14 Ground Conditions

14.1 Introduction

This chapter considers the geology and ground conditions along the route of the Proposed Scheme and whether there are contaminated land issues with regard to the development. The potential for adverse ground conditions at the Proposed Scheme are associated with the following:

- Naturally elevated concentrations of arsenic associated with the Northampton Sand Formation;
- Naturally elevated concentrations of radon gas;
- Potential application of sewage sludge to agricultural land at Norwood Farm; and
- Scrap yard at Sandy Lane.

14.2 Assessment Methodology

14.2.1 Approach

The potential for encountering adverse ground conditions along the route of the Proposed Scheme has been considered and assessed in accordance with Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 11 and incorporates the activities which are listed below:

- A detailed Phase 1 geo-environmental desk study following the British Standard BS10175 Investigation of Potentially Contaminated Land. The results of this study are reported in SLRR Geotechnical Report (Halcrow 2006). The desk study covered:
  - Site walkover survey to identify potential contaminative uses;
  - Review of Landmark EnviroCheck Report tailored to the Proposed Scheme with a 600m search radius;
  - Review of geological maps; and
• With respect to statutory designations of geological and geomorphological features which are considered to be of national importance, English Nature recommends consulting the Government’s ‘Multi-agency Geographic Information for the Countryside’ (MAGIC) website. This source was consulted as part of the desk study.

• Consultation with the Northamptonshire Biodiversity Records Centre of the Northamptonshire Wildlife Trust to confirm whether any new non-statutory designated Regionally Important Geological Sites (RIGS) have been designated within the study corridor.

14.2.2

Legislation and Guidelines

The legislative framework governing the definition of contaminated land is contained within Part IIa of the Environmental Protection Act 1990. Contaminated Land is assessed and managed in accordance with the Contaminated Land Report 11 – Model Procedures for the Management of Land Contamination (Environment Agency, 2004).

The importation, disposal, or treatment and reuse of materials in connection with construction of the Proposed Scheme will require detailed consultation with the Environment Agency to establish the requirements in relation to the current Waste Management Regulations. Each material source will need to be checked against an agreed contamination/geotechnical specification to demonstrate its suitability for use.

A site walkover to aid the identification and interpretation of visual and other sensory indicators of the possible presence of contamination along the Proposed Scheme should follow the guidance document CLR 2 (Department of the Environment, 1994).

Any intrusive ground investigation works to confirm the nature of the ground (geotechnical properties and presence of contamination) will need to be designed in accordance with British Standards BS5930 - Code of practice for site investigations and BS10175 – Code of practice for investigation of potentially contaminated sites.

14.2.3

Study Area

The study area comprises of a 600 metre radius of the construction footprint, which includes areas used for permanent land take and that required for temporary land take (for haul roads, construction
compounds, stockpiles etc) and includes areas used for landscaping, ecological mitigation and balancing ponds. This area was considered sufficient for identification of the local geology and ground conditions and relevant potential sources of contamination and sensitive receptors. Consideration is given to the following:

- Do minimum: No Proposed Scheme
- Do something 1: The Proposed Scheme
- Do something 2: The Proposed Scheme and associated development
- Do something 3: The Proposed Scheme and associated development including CVLR and SLIN

14.2.4

Receptors

Soil vulnerability
In the area where the Whitby Mudstone Formation underlies the site (approximately between the A4500 Weedon Road and Norwood Farm barns), the soils are likely to be of low leaching potential. Elsewhere within the study area, the soils are of II Intermediate leaching potential, which can possibly transmit a wide range of pollutants.

Aquifer Classification
The area between the A4500 Weedon Road and the Norwood Farm barns is underlain by a Non Aquifer, consisting of the Whitby Mudstone Formation.

The area between the Norwood Farm barns and where the route of the Proposed Scheme joins the existing Sandy Lane is underlain by a Minor Aquifer, consisting of the Northampton Sand Formation.

The length of the study area where the proposed Sandy Lane Link Road runs along the route of the Sandy Lane is underlain by a Major Aquifer, consisting of the White Limestone Formation.

Construction Materials
The construction materials for the Proposed Scheme are a receptor. Buried concrete and buried services can be affected by aggressive ground conditions.
**Construction workers**

Construction workers would be also potentially at risk from contamination through contact with harmful materials.

**Other potential impacts**

Other potential impacts would be the re-use of spoil on site and disposal of inert materials and other wastes, which are covered in Chapter 15 – Disruption due to Construction.

14.2.5

*Information Sources and Surveys*

A site walkover survey was undertaken by Halcrow in August 2006. The fields between the A4500 Weedon Road and Berrywood Road are used for dairy farming and arable crops (maize and wheat). Two businesses are located at the junction between the existing Sandy Lane and the Proposed Scheme. These are a plant nursery and a scrap yard for the demolition of vehicles. The full site walkover report is contained in the SLRR Geo-environmental Audit (Halcrow 2006).

14.2.6

*Significance Criteria*

There are four possible grounds for determination of Contaminated Land (from Section 78A(2) of the Environmental Protection Act 1990), namely:

(a) significant harm is being caused;
(b) there is a significant possibility of significant harm being caused;
(c) pollution of controlled waters is being caused; and
(d) pollution of controlled waters is likely to be caused.

For the purposes of Part II A, Controlled Waters are considered a “receptor”. In the case of pollution of controlled waters, “significance” of the pollution is not taken into account, i.e. any amount of contamination regardless of whether it is causing, or likely to cause, significant harm is sufficient to determine the land as contaminated land.

A Risk Categorisation (based on DETR, 2000) has been formulated and is presented within the SLRR Geo-environmental Audit (Halcrow 2006).

The assessment of the permanent impacts of the Proposed Scheme is made according to the classification of consequence within Appendix D of the SLRR Phase 1 Geo-Environmental Audit (Halcrow, November 2005) and the significance criteria set out in Table 14.1. DMRB Volume 11, Section 3, Part 11 does not set out significance criteria and therefore, the criteria used in Table 14.1 for consideration of the impact categories
for the ground conditions are based on DMRB Volume 11, Section 3, Part 5, Chapter 4 Visual Impact Assessment Methodology.

**Table 14.1: Significance Criteria for Ground Conditions**

<table>
<thead>
<tr>
<th>Significance Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substantial adverse impact</td>
<td>Where the scheme would cause a severe deterioration to ground conditions</td>
</tr>
<tr>
<td>Moderate adverse impact</td>
<td>Where the scheme would cause a medium deterioration to ground conditions</td>
</tr>
<tr>
<td>Slight adverse impact</td>
<td>Where the scheme would cause a negligible to mild deterioration to ground conditions</td>
</tr>
<tr>
<td>No impact</td>
<td>No significant deterioration or improvement in ground conditions</td>
</tr>
<tr>
<td>Slight beneficial impact</td>
<td>Where the scheme would cause a negligible to mild improvement to ground conditions</td>
</tr>
<tr>
<td>Moderate beneficial impact</td>
<td>Where the scheme would cause a medium improvement to ground conditions</td>
</tr>
<tr>
<td>Substantial beneficial impact</td>
<td>Where the scheme would cause a significant improvement to ground conditions</td>
</tr>
</tbody>
</table>

14.3

**Baseline Conditions**

14.3.1

*Potentially Historical Land Uses*

Surveys undertaken to assess the potential for contaminated land comprised a desk study review of historical Ordnance Survey maps and geological maps. The historical maps were provided by Envirocheck™ from historical Ordnance Survey records and cover the following periods:

- 1889: scale 1:10,560
- 1901: scale 1:10,560
- 1927: scale 1:10,560
- 1938: scale 1:10,560
- 1958: scale 1:10,560
- 1965-1969: scale 1:10,560
- 1990-1993: scale 1:10,000
- 1999: scale 1:10,000
14.3.2 Geology


The geological sequence along the route of the Proposed Scheme consists of relatively flat lying sedimentary rocks (mudstones, silts and limestone). The oldest is in the south and youngest is in the north, namely in order, the Whitby Mudstone Formation, Northampton Sand Formation, Rutland Formation and the white Limestone Formation of the Lower Jurassic Group. Boulder Clay overlies the solid geology within the north of the Proposed Scheme. The stratigraphy is described in detail in the SLRR Geo-environmental Audit (Halcrow 2006)

There are no Regionally Important Geological Sites (RIGS) or Sites of Special Scientific Interest (SSSI) designated for geological or geomorphological reasons in the study area.

14.3.3 Ground Investigation

A geo-environmental ground investigation was carried out in April 2006 along the route of the Proposed Scheme on behalf of English Partnerships, undertaken by Ian Farmer Associates and designed by Halcrow Group Limited. The results are presented in the Factual Report 2984 by Ian Farmer Associates. The general geological succession proven by the ground investigation from youngest to oldest is as follows:

- Topsoil (up to 0.3 m thick): typically described as soft to firm, dark brown slightly gravelly clay; the gravel was fine to medium, angular to rounded, of limestone and ironstone.
- Boulder Clay (up to 3.2m thick): typically described as firm to stiff, orange grey to brown mottled, slightly sandy and gravelly clay; the gravel is fine to coarse, subangular to rounded, of mudstone and limestone.
- Northampton Sand Formation (up to 6.8m thick): medium dense, light yellow to orange silty, fine to medium sand.
- Whitby Mudstone Formation (at least 6.6m thick): typically described as firm to stiff, blue grey mottled brown, closely fissured clay, with rare sand sized gypsum crystals.
The youngest geological sequence in the north of the Proposed Scheme, as shown on Drawing ES 14.1, namely the White Limestone Formation (WLF), Rutland Formation (UE and UEL) and Grantham Formation (GF) where not proven during the ground investigation.

No made ground was encountered during the ground investigation.

14.3.4 Radon Gas

Northamptonshire is an area of sedimentary Jurassic rocks (only ca 200m-years-old). The highest regions of soil radon production are found on Northampton Sand Formation ironstone, Grantham Formation and glacial sand and gravel (Sutherland and Sharman, 1996). The ironstone contains phosphorus (ca 0.7 per cent), which is often associated with uranium, and underneath is a layer of phosphorus-rich pebbles, which contain the highest concentration, up to 55 parts per million, of uranium. The ironstone is also rich in thorium, which generates the shorter half-life isotope of radon, 220Rn. Northamptonshire is classified as a radon affected area, with greater than 1 per cent of domestic dwellings being above the UK Action Level of 200 Bq m⁻³. (Denman and Phillips, 1998).

The soils and geology along the route of the Proposed Scheme contain elevated concentrations of arsenic. This is a naturally occurring phenomenon and is particularly associated with the Northampton Sand Formation, but not exclusively so (Pers. Comm. Northampton Borough Council, 2006).

Hydrogeology is assessed within Chapter 13 - Water Resources.

14.3.5 Chemical Testing

As part of the ground investigation in April 2006 along the route of the Proposed Scheme, 9N° soil samples were tested for total concentrations of a range of toxic metals, pH value, sulphide, sulphate, sulphur and cyanide. In addition, a smaller number of samples were tested for asbestos, hydrocarbons, phenol, pesticides and herbicides. The results and an interpretation are presented in the SLRR Geotechnical Report (Halcrow 2006) and are summarised here.

Results of chemical analyses of soils have been assessed using Defra’s Contaminated Land Exposure Assessment Model (CLEA) for the potential for harm to human health and the environment. The CLEA Model has a number of standard land use scenarios. The road scheme best fits within the scenario for ‘industrial land use’ and therefore the Soil
Guideline Values (SGV) for industrial land use have been used for the assessment of chemicals within the soils.

The review has shown that recorded concentrations of a wide range of contaminants associated with the natural geology and agricultural land use were below published UK SGV or Site Specific Action Criteria (SSAC) as appropriate. The selected SGV and SSAC are contained within the SLRR Geotechnical Report (Halcrow 2006).

It should be noted that the presence of fertilizers within the soils has not been assessed. It is likely that high concentrations of nitrate and phosphate are present within the soils as the land is currently used for agriculture. Field margins at Norwood Farm contained many stinging nettle plants (*Urtica Dioica*) which can be indicative of elevated concentrations of nutrients in the soil.

There are some high concentrations of arsenic within the topsoil. This metal is naturally occurring with the mudstone and Northampton Sand Formation below the site. Some concentrations of arsenic were higher than the CLEA Model Soil Guideline Values for ‘residential land use’ and ‘allotments’. This will impact on the development of the surrounding land development proposals within Northampton’s South Western District Development Area.

14.3.6  
*Potentially Contaminated Land*

Consultation with Northampton Borough Council and South Northampton Council has confirmed that there are no sites within the construction footprint considered to be contaminated land in terms of Part IIa of the Environmental Protection Act 1990.

A scrap yard is located at Sandy Lane, close to the northern section of the Proposed Scheme. The site is operated by T&S Threadgold. Records show that the site has held a licence since 1992 for waste management of end of life vehicles. There is the potential for the spillage of hydrocarbons associated with this activity.

14.3.7  
*Slois*

The underlying Drift Deposits and sedimentary bedrock form the principal soil parent materials along the route of the Proposed Scheme. The soil classification for the region is shown on the Soils of Eastern England Sheet 4, published by the Ordnance Survey, Southampton in 1983.
The southern third of the Proposed Scheme lies on *pelo-stagnogley* soil, seasonally waterlogged, slowly permeable clayey soils which are prominently mottled above 40cm depth. It is a distinct topsoil, found on tills and soft argillaceous rocks. The central third of the Proposed Scheme lies on *ferritic brown earths*, generally well-drained non-alluvial loamy or clayey soils with a weathered calcareous subsoil and are typically greater than 30cm depth. This type of soil covers approximately 40% of the UK and makes good agricultural soils. The northern third of the Proposed Scheme lies on *typical calcareous pelosols*. This is a slowly permeable clayey soil with a calcareous subsurface horizon and no clay enriched subsoil. They crack deeply in dry seasons and have a coarse blocky or prismatic structure.

The agricultural land classification of soils is Grade 3.

### 14.4 Potential impacts

The pollutant linkages and risk assessment are presented in Table ‘Preliminary assessment of risks associated with the site under present site conditions and during future redevelopment’ within the SLRR Geo-environmental Audit (Halcrow 2006). The main pollutant linkages of relevance to the Proposed Scheme are presented in Table 14.2.

<table>
<thead>
<tr>
<th>Source</th>
<th>pathway</th>
<th>receptor</th>
<th>potential significance (risk classification)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxic metals in soils</td>
<td>Direct contact</td>
<td>Site workers and general public</td>
<td>Medium / Low Risk</td>
</tr>
<tr>
<td></td>
<td>Migration of leachate</td>
<td>Groundwater</td>
<td>Medium / Low Risk</td>
</tr>
<tr>
<td>Hydrocarbons in soils</td>
<td>Direct contact</td>
<td>Site workers and general public</td>
<td>Medium / Low Risk</td>
</tr>
<tr>
<td></td>
<td>Migration of leachate</td>
<td>Groundwater</td>
<td>Medium / Low Risk</td>
</tr>
<tr>
<td>Radon gas in soils</td>
<td>Inhalation (in confined spaces only)</td>
<td>Site workers</td>
<td>Medium / Low Risk</td>
</tr>
<tr>
<td>Aggressive ground conditions (adverse pH, sulphate)</td>
<td>Direct contact</td>
<td>Buried concrete</td>
<td>Low Risk</td>
</tr>
<tr>
<td>Source</td>
<td>pathway</td>
<td>receptor</td>
<td>potential significance (risk classification)</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------</td>
<td>-------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Nitrate, Phosphate, Potassium</td>
<td>Migration of leachate</td>
<td>Controlled Waters</td>
<td>Medium / Low Risk</td>
</tr>
<tr>
<td>Pathogens</td>
<td>Direct contact</td>
<td>Site workers and general public</td>
<td>Medium / Low Risk</td>
</tr>
</tbody>
</table>

The locations of areas of potential constraints due to historical and current land uses are presented on Drawing ES 14.2.

The potential geotechnical implications at the site relate to the presence of potential soft alluvial soils which may not be suitable to found upon without ground improvement.

14.4.1 Construction Impacts

The construction footprint would also include a haul road, site compound and stockpile areas and there would be some effects on soil structure in these areas during the construction phase due to compaction, loss of soil structure and erosion. Once haulage routes and stockpile areas are no longer required, restoration would be undertaken to restore the original soil surface and vegetation in accordance with best practice, (Defra, 1998).

14.4.2 Operational Impacts

**Do minimum**

With this option there would be no impact on the ground conditions within the study area, as no development would take place relating to construction works and change to land uses.

**Do something**

Throughout the Proposed Scheme, there would be no beneficial effects to ground conditions.

There would be a potentially adverse impact due to typical soil concentrations of arsenic in the area, associated with the natural geology. Typical concentrations range from 30 mg/kg to 70 mg/kg. However, one record of arsenic within a soil sample from the proposed route of the CVLR to the south of the Proposed Scheme was 360 mg/kg. The UK Soil Guideline Value for arsenic within industrial and commercial sites is 500 mg/kg and any surplus soil excavated from the footprint of the Proposed Scheme can not be reused within areas proposed to be
developed for residential areas, schools and recreation areas without further site specific risk assessment. If surplus soils can not be beneficially reused, disposal at a licensed management facility such as landfill is required. This would be a moderate adverse effect.

The presence of Radon Gas is not considered to be significant considering that there are no dwellings on the Proposed Scheme. The presence of Radon Gas is therefore assessed as neutral.

There are not expected to be any permanent impacts from normal usage of the road on soils or geology. In the event of an accident, there is the potential for contaminative materials such as fuel or materials being transported to affect the surrounding ground through spillage into the drainage system. This would be a moderate to severe adverse effect, depending on the scale of such an incident. In this event restoration of the affected areas would be undertaken as necessary.

Provision of drainage to modern standards along the new sections of highway is likely to lead to a reduction in these risks due to modern design practices. This would be a slight beneficial effect as drainage standards would be higher than currently in place along the existing Sandy Lane.

**Do something 2**

There would be no beneficial effects to ground conditions. The permanent effects will be the same as for do something 1 but in addition, there will be the effects outlined below.

Concentrations of arsenic are likely to be higher than the UK CLEA Model Soil Guideline Values for ‘residential land use’ and ‘allotments’. Where concentrations of arsenic are proven by testing to be higher than 20 mg/kg, a PBET bioavailability test is accepted by the Regulator as showing whether there is the potential for harm to human health. Remediation due to arsenic may be required in areas proposed to be developed as residential areas, schools, allotments and landscaped areas. This would be a moderate adverse effect.

A Landmark Report, concluded that between 3% and 5% of the homes in the Upton Lodge site area will be above the Action Level for Radon Affected Areas, as defined by the Health Protection Agency (former NRPB). As such, protection measures are considered necessary for the construction of new dwellings or extensions.
Do something 3
There would be no beneficial effects to ground conditions. The permanent effects will be the same as for do something 2.

Mitigation Measures


The design and construction of confined spaces within the Proposed Scheme Assessments must be carried out in accordance with the Building Research Establishment Report BR 293 Radon in the workplace.

The principal potential effect of the construction would be the need to remove any contaminated materials. Should contaminating materials be encountered there would be a risk that disturbance would activate or enhance existing pathways for migration of pollutants to occur to the surrounding land, surface waters and groundwaters.

Should areas of contamination be uncovered during construction of the road, the materials would be excavated carefully and stockpiled separately from other arisings within the construction footprint until such time as the nature and composition of the materials has been confirmed.

Any storage of potentially contaminated materials would be within a secure area with contained drainage, provided with an impermeable base to prevent seepage of contaminated water and covered to prevent rainwater mobilising contaminants. Samples of material would be taken and analysed to determine the chemical constituents and an appropriate disposal route chosen. These procedures will be set out in detail in the CEMP and will comply with all appropriate Regulations.

Construction of the road is in itself an industrial process with the potential for contaminating the ground through spillage of materials such as diesel fuel and lubricating oils associated with the construction plant or by construction materials themselves, such as cement and associated products. Risks to the environment arising from these activities would be controlled during construction through careful management. Fuel storage areas would be bunded to prevent uncontrolled leakage from affecting the surrounding land and refuelling activities would be undertaken in such a
way as to prevent spillages from spreading beyond the immediate area. Any fuel or other contaminative materials that are spilled would be immediately cleared and the affected ground excavated and stored safely prior to disposal off site.

The Environment Agency Pollution Prevention Guidelines (PPG) PPG1: General Guide to the Prevention of Pollution, PPG 5: Works in, Near or Liable to Affect Watercourses and PPG6: Working at Demolition & Construction Sites should be referred to for guidance. In particular, precautions must be taken to ensure that the surface water course to the west of the Proposed Scheme and associated springs and ditches are completely protected against pollution, silting and erosion. The measures adopted would not only include contaminants that may affect water quality but also run off from construction roads and surfaces. Surface water drainage would be via soakaway and settlement ponds to prevent fine suspended solids from entering the water course. The CEMP will provide detailed descriptions of any measures required to be taken to mitigate potential adverse effects.

Measures to control erosion must be undertaken in order to retain the agricultural soils and to prevent pollution of the surface waters. This is particularly important during construction but also as part of the design of the road embankments to prevent long term erosion of the road scheme. Suitable planting of landscaping vegetation will mitigate erosion of embankments. The timing of construction works must be considered in order to minimise erosion of the agricultural land.

The handling, storage and preparation of soil must be undertaken in accordance with DMRB Volume 10 Section 1 Part 2 HA 56/92 New Roads Planting, Vegetation and Soils: Chapter 13 Soils. Topsoil along the route of the proposed carriageways and footprints of the embankments, the proposed construction haul road and the proposed site compound must be stripped. The topsoil must be suitably stored and reused for reinstatement of the haul road and the site compound and for reuse as topsoil within landscaped areas of the Proposed Scheme.

Wastes generated during construction would be treated as commercial waste and disposed of accordingly. Waste materials generated would include construction waste (soil, rock, timber, plastic, steel), office waste (paper, plastic), food and sewage wastes. The need for materials for construction works must be carefully considered in order to minimise waste. Reuse or recycling of materials such as soils and wood must be
considered. Disposal of waste materials would be via licensed waste contractors to appropriate disposal sites. Any waste soils generated on site that are suitable would be reused, such as arisings from piling operations, excavated material from levelling of the route and the excavation of balancing ponds. These materials may be suitable for use within the embankments. Waste generated on site would be stored safely in designated areas and in appropriate containers. Portable sanitation facilities would be provided for the construction workforce and all wastes removed via licensed waste contractors to appropriate disposal sites.

Restoration of areas used during the construction of the road would be undertaken to reinstate land to pre-existing condition, as far as reasonably practicable.

A limited volume of construction materials are required to be imported to the site in order to stabilise the existing ground under the Proposed Scheme or to form a capping layer.

The volume of cut is approximately 30,000m³ of which 26,500m³ will be useable. The required fill is approximately 27,500m³ leaving a deficit of approximately 1,000m³ to be imported. If a capping layer is required an additional 15,000m³ of material will need to be imported.

The geotechnical and chemical properties of imported fill material must be suitable for use. Reuse of any excavated material must be undertaken if this material is suitable.

14.6 Residual Impacts

There are naturally high levels of arsenic within the soils along the route of the Proposed Scheme. Where concentrations of arsenic are proven by testing to be higher than 20 mg/kg, a PBET bioavailability test is accepted by the Regulator as showing whether there is the potential for harm to human health. Any surplus soil from the Proposed Scheme may not be suitable for reuse within residential areas, allotments and schools unless bioavailability testing is undertaken as part of a risk assessment.

There are not expected to be any permanent impacts from normal usage of the road on soils or geology. Any pollution incidents which occur during the lifetime of the Proposed Scheme would be controlled as required.
14.7  Summary

The topsoil within the southern third of the Proposed Scheme consists of slowly permeable clayey soils which are seasonally waterlogged. The central third of the Proposed Scheme consists of well-drained non-alluvial loamy or clayey brown earth. The northern third of the Proposed Scheme consists of slowly permeable clayey soil.

The solid geology consists of Jurassic mudstone and limestone. Strata below the site are flat lying. The geology sequence underlying the site is oldest in the south and youngest in the north. The sequence consists of the Whitby Mudstone Formation, the Northampton Sand Formation, Grantham Formation, Rutland Formation and the White Limestone Formation.

The proposed new road alignment is to be constructed across agricultural land and there are no significant areas of waste materials or contaminated land expected to be encountered. There is the potential for migration of hydrocarbons from the end of life vehicle scrap yard at Sandy Lane.

A ground investigation has been undertaken along the route of the Proposed Scheme. A review of the ground conditions is contained within SLRR Geotechnical Report (Halcrow 2006). The review has shown that recorded concentrations of a wide range of contaminants associated with the natural geology and agricultural land use were below published UK Soil Guideline Values (SGV) or Site Specific Action Criteria (SSAC), as appropriate. The surface soils within the construction corridor are considered to be suitable for the Proposed Scheme with respect to the risk to human health and the environment. No remedial works or special precautions are required in respect of contaminants within the soils.

The sub-soils and geology below the construction corridor were found to contain elevated concentrations of naturally occurring arsenic. Soils excavated from the site must not be reused in areas which are likely to be developed for residential land use, allotments or schools unless a bioavailability assessment proves that there would be no harm to human health.

14.8  References

British Standards Institution, (1999) BS5930 Code of practice for site investigations
British Standards Institution, (2001), BS10175 Investigation of potentially contaminated sites - Code of practice

Building Research Establishment, (2001) Special Digest 1 – Concrete in Aggressive Ground


Halcrow Group Limited, (2006), Sandy Lane Relief Road Geoenvironmental Audit

Halcrow Group Limited, (2006), Sandy Lane Relief Road Geotechnical Report

Sutherland, D and Sharman, O., (1996), Geol. Today, p 63.