an indication of the likely ground water conditions.

The design of basement support in the temporary and permanent conditions needs to take account of the need to maintain the stability of the excavation and surrounding structures and to protect against perched groundwater inflows. The choice of wall may be governed to a large extent by the access restrictions.

A bored pile wall is likely to be the most appropriate method of supporting the basement excavation in the temporary and permanent conditions and could have the advantage of being incorporated into the permanent works and will be able to provide support for structural loads. A secant wall may be required to provide the necessary watertightness; however, on the basis of the monitoring to date, it may be possible to adopt a contiguous bored pile wall, if further monitoring or trial excavations confirm that inflows are unlikely to be significant. It is important to bear in mind that higher inflows may result from the presence of larger and / or inter-connected pockets of water, which may be present within the basement excavation; however, once the piled wall is in place, it may be possible to deal with any areas of higher inflow through localised grouting.

A secant wall may have the advantage of maximising usable space in the basement as it would not require a secondary waterproofing inside the wall, which would be the case with a contiguous bored pile wall.

The ground movements associated with the basement excavation will depend on the method of excavation and support and the overall stiffness of the basement structure in the temporary condition. Thus, a suitable amount of propping will be required to provide the necessary rigidity. In this respect the timing of the provision of support to the wall will have an important effect on movements. Consideration will need to be given to a retention system that maintains the stability at all times of neighbouring properties.

7.1.1 Basement Retaining Walls

The following parameters are suggested for the design of the permanent basement retaining walls.

Stratum	Bulk Density (kg/m^3)	Effective Cohesion (c' – kN/m^2)	Effective Friction Angle (Φ' – degrees)
Made Ground	1700	0	27
Claygate Member	1900	0	25
London Clay	1960	0	25

The investigation has indicated that groundwater is likely to be present within the basement excavation. Reference to Clause 3.4 of BS BS8102:1990 "Protection of Structures Against Water from the Ground" indicates that, for basements that are deeper than 4 m a water table of 1 m below ground level should be adopted.

Reference should also be made to BS 8002:1994 “Code of Practice for Earth Retaining Structures” which states that an obligatory minimum surcharge of 10 kN/m² should be applied to the surface of retained soils in the design of all retaining walls. Additional surcharge loading should be used in the design to take account of incidental loading arising from construction plant, stacking of materials and movement of traffic during construction.

In addition to the design for a surcharge on the perimeter walls consideration should be given during the design stage, to the requirement of an “unplanned excavation” in the front of any retaining wall which should be; not less than 0.5 m and not less than 10% of the total height retained for cantilever walls, or of the height retained below the lowest support level for propped or anchored walls.

7.1.2 Basement Heave

The excavation of the proposed basement is likely to result in heave of the underlying Claygate Member, which will comprise an “immediate” elastic component that may be expected to occur within the construction period, together with long term swelling movement that would theoretically occur over a period of many years. The effects are likely to be mitigated to some extent by the loads applied by the existing and proposed structures. However, a detailed analysis of the likely movements should be carried out once the basement design has been finalised.

7.1.3 Basement Floor Slab

Following the excavation of the basement, it should be possible to adopt a ground bearing floor slab, on the natural soils. It would be prudent to proof roll the stratum, with any soft spots revealed being removed and replaced with suitably compacted granular fill.

A ground bearing slab will need to be suitably reinforced to cope with any movements associated with heave of the underlying clay soils and consideration will also need to be given to the possible requirement to design the basement with respect to a theoretical ground water level 1.0 m below ground level. It may therefore be necessary to incorporate a void below the slab to accommodate these movements. Further consideration will need to be given to these issues once the levels and magnitude of any slab loading are known.

7.2 Spread Foundations

It should be possible to use spread foundations bearing within the firm clay of the Claygate Member below basement level. Moderate width pad or strip foundations bearing on the firm clay at 4.2 m may be designed to apply a net allowable bearing pressure of 120 kN/m^2. This value incorporates an adequate factor of safety against bearing capacity failure and should ensure that settlement remains within normal tolerable limits.

It is unlikely that it will be possible to attain the required depths without encountering groundwater inflows from within silt partings of the Claygate Member and perched water may be present around existing foundations; however this should be possible to deal with any such inflows into foundation excavations through sump pumping. However, further monitoring or trial excavations should be carried out to confirm this as discussed in section 7.1.

The depth of the basement excavation should be such that foundations will be placed below the depth of actual or potential desiccation but this should be checked once the proposals have been finalised.

7.3 Piled Foundations

For the ground conditions at this site, driven or bored piles could be adopted. Driven piles would have the advantage of minimising the spoil that is generated, but the effects of noise and vibrations on neighbouring sites are unlikely to be acceptable. Some form of bored pile may therefore be more appropriate. A conventional rotary augered pile is unlikely to be suitable, as temporary casing would need to be installed into the Claygate Member to protect against groundwater inflows. Therefore, to avoid the requirement for casing, bored piles installed using continuous flight auger (cfa) techniques are likely to be the most appropriate technique.

The following table of ultimate coefficients may be used for the preliminary design of cfa piles, based on the SPT / cohesion depth graph in the appendix. Greater reliance should be placed on the results of the in-situ SPTs as the laboratory test results are not considered to accurately represent the strength of the clay. All depths are shown relative to existing ground floor level.

Ultimate Skin Friction		**kN/m^2**
Made Ground and Claygate Member	GL to 4.2 m	Ignore (basement)
Claygate Member ($\alpha = 0.5$)	4.2 m to 6.9 m	Increasing linearly from 25 to 40
London Clay ($\alpha = 0.5$)	6.9 m to 19.0 m	Increasing linearly from 40 to 95
Ultimate End Bearing		**kN/m^2**
London Clay	14.0 m to 19.0 m	Increasing linearly from 1250 to 1700

In the absence of pile tests, guidance from the London District Surveyors Association[1] (LDSA) suggests that a factor of safety of 2.6 should be applied to the above coefficients in the computation of safe theoretical working loads and that the average ultimate skin friction within the clay should be limited to 110 kN/m^2.

On the basis of the above coefficients and a factor of safety of 2.6 it has been estimated that a 450 mm diameter pile extending 15 m below the proposed 4.2 m deep basement to a depth of 19 m below ground level, should provide a safe working load of about 600 kN, whilst a 450 mm diameter pile extending 10 m below the proposed 4.2 m deep basement, to a depth of 14 m, should provide a safe working load of about 350 kN.

The above examples are not intended to constitute any form of recommendation with regard to pile size or type, but merely serve to illustrate the use of the above coefficients. Specialist piling contractors should be consulted with regard to the design of an appropriate piling scheme and their attention should be drawn to the presence of groundwater inflows within the Claygate Member.

7.4 Shallow Excavations

On the basis of the borehole and trial pit findings it is considered that shallow excavations for foundations and services that extend through the made ground or Claygate Member should remain generally stable in the short term, although some instability may occur. Where personnel are required to enter excavations, a risk assessment should be carried out and temporary lateral support or battering of the excavation sides considered in order to comply with normal safety requirements. Any inflows of ground water into shallow excavations should be suitably controlled by sump pumping.

7.5 Effect of Sulphates

Chemical analyses on samples of the made ground and Claygate Member have revealed low concentrations of soluble sulphate and near-neutral pH, corresponding to Class DS-1 and AC-1s of Table 2 of BRE Special Digest 1 Part C (2005), assuming static groundwater conditions. The guidelines contained in the above digest should be followed in the design of foundation concrete.

1 *LDSA (2009) Foundations No 1 – Guidance notes for the design of straight shafted bored piles in London Clay. LDSA Publications*

7.6 Hydrogeological Assessment

It is understood that the current proposal is to lower the existing basement by about 600 mm and construct a new basement approximately 3.0 m deep under the ballroom which will extend beyond the footprint of the existing building to the edge of the patio terrace. There will be a deepened area in the centre of the basement to accommodate a swimming pool, approximately 1.2 m deeper than the rest of the basement, such that the maximum depth of the basement will be 4.2 m.

The investigation encountered shallow groundwater within the Claygate Member and it is unlikely that the basement will be constructed without some form of groundwater control.

The desk study research that the Claygate Member is a minor aquifer and there is potential for surface runoff to inflow into the basement excavation from the higher ground to the west and as a result water is likely to collect behind any permanent retaining structure. However, the basement construction will only act as a partial barrier to any groundwater flow, because there is space between this and any neighbouring structures. In addition, the basement does not extend into the less permeable London Clay. As such, the potential cut-off of the new basement is unlikely to cause any significant increases in the water level on the upstream side.

The basement and any other construction beneath the groundwater level could theoretically locally deviate the water flow but, given the topography of the area and arrangement of the buildings, it is not considered that this would have any significant influence on the local hydrogeology.

7.7 Contamination Risk Assessment

One of the requirements of the Environment Act (1995) is that local authorities carry out inspections of their area with a view to identifying sites that may be contaminated. When assessing whether a site is contaminated the local authority will attempt to establish the presence of a 'pollution linkage'. A pollution linkage requires there to be a source of contamination, a sensitive receptor that can be adversely affected by the contamination and a pathway via which contamination can reach the target.

The desk study has not indicated that the site has had a contaminative history and no visual or olfactory evidence of contamination was noted during the ground investigation. Contamination testing did not form part of the brief.

7.8 Waste Disposal

Any spoil arising from excavations will need to be disposed of to a licensed tip.

Under the European Waste Directive landfills are classified as accepting inert, non-hazardous or hazardous wastes in accordance with the EU waste Directive. Based upon on the technical guidance provided by the Environment Agency[2] it is considered likely that the made ground from this site, as represented by the four chemical analyses carried out, would be generally classified as a NON-HAZARDOUS waste, whilst the natural soils may be classified as an INERT waste. However, it is recommended that a review should be carried out of the excess spoil that is likely to be generated and that should significant quantities of ash and clinker be encountered within this spoil that further testing be carried out to classify it as being a

2 *Environment Agency 2008. Hazardous Waste: Interpretation of the definition and classification of hazardous waste. Technical Guidance WM2 Version 2.2*

hazardous waste or a non-hazardous waste. WAC leaching tests should then be carried out on any material to be disposed of to landfill that is likely to be classified as being hazardous. Such WAC leaching tests may not be necessary upon samples of natural soils which are to be disposed of as an inert waste as the site may be considered as having had an uncontaminated history.

Under the requirements of the European Waste Directive all waste needs to be pre-treated prior to disposal. The pre-treatment process must be physical, thermal, chemical or biological, including sorting. It must change the characteristics of the waste in order to reduce its volume, hazardous nature, facilitate handling or enhance recovery. The waste producer can carry out the treatment but they will need to provide documentation to prove that this has been carried out. Alternatively, the treatment can be carried out by an approved contractor. The Environment Agency has issued a position paper[3] which states that in certain circumstances, segregation at source may be considered as pre-treatment and thus excavated material may not have to be treated prior to landfilling if the soils can be segregated onsite prior to excavation by sufficiently characterising the soils in-situ prior to excavation.

The above opinion with regard to the classification of the excavated soils is provided for guidance only and should be confirmed by the receiving landfill once the soils to be discarded have been identified. The local waste regulation department of the Environment Agency (EA) should be contacted to obtain details of tips that are licensed to accept the soil represented by the test results. The tips will be able to provide costs for disposing of this material but may require further testing.

3 *Regulatory Position Statement 'Treating non-hazardous waste for landfill - Enforcing the new requirement' Environment Agency 23 Oct 2007*