

**Phase I Geo-Environmental Assessment Report**

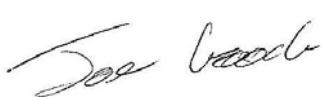
Selwyn Primary School  
Cavendish Road  
Highams Park  
London  
E4 9NG

**Prepared for:**

Mace Group  
155 Moorgate  
London  
EC2M 6XB

**EPS Project:** UK13.1429  
**Report Status** Final  
**Date Issued:** 22<sup>nd</sup> January 2014

**Author:** **Reviewed / Authorised:**



Joe Gooch  
Consultant



Steve Bullock  
Director



**Your specialists on the ground**

7B Caxton House  
Broad Street  
Cambourne  
Cambridge CB23 6JN

**T** +44 (0) 1954 710666  
**F** +44 (0) 1954 710677  
**E** [info@epstrategies.co.uk](mailto:info@epstrategies.co.uk)  
**W** [www.epstrategies.co.uk](http://www.epstrategies.co.uk)



**SELWYN PRIMARY SCHOOL**

**NON TECHNICAL SUMMARY**

This report presents the findings of a Phase I Geo-Environmental Assessment (Desk Study) which was carried out to identify potential contamination from previous or current uses of the site and surrounding area and to provide an initial assessment of geological and geotechnical aspects of the site and how the proposed development or surrounding environment might be affected.

- The site currently comprises a primary school with teaching blocks and asphalt playgrounds. The surrounding land use is predominantly residential with Highams Park and the River Ching located to the South.
- Ground conditions are anticipated to consist of London Clay, with potentially some alluvial deposits towards the southern boundary.
- Historic maps indicate that the site remained undeveloped up until the early 1900's, when the existing school was constructed. Also at this time the surrounding area began to undergo large residential expansion, changing the landscape from rural to urban. During the 1970's and during the 1990's extensions and interconnections have been added between the original three school buildings.
- Plausible contaminant linkages have been identified between made ground materials present on site and current and future site users and workers.
- It is recommended that a number of boreholes be formed to assess the nature and quality of the underlying soils and also to assist in the design of the proposed development.

By its very nature, the above bullet points represent a simplified summary of our work and should not be relied upon to form the basis for key decisions for the proposed development. A full picture is provided in the following report. Alternatively give us a call and we'll talk you through it.

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION.....</b>	<b>1</b>
1.1	Background.....	1
1.2	Objectives .....	1
1.3	Limitations and Constraints .....	2
<b>2</b>	<b>GEO-ENVIRONMENTAL SETTING .....</b>	<b>3</b>
2.1	Site Location and Description.....	3
2.2	Geology and Geological Hazards .....	3
2.3	Regional Hydrogeology .....	4
2.4	Regional Hydrology .....	4
2.5	Flood Risk .....	4
2.6	Environmentally Sensitive Areas .....	4
2.7	Landfill Sites & Sources of Industrial Pollution .....	4
2.8	Industrial Sites .....	5
2.9	Site History.....	5
2.10	Unexploded Ordnance .....	5
<b>3</b>	<b>ENVIRONMENTAL CONCEPTUAL MODEL.....</b>	<b>6</b>
3.1	Source Characterisation .....	6
3.2	Potential Receptors .....	6
3.3	Potential Pathways .....	7
3.4	Summary of Contaminant linkages.....	8
<b>4</b>	<b>GEOTECHNICAL APPRAISAL .....</b>	<b>10</b>
4.1	Conceptual Geotechnical Ground Model.....	10
<b>5</b>	<b>CONCLUSIONS &amp; RECOMMENDATIONS .....</b>	<b>11</b>

### Figures

Figure 1	Site Location Plan
Figure 2	Current Site Layout Plan
Figure 3	Aerial Photograph
Figure 4	Site Context – CLR 11

### Appendices

Appendix A	Selected Site Photographs
Appendix B	Surrounding Land Use
Appendix C	Geological Context
Appendix D	Groundwater Vulnerability Map and Flood Map
Appendix E	Selection of Historic Maps
Appendix F	Unexploded Ordnance Report



## 1 INTRODUCTION

In December 2013, Environmental Protection Strategies Ltd (EPS) was commissioned by Mace Group to complete a Phase I Geo-Environmental Assessment (Desk Study) at Selwyn Primary School, Cavendish Road, Highams Park, London, E4 9NG (the 'site'); see Figure 1.

This report presents the findings, conclusions, and recommendations of the Phase I Investigation undertaken for the site as instructed.

### 1.1 Background

A Phase 1 Investigation comprises the first stage of the ground investigation process. The purpose of this is to determine what potentially contaminative activities may have occurred at the property or the surrounding area which may pose a risk to site users or the surrounding environment, either at present or in the future as well as assessing geological and geotechnical hazards.

The method used in this investigation to assess the environmental risk posed is based on the concept of 'contaminant linkage', which considers the following three factors:

<b>Source</b>	The location from which an environmentally hazardous / contaminative substance is (or was) derived.
<b>Receptor</b>	An environmentally sensitive object or condition e.g. person, property, controlled water, or ecological system, which may be present now or in future.
<b>Pathway</b>	A route or mechanism via which a source could come into contact with a receptor to cause significant harm.

If all three factors are identified, there is the potential for a 'contaminant linkage' to be active, which could result in significant harm being caused to the environment or human health.

### 1.2 Objectives

The purpose of this Phase 1 Investigation is to evaluate the potential contaminant linkages that may be active at the site in its current condition, or could become active in future and to determine if any action is required to investigate them further or to break them.

This is achieved by carrying out the following activities:

- a) Examining the site history - late 1800s to present day through review of historical maps of the area, site records, records held by relevant local authorities, the Environment Agency and review of other information databases.
- b) Characterising the site's sensitivity through examination of existing geological, hydrogeological, topographical, and historical maps and aerial photographs of the area.
- c) Identifying Potential Areas of Concern (PAOCs) through a combination of historical map and data review and site inspection together with interview of key site personnel.
- d) Consideration of any future plans for the site and the effects that proposed changes may have on contaminant linkages and geology over time.
- e) Development of a site conceptual model and contaminant linkage assessment.



### **1.3 Limitations and Constraints**

The purpose of this report is to present the findings of a Phase I Ground Investigation conducted at the location(s) specified. When examining the data collected from the investigations made during the assessment, EPS makes the following statements.

If third parties have been contracted / consulted during compilation of this report, the validity of any data they may have supplied, and which are included in the report, have been assessed as far as possible by EPS. However, EPS cannot guarantee the validity of these data.

No visible evidence of Japanese Knotweed was identified during the site walkover however this plant can be difficult to identify in the early stages of growth and therefore it is not always possible to identify its presence at certain times of the year. For this reason EPS cannot confirm that Japanese Knotweed rhizomes do not exist and it is recommended that if it is suspected that this species, or other similarly invasive plants are present at the site, a specialist contractor should be commissioned to make a detailed assessment.

The report has been prepared for the client(s) listed on the report title page. EPS accepts no liability or responsibility for use of, or reliance upon, this report and or the information contained within it by third parties.

No part of this report, or references to it, may be included in published documents of any kind without approval from EPS.

This report and its contents, together with any supporting correspondence or other documentation, remain the property of Environmental Protection Strategies Ltd until paid for in full.

## 2 GEO-ENVIRONMENTAL SETTING

The following section provides a summary of the information collected in relation to the site location and history.

### 2.1 Site Location and Description

The site is located to the north of Cavendish Road, to the south and east of Selwyn Avenue and to the west of Haldan Road. The school grounds are roughly rectangular in shape, with dimensions of around 160m (north to south) and 60m (east to west) covering an area of approximately 9600m<sup>2</sup>. It lies at an approximate elevation of 21m above ordnance datum (AOD) with the surrounding area being generally flat in nature. To the south western corner of the site is a small area of undeveloped land, containing mature vegetation. It is understood that this is also an area of the overall school site, although it is not known whether development is considered for this area.

Metal fencing surrounds the school, with the main buildings occupying north eastern, north western and central southern areas, with hard play areas and associated play equipment located between them. The existing structures are generally single storey in height with pitched roofs. Helwys Court along with the area of undeveloped land lies beyond the western boundary of the school, with residential properties and their associated gardens lying to the south, north and east.

A plan showing the site location is provided as Figure 1, a current site layout plan is included as Figure 2 and an aerial photograph is included as Figure 3. Selected site photographs are included as Appendix A and relevant extracts of a Landmark Envirocheck report are included as Appendix B.

### 2.2 Geology and Geological Hazards

Geological maps of the area (British Geological Survey 1:50,000 series, Sheet 256 – North London - Solid and Drift Edition) indicate a bedrock geology of London Clay Formation materials from the Eocene epoch to outcrop beneath the site. Superficial deposits of Alluvium (clay, silt, sand and gravel) from the Flandrian epoch are shown to outcrop along the southern boundary.

Hazard	On site Risk
Mining	None
Collapsible Ground	Very Low
Compressible Ground	Very Low
Ground Dissolution	None
Running Sand	Very Low
Landslide	Very Low
Shrinking/Swelling Clay	Moderate

The BGS and Health Protection Agency (HPA) report entitled 'Indicative Atlas of Radon in England and Wales' (November 2007) shows the site to lie within a 1km grid section where the percentage of homes above the radon action level is between 0% and 1%. The joint Building Research Establishment Ltd (BRE) report entitled 'Radon: Guidance on Protective Measures for New Buildings - 2007' reports that the site does not lie within an area where basic construction protection methods will need to be employed.

The site's geological context is presented as Appendix C.

### **2.3 Regional Hydrogeology**

The Environment Agency (EA) groundwater vulnerability map of the area shows the London Clay beneath the site as unproductive strata.

The site does not lie within a Groundwater Source Protection Zone.

The Envirocheck report indicates one groundwater abstraction within 1km. This is located approximately 375m south west and relates to large garden watering at the Walthamstow Stadium.

Groundwater vulnerability maps are included as Appendix D.

### **2.4 Regional Hydrology**

The nearest surface water feature is listed as being approximately 35m south west and most likely refers to the presence of The River Ching river which is in the vicinity and runs south of the school site.

Ten discharge consents are listed within 1km, the closest of which is located approximately 300m east and relates to treated sewage discharge and storm overflow discharge into Ching Brook.

### **2.5 Flood Risk**

Review of the EA flood zone map for the area indicates that the site lies within flood zone 1 as defined within Table 1 of technical guidance to the National Planning Policy Framework (NPPF) which is the area with the lowest potential risk of flooding from fluvial or tidal sources. The area to the immediate south of the site where the River Ching is located is listed as flood zone 3, the area with the highest potential risk of flooding.

It should be noted that the EA maps do not take into account flooding from other potential sources of flood water, such as from poor drainage, or groundwater.

### **2.6 Environmentally Sensitive Areas**

Sites of special scientific interest are located approximately 1km east and 2km west, with areas of adopted green belt also found in these locations. A local nature reserve lies approximately 500m north and the site itself is listed as being within a nitrate vulnerable zone.

### **2.7 Landfill Sites & Sources of Industrial Pollution**

No historic landfill sites are listed within 1km.

Eleven pollution incidents to controlled waters have been reported within 1km. Only one is within 250m of the site and is listed as a category 3 minor incident. The pollutant which was involved in this incident is listed as oils.

## 2.8 Industrial Sites

The Envirocheck Report lists 150 industrial land uses within a 1km search radius, relating to a range of industries. The closest of these relate to a damp and dry rot control company 20m south east, a washing machine servicing and repairs company 75m west and a equipment manufacturer 155m east.

Active fuel stations are recorded approximately 415m north east, 690m west, 780m west and 900m north west of the school site. Now obsolete fuel stations are recorded 885m north west and 950m west.

## 2.9 Site History

As part of this investigation, a search of historical maps dating back to 1864 was undertaken in order to determine previous land uses on site and in the surrounding area. A summary of historical map data from 1864 to 2013 is provided below and copies of relevant historic maps and any others examined during the investigation are included in this report as Appendix E.

EPS has examined the maps provided and has identified the following key features:

- Early mapping from 1865 shows the site to be undeveloped rural land, comprising a number of segmented fields which border the River Ching. The site is seen to remain in this condition up until the late 1890's and early 1900's. At this time London and its surrounding boroughs begin to rapidly expand. By 1919 available maps show three school buildings present on site in the locations which they are found today. At this time the three builds are shown to be separate, with no interconnections between them. By the 1970's an interconnection between the southern and north western school building is visible, with a further extension attached to the east of the southern school building visible on site by 1991.
- The land use in the surrounding area is seen to change dramatically over time. From the early 1900's to the present day the surrounding area moves from a rural setting to become a large residential area. Over time however areas of undeveloped land have remained within the close vicinity. Highams Park has remained to the south of the school site, with multiple sports pitches and recreational areas present. Walthamstow forest is within 1km east, with Ainslie and Larks Woods within 1km north. Further to the east more large recreational areas have remained present, with the Banbury Reservoir beyond.

## 2.10 Unexploded Ordnance

As part of this investigation an initial unexploded ordnance (UXO) risk assessment has also been performed.

This has been provided by 6 Alpha Associates Limited and indicates that a primary bombing target was located within close proximity to the site with a high explosive bomb strike recorded in the sites immediate vicinity. The area is therefore considered to have a moderate risk of the presence of UXO's and a further more detailed risk assessment has been recommended.

The UXO risk assessment is presented in Appendix F.





### 3 ENVIRONMENTAL CONCEPTUAL MODEL

The following section provides a review of the contaminant linkages that may be active at the site through examination of the potential sources that may be present as a result of historic and/or current site activities and where potential interaction between these sources and the identified human / environmental receptors may occur.

#### 3.1 Source Characterisation

The following potential contaminant sources have been identified at the site and in the surrounding area:

Potential Source	Source Description	Principal Contaminants of Concern
Historic Site Use	Made ground associated with landscaping and construction of current buildings	PAH, Metals

Notes: PAH Polycyclic Aromatic Hydrocarbons

#### 3.2 Potential Receptors

A framework for the assessment of risks arising from the presence of contamination in soils has been produced by the Environment Agency and the Department for the Environment, Food and Rural Affairs (DEFRA) and is presented with the report ‘Using Science to Create A Better Place: Updated Technical Background to the CLEA Model – Science Report SC050021/SR3’. This guidance document defines a series of standard land-uses, which form a basis for the development of a Conceptual Site Model.

The preliminary proposed development plan for the site currently includes the construction of a new school building. This proposed future land use, as defined within Science Report SC050021/SR3, has been considered as:

- Commercial

It is understood that the development scheme for this site is under constant review and is subject to future amendment. Therefore, any developments that lead to a change of use for the site will require revisions to be made to the site conceptual model developed; dictated by the technical guidance previously outlined. In view of the environmental setting, current and potential future land use of the site and surrounding sites, the potential receptors for contaminant impact are discussed below:



<b>Receptor</b>	<b>Site Specific Description</b>
<b>Human</b>	Future site users, site workers involved in the site redevelopment and those working and living in the surrounding area have the potential to be at risk from exposure to potential contaminants of concern (CoCs).
<b>Groundwater</b>	The site is reported to lie on unproductive aquifer and therefore groundwater is not considered to be a sensitive receptor.
<b>Flora and Fauna</b>	Some of the identified contaminants of concern are known to be phytotoxic and as such the potential for this impact should be considered.
<b>Buildings &amp; Infrastructure</b>	Subsurface structures are likely to be present at the site that may be adversely affected by the potential presence of the identified contaminants of concern. These include concrete used in building foundations, buried potable water supply pipes, and other service lines and pipes.
<b>Adjacent Land</b>	Surrounding residential properties with domestic garden areas could be a potential receptor to contaminants of concern. However, the contaminants of concern identified are not considered to be particularly environmentally mobile and low permeability cohesive soils are anticipated close to the surface and therefore adjacent land is not considered to be at risk from site derived contaminants.

### 3.3 Potential Pathways

Where contaminants may be present in soil, there are a number of potential pathways that enable human receptors to come into contact with or be exposed to them. The most direct pathways, considered under current UK legislation, can be summarised as follows:

- Direct ingestion of contaminated soil
- Ingestion of household dust
- Ingestion of contaminated vegetables
- Ingestion of soil attached to vegetables
- Dermal contact with contaminated soil
- Dermal contact with household dust
- Inhalation of fugitive soil dust
- Inhalation of fugitive household dust
- Inhalation of vapours outside
- Inhalation of vapours inside

Clearly, not all of these potential pathways apply for every standard land-use; the simplest example for exclusions being a commercial / industrial site which is covered by concrete hardstanding. The concrete precludes the direct exposure of humans working at the site to contaminated soils.

However in addition to direct exposure pathways, a number of physical transport mechanisms / pathways may also exist at a site that allow remote or less accessible contaminants in soil or groundwater to reach human or environmental receptors both at a site and beyond the site boundary. These include the following:

- Downward and lateral movement of contaminants in soil either by gravity or through being 'leached' by percolating rainwater
- Lateral migration of contaminants dissolved in groundwater.
- Direct seepage or leaching of contaminants from soil into subsurface drains or supply pipework.
- Volatilisation of contaminants from groundwater or unsaturated soils into buildings or outdoor air.

Through examination of the standard land use and environmental setting at each site, the presence of pathways and transport mechanisms described above must be considered when assessing whether a contaminant linkage may plausibly be active, and therefore be included in the conceptual site model.

### 3.4 Summary of Contaminant linkages

Considering the site use and environmental setting, and proposed land use, the following plausible contaminant linkages have been identified through this phase I assessment and require further investigation.

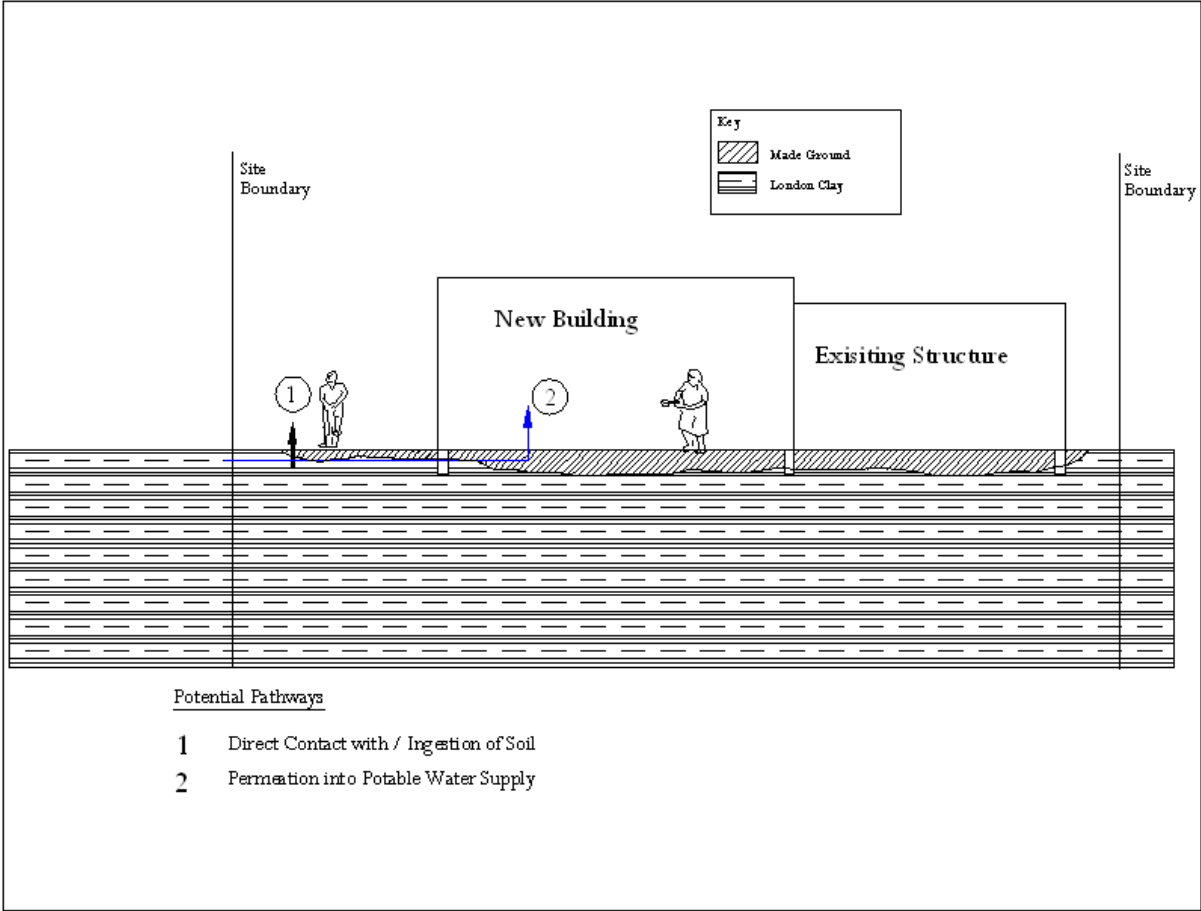
Source	Pathway	Receptor
Contaminated soil	Ingestion of soil through direct contact and inhalation of fugitive dusts	Site users
Contaminated soil	Ingestion of soil through direct contact, inhalation of fugitive dusts, eating or smoking with dirty hands.	Construction workers during redevelopment
Contaminated soil	Ingress / diffusion through permeable potable water supply pipes.	Site users

The following comments are made with respect to contaminant linkages which have been considered through development of the conceptual model, but have not been concluded as 'plausible' – i.e. through which a significant possibility of significant harm could occur to an identified receptor:

- Whilst active petrol stations have been identified in the area, they are not within 250m of the school and given this distance the presence of infrastructure between them and the site and the presence of low permeability clay soils, they are not considered to pose a risk to future development of the site.

The following diagram provides an illustration of the plausible contaminant linkages that may be active at the site and which may need further investigation or control to ensure safe development:

**Illustrative Environmental Conceptual Site Model**



## 4 GEOTECHNICAL APPRAISAL

Geological records indicate the ground conditions to comprise sands and gravels underlain by London Clay.

### 4.1 Conceptual Geotechnical Ground Model

A conceptual geotechnical ground model is provided in the table below which assesses potential design elements, anticipated strata and ground conditions:

Element	Anticipated Strata	Parameter(s)	Anticipated Conditions
Foundations	Made Ground	Allowable Bearing Pressure	Not appropriate as bearing strata
		Settlement	High Sensitivity
		Volume Change	Depends upon the soil composition
	London Clay Formation	Allowable Bearing Pressure	75kN/m <sup>2</sup> to 150kN/ m <sup>2</sup>
		Settlement	Moderate sensitivity to loading
		Volume Change	High volume change potential
Drainage	Made Ground	Permeability	Not suitable for infiltration drainage
	London Clay Formation		Not suitable for infiltration drainage
Pavement Construction	Made Ground	CBR Value	2% to 3% depending on characteristics of strata encountered
Concrete Grade	Made Ground	Grade	Low to Moderate risks of high sulphate levels
	London Clay Formation		Moderate to High risk of high sulphate levels

## 5 CONCLUSIONS & RECOMMENDATIONS

By consideration of the history and environmental setting, this Phase I investigation has identified plausible contaminant linkages associated with likely made ground materials on site, which will need to be further assessed.

The site is currently a primary school comprising classroom buildings and asphalt playground.

In accordance with the Model Procedures for Management of Land Contamination (Contaminated Land Report 11) the risks identified by this work will require further assessment in order to determine the most appropriate action for this site. A summary of the approach outlined in CLR11, marking the work already completed under the risk assessment phase, is presented as a flow diagram in Figure 4 of this report.

Contaminant linkages have been identified which could affect future site users. It is therefore recommended that to comply with the likely requirements of the regulatory bodies, a number of boreholes be drilled in order to assess the nature and quality of the shallow soils across site. This will help ascertain whether there is any risk associated with any made ground beneath the proposed new buildings.

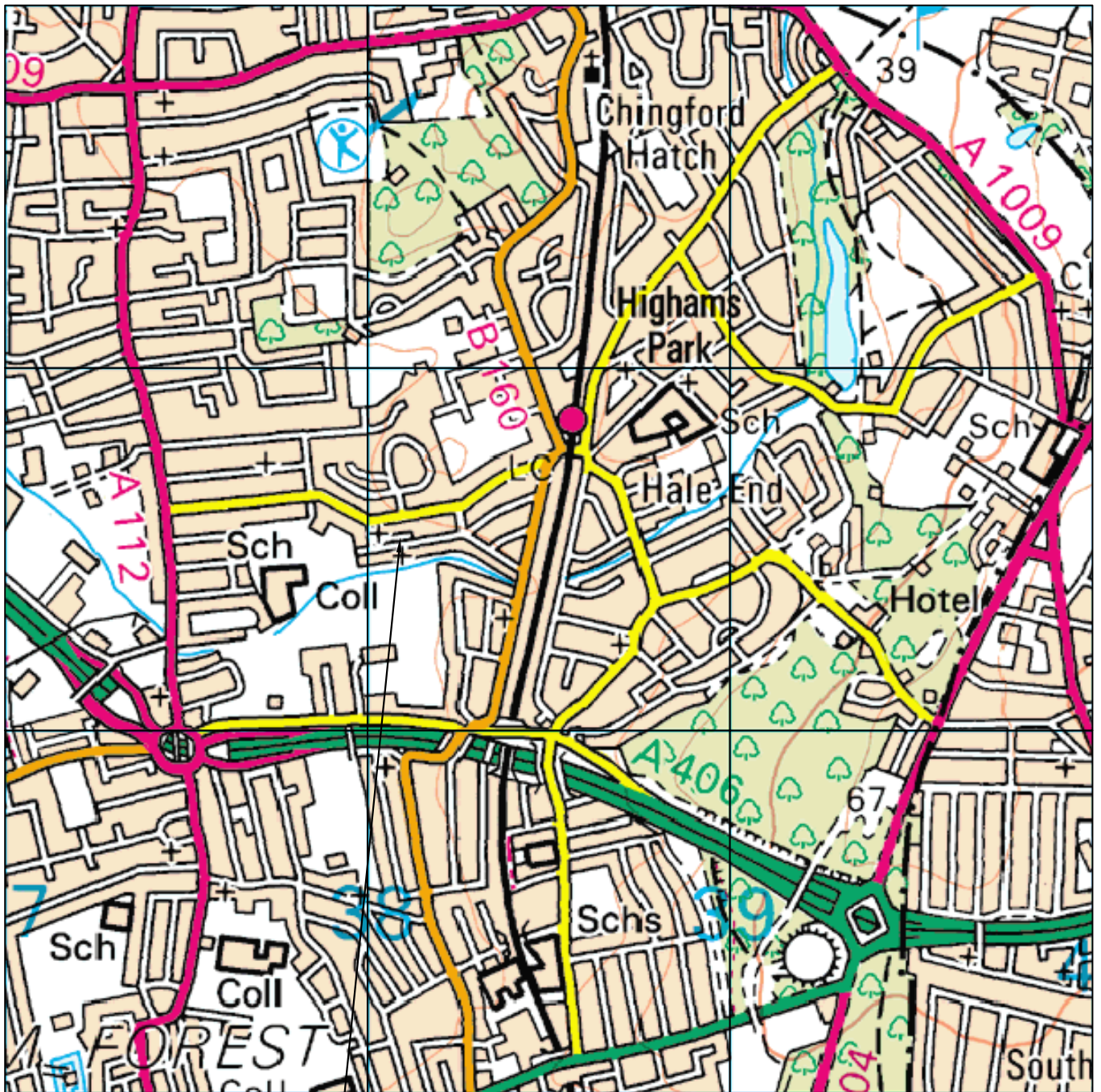
We would recommend that the further works (Phase II Investigation) should comprise the following works to address the contamination linkages identified above and provide geotechnical information to assist in foundation design. It is understood that the development plan for this site is under review and as such the intrusive works should be targeted in the area of the proposed development when designs are finalised.

- Forming boreholes to a target depth of 3m to 4m at approximately six to seven locations
- Chemical analysis of soil to assess the presence of any contaminants of concern identified in this report.
- Geotechnical testing to assist in foundation design and pavement design where required.
- Reporting to identify ground conditions and contamination status of the site.

A copy of this report should be provided to the Environmental Health Department of Waltham Forrest Council for inclusion into their land quality records and so that the proposed scope of works can be agreed prior to commencement.



## FIGURES



Approximate Site Location

Crown Copyright. All rights reserved.  
Licence Number: 100054115



**Title:** Site Location Plan

**Project:** Selwyn Primary School,  
Cavendish Road, E4 9NG

**Client:** Mace Group

**Fig No:** 1

Scale: Not Shown

Drawn By: JG | Approved By: SB

Job No: UK13.1429

Dwg No: Mace/Selwyn/0114/01

Date: January 2014





Approximate Site Boundary

Crown Copyright. All rights reserved.  
Licence Number: 100054115



**Title:** Current Site Layout Plan

**Project:** Selwyn Primary School,  
Cavendish Road, E4 9NG

**Client:** Mace Group

**Fig No:** 2

Scale: Not to Scale

Drawn By: JG | Approved By: SB

Job No: UK13.1429

Dwg No: Mace/Selwyn/0114/02

Date: January 2014



Approximate Site Boundary

Crown Copyright. All rights reserved.  
Licence Number: 100054115



**Title:** Aerial Photograph

**Project:** Selwyn Primary School,  
Cavendish Road, E4 9NG

**Client:** Mace Group

**Fig No:** 3

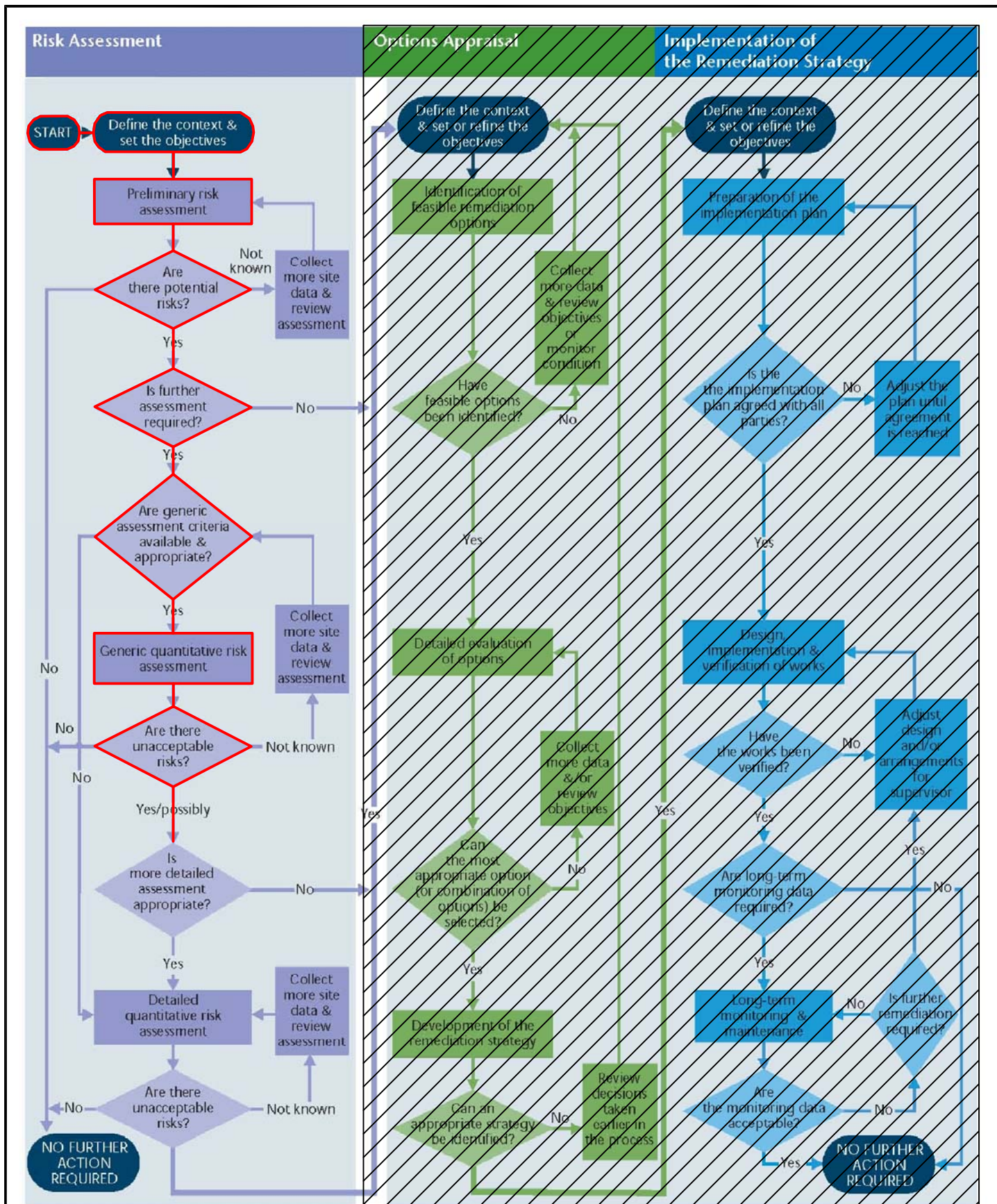
Scale: Not to Scale

Drawn By: JG | Approved By: SB

Job No: UK13.1429

Dwg No: Mace/Selwyn/0114/03

Date: January 2014



Assessment Pathway for Site



**Title:** Site Context - CLR11

**Project:** Selwyn Primary School, Cavendish Raod, E4 9NG

**Client:** Mace Group

**Fig No:** 4

Scale: n/a

Drawn By: JG Approved By: SB

Job No: UK13.1429

Dwg No: Mace/Selwyn/0114/04

Revision Date: January 2014

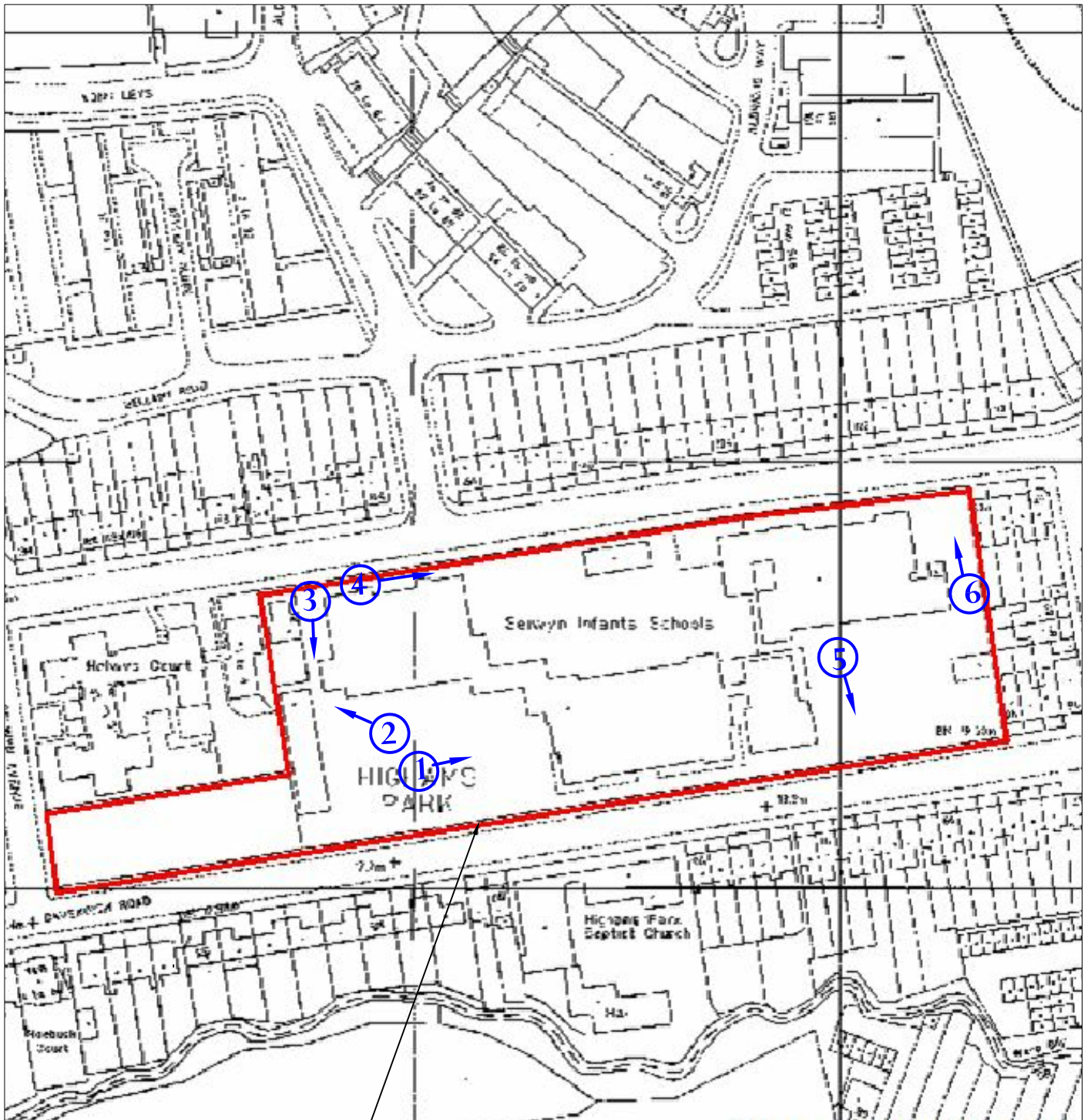


## **APPENDICES**



## **APPENDIX A**

### **Selected Site Photographs**



Approximate Site Boundary

Crown Copyright. All rights reserved.  
Licence Number: 100054115



**Title:** Photo Location Plan

**Project:** Selwyn Primary School,  
Cavendish Road, E4 9NG

**Client:** Mace Group

**Appendix A**


Scale: Not to Scale

Drawn By: JG | Approved By: SB

Job No: UK13.1429

Dwg No: Mace/Selwyn/0114/AppA

Date: January 2014

<p>Photo 1: Southern School site buildings' western edge</p>	<p>Photo 2: Corner of western school site buildings</p>
	
<p>Photo 3: Gate along western boundary</p>	<p>Photo 4: Northern boundary of school site looking east</p>
	
<p>Photo 5: View of southern boundary</p>	<p>Photo 6: View of northern boundary from eastern boundary</p>
	



## **APPENDIX B**

### **Surrounding Land Use**