

## 13. GROUND CONDITIONS AND CONTAMINATION

### INTRODUCTION

- 13.1 This chapter, written by Waterman Environmental, considers the implications of the four proposed Development Scenarios upon the prevailing ground conditions. A summary of relevant legislative and planning policy is given, together with the assessment methodologies employed. Potential effects, mitigation and the resulting residual effects are then considered during both demolition and construction works and following completion and operation of all four Development Scenarios.
- 13.2 The assessment draws upon and summarises the results of a Phase 1 Land Quality Assessment undertaken by Waterman Environmental in July 2008. This is presented within Technical Appendix 13a.

### LEGISLATIVE AND PLANNING POLICY CONTEXT

#### Legislation

##### **Environmental Protection Act, 1990 and Environment Act 1995**

- 13.3 Current legislation on contaminated land is principally contained within Part IIA of the Environmental Protection Act (EPA), 1990 (Ref. 13.1). This has been retrospectively inserted by Section 57 of the Environment Act, 1995 (Ref. 13.2). Guidance on the regulatory regime is provided in DETR Circular 02/2000 (Ref.13.3).
- 13.4 Under the legislation, contaminated land is defined as:
- “...any land which appears to the Local Authority in whose area it is situated to be in such a condition that:*
- (a) *‘Significant harm’ is being caused or there is a significant possibility of such harm being caused; or*
- (b) *pollution of controlled waters is being, or is likely to be, caused.”*
- 13.5 ‘Significant harm’ is defined in the guidance according to risk-based criteria and must be the result of ‘pollutant linkages’. Such pollutant linkages can be assessed using a qualitative risk assessment that addresses the identification of:
- Potential sources of contamination;
  - Sensitive receptors; and
  - Migration pathways linking the potential source(s) to the sensitive receptor(s).
- 13.6 All three of the above must be present to complete the pollutant linkage and for an environmental risk to exist. As such, the presence of contamination in itself does not necessarily indicate a need for remedial action. Accordingly, a site can only be considered ‘contaminated’ when a risk to the environment or human health is present due to the presence of a ‘source-receptor-pathway’ linkage. In such circumstances and where there is a significant risk posed to human health and/or the environment, the Acts state that Local Planning Authorities (LPAs) must adopt a ‘suitable for use’ approach. This means that the degree of site contamination remediation is dictated by the site’s proposed end use.

**Contaminated Land (England) Regulations, 2000**

- 13.7 The statutory guidance (DETR Circular 02/2000) which accompanied the Contaminated Land (England) Regulations, 2000 (Ref. 13.4), bringing into effect Part IIA of the EPA 1990, (widely known as the 'contaminated land regime'), describes a risk assessment methodology in terms of 'significant pollutants' and 'significant pollutant linkages' within a source-pathway-receptor conceptual model of a site. The model comprises:
- The principal pollutant hazards associated with the site (the sources);
  - The principal receptor(s) at risk from the identified hazards (for example, people, environmental assets, surface water and/or groundwater); and
  - The existence, or absence, of plausible pathways which may exist between the identified hazards and receptor(s).
- 13.8 For land to be determined as 'contaminated' in a regulatory sense, and therefore require remediation (or a change to less sensitive use), all three elements (source-pathway-receptor) of a significant pollutant linkage must be present. The legislation places a responsibility on the LPA to determine whether the land in its area is contaminated by consideration of whether:
- *“Significant harm is being caused; or*
  - *There is a possibility of significant harm being caused; or*
  - *Pollution of controlled waters is being, or is likely to be, caused.”*

**Water Resources Act, 1991**

- 13.9 The Water Resources Act (Ref. 13.5) protects the quality of groundwater and surface water, collectively defined as 'controlled waters'. Further details can be obtained by reference to Chapter 14: Surface Water Drainage and Flood Risk.
- 13.10 The Water Resources Act is of specific relevance to soil contamination in those cases where the nature, extent and mobility of contamination present a risk of pollution of controlled waters. In such cases, the land owner is committing an offence if the pollution of controlled waters is not prevented once the site has been identified as being a source of contamination.

**Hazardous Waste (England and Wales) Regulations, 2005**

- 13.11 Depending on its characteristics and the requirements for treatment or disposal, contaminated soil may be classified as hazardous waste. The relevance and need to consider the relevant regulations summarised below would depend on the composition and characteristics of waste soil generated at a site.
- 13.12 The Hazardous Waste (England and Wales) Regulations (Ref. 13.6) came into force on 16 July 2005. The Hazardous Waste Regulations implement the provisions of the European Hazardous Waste Directive 91/689/EEC (Ref. 13.7) into England and Wales.
- 13.13 The Hazardous Waste Regulations main aim is to provide a consistent definition of hazardous waste and to ensure the environmentally sound management and regulation of such waste. As such, the Hazardous Waste Regulations set out procedures to be followed when disposing of, carrying and receiving hazardous waste. The main aims are to:
- Implement a definition of hazardous waste into domestic legislation (and consequently remove the use of the term special waste);
  - Require producers or consignors of hazardous waste to notify their premises;
  - Restrict mixing and to require separation of wastes, where appropriate;
  - Provide cradle-to-grave documentation for the movement of hazardous waste; and
  - Require consignees to keep thorough records of hazardous waste and provide the Environment Agency with quarterly disposal and recovery information.

**List of Waste (England) Regulations, 2005**

- 13.14 The List of Waste Regulations (Ref. 13.8) came into force at the same time as the Hazardous Waste Regulations. The two are strongly linked. However, under the List of Waste Regulations the waste producer is under a duty of care to ensure the characterisation of produced waste in order to establish its key characteristics as specified in the Regulations. That is, to assess the physical and chemical properties of the waste in order to classify it as hazardous, non-hazardous or inert waste. In particular, details of the chemical composition and leaching behaviour (exposure to water) of the waste are required.

**The Environmental Protection (Duty of Care) Regulations, 1991**

- 13.15 Known as the Duty of Care Regulations, the Environmental Protection Regulations (Ref. 13.9) relate to the requirements on waste producers to prevent the escape of waste, environmental pollution or harm to human health during the transfer, treatment or disposal of waste.
- 13.16 Under the Regulations, the producer has a responsibility to ensure that if the waste is transferred, it goes only to an:
- “...authorised person or to a person authorised for transport purposes.”*
- 13.17 When transferring waste, the producer must also ensure that a written description (known as a ‘transfer note’) is made available to the new holder. The description of the waste must be sufficient for the new holder and each person receiving it thereafter to be able to comply with their duty to prevent the escape of waste.

**Environmental Permitting Regulations, 2007**

- 13.18 The disposal of material off-site to licensed disposal facilities was regulated by the Landfill (England and Wales) Regulations 2002 (as amended) (Ref. 13.10). This set out a pollution control regime for landfills. Under these regulations, materials to be disposed of off-site were classified as ‘hazardous’, ‘non-hazardous’, or ‘inert’ in accordance with the criteria and procedures for the acceptance of waste at landfills. In these criteria the materials are classified primarily from an assessment of the concentrations of potential contaminants measured in dissolved matter extracted from the material with limited additional testing of the material itself.
- 13.19 The domestic Landfill Regulations have since been revoked. Citation is now via Schedule 10 of the Environmental Permitting Regulations 2007 (EPR 2007) (Ref. 13.11), which directly references the European Directive 1999/31/EC and the Council Decision 2003/33EC establishing criteria and procedures for the acceptance of waste at landfills.

**National Planning Guidance****Planning Policy Statement Note 23: Planning and Pollution Control, 2004**

- 13.20 Planning Policy Statement 23 (PPS23) (Ref. 13.12) provides guidance in relation to environmental protection and pollution control legislation. Of particular relevance is the fact that PPS23 notes that potential environmental effects of development upon water, air or land are capable of being considered a material consideration within the planning process.
- 13.21 Chapter 4 of PPS23 deals specifically with contaminated land and Annex 2 provides guidance on the need to account for the potential environmental consequences of contaminated land in drawing up development plans and in determining planning applications.

## Regional Planning Guidance

### **The London Plan: Spatial Development Strategy of Greater London, 2008**

- 13.22 Key policies of the London Plan (Ref. 13.13) relating to contaminated land are set out in policy 4A.33 (Bringing Contaminated Land into Beneficial Use). This policy states that such land affected by contamination should be recycled into new uses, subject to the implementation of appropriate remedial actions. The policy is set out as follows:

*“The Mayor will work with strategic partners to identify best practice mechanisms to enhance remediation of contaminated sites and bring the land into beneficial use.”*

### **Other Guidance**

#### **The Model Procedures for the Management of Land Contamination (CLR 11), 2004**

- 13.23 The Model Procedures for the Management of Land Contamination (CLR 11) (Ref. 13.14) provides the technical framework for applying a risk management process when dealing with contaminated land. The process involves identifying, making decisions on, and taking appropriate action to deal with land contamination in a way that is consistent with government policies and legislation within the UK. CLR11 procedures are intended to assist all those involved in dealing with land contamination, including landowners, developers, professional advisors, regulatory bodies and financial providers.

## Local Planning Policy

### **Westminster City Council Replacement Unitary Development Plan, 2007**

- 13.24 Policy ENV 8 of Westminster City Council's (WCC's) Replacement Unitary Development Plan (UDP) (Ref. 13.15) aims to encourage development on potentially contaminated land.
- 13.25 Policy ENV 8 also states that surveys should be undertaken by developers to establish the level of contamination in the soils and/or groundwater/surface waters. Subsequently, if deemed necessary, a strategy for remediation should be agreed with WCC prior to commencing any redevelopment works.

### **Westminster City Council Victoria Area Planning Brief, 2006**

- 13.26 With regard to contaminated land, WCC's Victoria Area Planning Brief (VAPB) (Ref. 13.16) makes reference to WCC's Code of Construction Practice (CoCP). Details of WCC's CoCP requirements are presented within Chapter 6: Demolition and Construction.

## ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

### Assessment Methodology

#### **Establishment of the Baseline Conditions**

- 13.27 The baseline assessment below has considered the existing land uses within the boundaries of the three application sites. Due to the similar nature of the land uses (historical and current) within the boundary of the three application sites and their proximity to each other, it is deemed reasonable to assume that the contamination risks identified within this chapter are relevant to all four Development Scenarios. Where notable exceptions to this assumption exist, these are stated within the text.
- 13.28 A detailed description of existing uses within the application sites is presented within Chapter 3: Existing Land Use and Activities.
- 13.29 The baseline ground conditions currently existing within the three application sites have been established through the following:

- A walkover survey undertaken in July 2008 in order to identify any potentially contaminating land uses, existing contamination pathways and receptors
- Review of the British Geological Survey (BGS) Geological Map, Series Sheet 270, South London (Ref. 13.17);
- Review of an EnviroCheck Report obtained from the Landmark Information Group (refer to Technical Appendix 13a) in order to identify any registered contaminative sources and/or incidents. This included a review of historic maps (1878 to 1991) in order to establish if any historic contamination is likely to be present within, or surrounding, the boundary of the three application sites;
- Review of the Explosive Ordnance Threat Assessment of Victoria Interchange undertaken by BACTEC (refer to Technical Appendix 13a);
- Review of Norwest Holst's Ground Investigation, (refer to Technical Appendix 13a);
- Review of Arup's Geotechnics Initial Desk Study, which partially encompasses the sites of the three applications (refer to Technical Appendix 13b);
- Consultation with WCC's Environmental Health Officer, Planning Department and Building Control Department; and
- Consultation with Thames Water, Property Insight Department.

#### Development of a Conceptual Risk Assessment Model

- 13.30 In order to evaluate the potential and residual environmental risks associated with any potential contaminants present on the sites of the three applications, a simple source-pathway-receptor model has been developed in line with the EPA and the approach suggested in current UK guidance relating to human health, including the Contaminated Land Exposure Assessment Model (CLEA) (Ref. 13.18) CLR 7 to CLR10. Accordingly, the desk-based risk assessment, as summarised below and presented within Technical Appendix 13a, comprises:
1. Identification of potential ground contamination source(s);
  2. Identification of potential contamination pathway(s);
  3. Identification of potential contamination receptor(s);
  4. Identification of potential ground contamination risk(s); and
  5. Assessment of the relative significance of the potential ground contamination risk.
- 13.31 It therefore follows that this assessment seeks to determine the significance of the environmental effects in the sense of assessing the 'environmental risk', rather than the significance of the 'environmental effect' as applied to all other technical assessments contained within this Environmental Statement (ES).
- 13.32 Steps 1-5, as noted above, have been carried out within this assessment for the demolition and construction phases of the proposed Development Scenarios as well as for the completed, operational and occupied Development Scenarios.

#### Significance Criteria

- 13.33 The significance of the environmental risk is considered to be dependent on the value of the resource, the sensitivity of the receptor and the ways in which the Development Scenarios could provide a contamination pathway to the receptor. The significance of the risk is also governed by the timescales involved and the extent of the area affected.
- 13.34 In consideration of the above, the relative significance of contamination risk has been established by the use of the following seven-point contextual scale:
- **Substantial beneficial:** Major reduction in risk to human, animal or plant health. The benefit would also relate to a significant local-scale or significant regional scale improvement to the quality of potable groundwater or surface water resources;

- **Moderate beneficial:** Moderate reduction in risk from contamination to human, animal or plant health and safe occupancy of buildings. The benefit would also relate to a moderate and local scale improvement to the quality of controlled waters;
- **Minor beneficial:** Minor reduction in risk to human, animal or plant health. The benefit would also relate to a minor and local-scale improvement to the quality of potable groundwater or surface water resources and/or a moderate to significant improvement to the quality of groundwater or surface water resources used for commercial or industrial abstraction only;
- **Negligible:** No appreciable risk to human, animal or plant health, potable groundwater or surface water resources of any importance. Any contamination risks would result in minor and reversible effects;
- **Minor adverse:** Temporary and minor risk to human health. The contamination risk would have the potential to result in moderate, local-scale reduction in the quality of potable groundwater or surface water resources of local importance which would be reversible with time and/or reversible widespread reduction in the quality of groundwater or surface water resources used for commercial or industrial abstractions and/or a reversible detrimental effect on animal or plant populations;
- **Moderate adverse:** Moderate risk from contamination to human health, plant growth, controlled waters and safe occupancy of buildings. The contamination risk would have the potential to result in a severe temporary change to the water quality of ground water and/or severe temporary harmful effects upon animal or plant populations; and
- **Substantial adverse:** Severe or high risk to human health. The contamination risk would have the potential to result in a severe temporary or permanent reduction in the quality of a potable groundwater or a surface water resource of a local, regional or national importance and/or permanent or severe temporary detrimental effect upon animal or plant populations.

### BASELINE CONDITIONS

- 13.35 As previously noted, the baseline conditions are detailed for the sites of the three applications, with notable exceptions highlighted where deemed appropriate. A detailed description of existing uses within the individual application sites is presented within Chapter 3: Existing Land Use and Activities.

### Walkover Survey Observations

- 13.36 A walkover survey of the three application sites was undertaken in July 2008, with the main observations and conclusions summarised below. Further details of the walkover survey are provided within Technical Appendix 13a.
- 13.37 The three application sites are typically urban and limited open areas comprise of a mixture of paved surfaces and tarmac hardstanding. Existing land uses are predominantly commercial in nature providing a mix of office, retail and leisure accommodation. The application sites contain several building blocks of various size and height, transport infrastructure (including local highways) and areas of hard standing. The lack of current soft landscaping entails that the primary existing pathway to the subsurface is likely to be from the existing drainage network.

- 13.38 Road side car-parking facilities are currently available along Victoria Street (application site 1, all Development Scenarios), Allington Street (application sites 1, 2 and 3, all Development Scenarios) and Warwick Row (application site 1, all Development Scenarios). As such, leaks from parked vehicles may present a potential source of fuel/oil contamination. Although hardstanding across the three application sites generally appeared to be in good condition, cracked tarmac was noted on Allington Street (application sites 1, 2 and 3, all Development Scenarios) and Warwick Row (application site 1, all Development Scenarios).
- 13.39 In view of the above. potential contamination sources identified within the three application sites are predominantly associated with drainage infrastructure along the existing road network.
- 13.40 In terms of topography, there are no substantial changes in ground level across the three application sites; however there are some localised changes in levels across the three application sites. The lowest point lies at 3.3m Above Ordnance Datum (AOD) at Allington Street within application site 1 (all Development Scenarios). Levels rise to a maximum of 5.6m AOD at Buckingham Palace Road within the western boundary of application site 1 (all Development Scenarios).

### Geology

- 13.41 The BGS Geological Map for South London reveals that all three application sites are underlain by Made Ground overlying Alluvium. Taplow Terrace River Gravels underlie the Alluvium followed by the London Clay, the Thanet Sand and the Upper Chalk. A summary of the existing geology is presented in Table 13.1.

**Table 13.1: Geology**

Stratum	Application Site / Development Scenario	Estimated Thickness (Below Ground Level (BGL))	Stratigraphy	Typical Description
Made Ground.		2.0 - 4.3m	Recent	Concrete/tarmac hardstanding underlain by soil fill materials (brick, stone and concrete rubble in a sand and clay matrix). Decomposing wood, ash and mortar have also been noted.
Alluvium.	1, 2 and 3 / 1, 2, 3 and 4	0 - 2.5m (average 1.5m)	Quaternary	Soft silty clay which is additionally described as peaty or organic.
Taplow Terrace River Gravels.		4.0 - 6.0m	Quaternary	Sand and gravel.
London Clay Formation.		40.0m +	Tertiary	Fissured blue grey clay with occasional pyrite nodules.
Thanet Sands.		0.0 - 18.0m	Palaeocene	Fine grained sand.
Upper Chalk.		95m	Cretaceous	Soft white limestone with flints.

- 13.42 There are no significant geological land forms recorded within, or within the vicinity of the three application sites.

### Hydrology and Hydrogeology

- 13.43 According to the Environment Agency (EA) Groundwater Vulnerability Map, Sheet 39 (West London), the Alluvium and Taplow Terrace River Gravels underlying the three application sites are classified as Minor Aquifers. The London Clay Formation is classed as a Non-Aquifer and the Upper Chalk, at depth, is classified as a Major Aquifer. The London Clay formation is considered to act as an aquiclude preventing any contamination present in the superficial Made Ground, Alluvium and River Terrace Gravels from migrating vertically into the underlying Upper Chalk.
- 13.44 An assessment of the hydrogeological properties associated with each geological stratum is presented in Table 13.2.

**Table 13.2: Summary of Hydrogeological Properties**

Strata	Application Site / Development Scenario	Hydrogeological Properties	Classification According to the EA
Made Ground.		May contain small quantities of perched water.	Non-Aquifer.
Alluvium.		Important for local supplies and maintaining river base-flow.	Minor Aquifer.
Terrace River Gravels.	1, 2 and 3 /	Important for local supplies and maintaining river base-flow.	Minor Aquifer.
London Clay Formation.	1, 2, 3 and 4	Contains insignificant quantities of water for abstraction.	Non-Aquifer.
Thanet Sands.		Important for local supplies and maintaining river base-flow.	Minor Aquifer.
Upper Chalk.		Highly permeable strata, contains large quantities of groundwater for abstraction.	Major Aquifer.

- 13.45 The nearest surface water features (ponds/lakes) are situated approximately 200m northwest of the three application sites in Buckingham Palace Gardens and 430m northeast in St James's Park. Furthermore, the River Thames is located approximately 1.2km to the south and east of the three application sites. Further details on surface water are provided within Chapter 14: Surface Water Drainage and Flood Risk.

### Water Abstractions

- 13.46 EA databases indicate that the three application sites are not located within a groundwater source protection zone associated with abstractions for potable water supply.
- 13.47 The Landmark Information Group (refer to Technical Appendix 13a) indicates that there are 16 groundwater abstraction within 1km of the three application sites. The closest recorded abstraction is operated by London Underground Ltd (LUL) for non-evaporative cooling purposes, approximately 53m to the south. The nearest sensitive abstraction is operated approximately 247m to the north by The Keeper of the Privy Purse for irrigational purposes. However, details of the producing strata are not provided.

## Potential for Historical Ground Contamination

### Historical Land Uses

- 13.48 Historical development on the three application sites, as well as within the surrounding area, is detailed within Chapter 12: Archaeology. However, Table 13.3 below provides a summary of this historical development with a particular focus on the identification of former, potentially contaminative land uses. This has been facilitated by the review of historical maps, which are presented in Technical Appendix 13a.
- 13.49 Potentially contaminative land uses are indicated within the table by the use of bold and italicised text. Where a specific land use relates explicitly to a particular application site and Development Scenario, this is indicated within the table. Distances to all surrounding land uses are approximate and taken from the outer boundary of all three application sites.

**Table 13.3: Summary of Historical Development**

Source	Application Sites (Development Scenarios)	Surroundings (distances are approx from outer boundary of all application sites)
OS Map 1878.	Commercial properties are present in the northwest area of application site 1 (all Development Scenarios). The trajectory of the <b>Metropolitan District Railway</b> passes through the southeast corner of application site 2 (Development Scenarios 1 and 2).	<p>The surrounding area is predominantly commercial and residential. However, a large undeveloped area remains approximately 100m to the southeast.</p> <p>The <b>Stag Brewery</b> is located approximately 20m to the northeast.</p> <p>A 'cab stand' and a <b>Station</b> are detailed immediately to the south.</p> <p>A <b>tank</b> is located approximately 150m to the northwest.</p> <p>A <b>distillery</b> and <b>Christ Church Grave Yard</b> are located 290m and 500m to the east and northeast respectively.</p> <p><b>Saw mills</b> and a <b>timber yard</b> are detailed 300m and 380m to the south and southeast and a <b>fire station</b> is positioned 330m to the east/southeast. An industrial home and a <b>coach manufacturing works</b> are located 290m and 370m southeast respectively.</p> <p>Grosvenor Gardens and <b>Victoria Station</b> are situated immediately to the west and 90m to the south respectively. A <b>works</b> is located 160m southwest and <b>coach manufactories</b> are located approximately 390m and 470m southwest. <b>Marble and stone saw mills</b> and <b>Pimlico Slate Works</b> are situated 410m and 435m to the southwest respectively.</p>
OS Map 1896-1898	The numerous commercial buildings in the northwest corner of application site 1 (all Development Scenarios) have been replaced by three larger units.	<p>The aforementioned taxi rank is no longer marked. Victoria Palace is situated immediately to the east of Allington Street. The Little Ben Clock and a lavatory are situated approximately 25m to the south.</p> <p>The <b>tank</b> 150m northwest, <b>works</b> 160m west, <b>marble and stone saw mills</b>, <b>Pimlico Slate Works</b> and the <b>coach manufactories</b> to the southeast and southwest are no longer marked. The <b>distillery</b> to the east is no longer shown.</p> <p>A school and <b>Wellington Barracks</b> are</p>

Source	Application Sites (Development Scenarios)	Surroundings (distances are approx from outer boundary of all application sites)
		<p>located 230m east and 320m to the northeast respectively.</p> <p>A tramway is located approximately 50m to the south and a picture theatre has been constructed 100m to the south.</p> <p>Ambrosden Avenue, Thirlby Gardens and other buildings have been constructed 180m to the southeast.</p>
OS Map 1916	<p>The large units in the northwest corner of application site 1 (all Development Scenarios) have been removed and replaced by several small structures.</p> <p>The <b>Metropolitan District Railway</b> within application site 2 (Development Scenarios 1 and 2) appears to have been dismantled.</p>	<p>Terminus Place (<b>Bus Station</b>) is marked 40m to the south.</p> <p>Westminster Cathedral is located 140m to the southeast and the Army and Navy Stores have been constructed 350m to the east.</p> <p><b>Garages</b> are located 290m, 530m and 570m to the south, southeast and southwest respectively. An <b>electricity works</b> is situated 360m to the southwest.</p>
OS Map 1951-1952	<p>A theatre is marked in the southwest area of application site 1 (all Development Scenarios).</p>	<p><b>Ruins</b> are located in the surrounding area the closest of which are located approximately 10m to the east.</p> <p>The Hotel Rubens and the Westminster Theatre are located 20m and 90m to the north respectively.</p> <p>An <b>Electrical Substation</b> and a subway are marked 15m and 50m to the south.</p> <p><b>Tanks</b> are located 100m to the northeast and a <b>Territorial Army (TA) Centre</b> is located 340m to the northeast.</p> <p>A <b>bus depot</b> is located 350m to the southeast. <b>Artillery houses</b> and a <b>warehouse</b> lie 430m to the east and an <b>engineering works</b> is located 590m to the southeast.</p> <p>To the southwest lies an <b>electricity substation</b> and <b>Victoria Coach Station</b> at 360m and 50m respectively.</p>
OS Map 1967-1968	<p>No structures are present within the northwest area of application site 1 (all Development Scenarios). 'The Stag' <b>Public House</b> is situated in the northeast within application sites 1 and 3 (all Development Scenarios).</p> <p>Bressenden Place runs along the northern and eastern boundaries of the three application sites (all Development Scenarios).</p> <p>The Metropole Cinema occupies the site of the aforementioned theatre in the southwest of application site 1 (all Development Scenarios), and the path of the old <b>Metropolitan District Railway</b> within application site 2 (Development Scenarios 1 and 2) is followed by an underground line.</p>	<p><b>Stag Brewery</b> is no longer present.</p> <p>The three application sites are bounded by Glen House to the east and Eland House to the North. Roebuck House and Watney House lie approximately 20m to the northeast. St. Vincent's School has been constructed to the southwest.</p> <p>Portland House and Glen House have been constructed approximately 20m and 6m east respectively. A <b>Pond</b> is detailed approximately 65m to the northeast.</p> <p>An <b>electrical substation</b> is located 270m northeast. <b>Garages</b> are detailed approximately 350m southwest, 350m south and 350m and 600m to the northwest respectively. In addition a <b>bus depot</b> is located 460m southwest.</p>

Source	Application Sites (Development Scenarios)	Surroundings (distances are approx from outer boundary of all application sites)
OS Map 1977 and 1980-1987	By 1977, Lake View Court and the Royal Westminster Hotel are located in the northwest corner of application site 1 (all Development Scenarios).	By the 1980s the <b>bus depot</b> 460m to the southwest was labelled generically as a <b>depot</b> and a multi-storey car park has been constructed immediately to the south of <b>Victoria Coach Station</b> .
OS Map 1991	No significant changes to building footprint or layout and form are evident within the three application sites.	The <b>Pond</b> 65m to the northeast is no longer marked. The <b>electrical substation</b> 270m to the north is no longer marked and a <b>depot</b> is located approximately 430m to the southeast. No other significant changes to the surrounding land use are noted.

### EnviroCheck Database Search

- 13.50 The following information has been obtained from a Landmark Envirocheck Report commissioned for the sites of all three applications, which is presented within Technical Appendix 13a. Distances to all recorded entries within the surrounding area are approximate and taken from the outer boundary of all three application sites.
- 13.51 A single Environmental Permit, formerly Local Authority Pollution Prevention and Control (LAPPC), is operated within the boundary of the three application sites by Victoria Dry Cleaners, on Allington Street (application site 1, all Development Scenarios). This is in relation to laundry operations.
- 13.52 A further three Environmental Permits (formerly LAPPC's) are operated within 500m of the three application sites. The nearest of these also pertains to a dry cleaners located approximately 290m to the northeast.
- 13.53 There are three Registered Radioactive Substances operations recorded within 1km of the three application sites. The closest is located approximately 452m to the east and pertains to Rolls Royce Plc., who are authorised under Section 13 of the Radioactive Substances Act to dispose of radioactive waste.
- 13.54 A single Control of Major Accident Hazards (COMAH) site (upper tier) was recorded within 1km of the three application sites. This relates to Aquila Energy Storage Ltd. located approximately 345m to the east. However the records have ceased to be supplied under the COMAH regulations.
- 13.55 Landmark Information Group also indicates that there are three active discharge consents within 1km of the three application sites. The closest is operated by Terrace Hill (Wilton Road) Nominee No. 1 Ltd. and No. 2, who is permitted to discharge process water to groundwater via a borehole located 269m to the south.

### Recorded Contamination Events

- 13.56 Landmark Information Group indicates that two Category 3 (minor) pollution incidents to controlled waters have occurred within 1km of the three application sites. The closest involved unknown oils contaminating on unspecified receiving waters approximately 61m to the southwest.

### Unexploded Ordnance

- 13.57 An explosive ordnance threat assessment was undertaken by BACTEC in 2006 (refer to Technical Appendix 13a) and indicates that there is a high risk of encountering explosive ordnance in the area of the building fronting Victoria Street to the west of Allington Street (application site 1, all Development Scenarios). A medium risk also exists in the area of Allington Street to the west of Elliot House (all application sites, all Development Scenarios) and in the vicinity of the junction between Allington Street and Bressenden Place (application sites 2 and 3,

Development Scenarios 1, 2 and 3). The remaining areas within the three application sites have been classified as posing a low risk with respect to encountering unexploded ordnance.

### Type and Quantity of Potential Ground Contamination

- 13.58 No intrusive site investigations have been undertaken over the entire area occupied by the three application sites to-date. However, several studies encompassing various areas of the application sites have been reviewed. These include:
- Ground Investigation (Norwest Holst, 2006) (refer to Technical Appendix 13a); and
  - Geotechnical Initial Desk Study (Arup Geotechnics, 2003) (refer to Technical Appendix 13a).
- 13.59 The key results and conclusions of the previous site investigation works undertaken within the three application sites are summarised in Table 13.4 below. Further details are provided within Technical Appendix 13a.

**Table 13.4: Summary of Previous Site Investigation Works**

Type of Contamination	Comment
Soil contamination.	Chemical testing of soils during the Norwest Holst Ground Investigation revealed elevated levels of lead within the Made Ground in the vicinity of Victoria Street (application site 1, all Development Scenarios) and immediately to the east of The Stag Public House (application sites 1 and 3, all Development Scenarios). Elevated copper values were also recorded within the Made Ground on Allington Street (application site1, all Development Scenarios) and immediately to the east of The Stag Public House (application sites 1 and 3, all Development Scenarios).
Ground water contamination.	Chloride, nitrate and sulphate contaminants were derived from Made Ground leachate tests undertaken during the Norwest Holst Ground Investigation. Sulphate leachate tests were also conducted on natural strata. No elevated chloride or nitrate concentrations were recorded in the groundwater underlying the three application sites.
Ground gas.	Gas testing for carbon dioxide, methane, hydrogen sulphide and carbon monoxide was undertaken during the Norwest Holst Ground Investigation to assess the potential for ground gas production through the decomposition of peat deposits (alluvium). Carbon dioxide concentrations of up to 7.6% were recorded on Allington Street (application site 1, all Development Scenarios). Consequently, gas protection measures would need to be incorporated into any future building designed within the three application sites.

- 13.60 Table 13.4 indicates that local hotspots of contamination are known to exist within investigated areas of the three application sites. However, as acknowledged above, no intrusive site investigation of the entire area covered by the three application sites has been undertaken. Therefore, the presence of additional contamination hotspots cannot be discounted. As such, the potential presence of pollutants in the underlying soil and groundwater cannot be precisely quantified. However, based upon the above information and professional experience, the types of contamination that may be present across the area of the three application sites, include:
- Ground gas from the decomposition of peat deposits (alluvium);
  - Fuels, oils and petrochemicals;
  - Metals and heavy metals (including leachate); and
  - Organic solvents.
- 13.61 Further detail regarding potential contamination sources is provided in Technical Appendix 13a.

### Conceptual Risk Assessment Model

- 13.62 The following section describes the current contamination risk posed to identified receptors on, or within the vicinity of, the three application sites. On this basis, a framework is also set out to subsequently assess the contamination risks relating to the four proposed Development Scenarios and to inform an appropriate remediation strategy, where necessary. As previously noted, due to the similar nature of uses (historical and current) within the three application sites, and their proximity to each other, it is considered that a single conceptual model represents the existing risk for all four Development Scenarios.

### Current Application Site Occupiers and Users

- 13.63 The three application sites are almost entirely covered with buildings and hard standing, with minimal areas of open landscaping. As such, any potential contamination within underlying soils and groundwater is currently contained and presents a low risk to current occupiers and users.
- 13.64 Previous gas monitoring (refer to Technical Appendix 13a) indicates elevated ground gas levels to the east of Victoria Dry Cleaners/Franks & Co. on Allington Street (application site 1, all Development Scenarios). Such gas could theoretically migrate into, and collect within, confined spaces in existing buildings thus causing a risk of vapour inhalation to users. The degree to which this may currently occur is dependent upon existing floor slab construction and the presence of any gas protection measures, the nature and extent of which is currently unknown. This, combined with a lack of comprehensive site investigation (and hence knowledge of existing ground gas) across the three application sites, the contamination risk from ground gas to current occupants and users of existing buildings within all three application sites is considered to be medium.

### Water Resources

- 13.65 Existing surface water features in the vicinity of the application sites include ponds and lakes at Buckingham Palace Gardens and St James' Park (approximately 200m and 430m northwest of the outer boundary of the three application site boundaries respectively) and the River Thames (approximately 1.2km south and east). However, there is a potential for lateral migration of contamination within underlying Made Ground or superficial deposits to surface water features, although these features are unlikely to be affected due to their distance from the boundary of the three application sites. Contamination risks to surface water features from all three applications are therefore considered to be low.
- 13.66 As previously noted, the underlying Alluvium and Terrace River Gravels beneath all three application sites are classified as Minor Aquifers. However, the three application sites are predominantly covered in good condition hard standing, which would serve to inhibit contamination infiltration to the underlying strata. Additionally, the Upper Chalk creates a Major Aquifer beneath the three application sites at depth. However, this is overlaid by the low permeability deposits of the London Clay Formation, which would serve to restrict the vertical migration of contamination into this aquifer.
- 13.67 On the basis of the above, the existing risk of contamination is considered to be low to medium with regard to the shallow Minor Aquifers (Alluvium and River terrace Gravels) and low with regard to the Minor (Thanet Sands) and Major Aquifer (Upper Chalk) at depth for all three applications.

### Fauna and Flora

- 13.68 A previous ecological assessment was undertaken for the three application sites and is further discussed in Chapter 2: EIA Methodology. However, in summary, this identified existing application site habitats as being of low ecological value. Existing soft landscaping within the three application sites consists of small tree/shrub plantings located along Bressenden Place (all applications, all Development Scenarios) and in between Warwick Row and Carrier House (application site 1, all Development Scenarios). These are, however, largely protected from any soil and groundwater contamination by the existing built environment, and are therefore unlikely to

be affected by historical contamination sources. On this basis, the risk to existing fauna and flora is considered to be low.

### **Buildings and Other Structures**

- 13.69 Existing soil and groundwater contamination on, and surrounding, the three application sites has the potential to affect existing buildings and structures through chemical attack, particularly in the case of buried water pipes. As a result, the overall risk to existing buildings and structures is considered to be low to medium.
- 13.70 Several brick constructed combined public sewers currently run beneath all three application sites (refer to Chapter 14: Surface Water Drainage and Flood Risk for details). The project utilities engineers Peter Brett Associates (PBA) suggest that, due to their age, these sewers should be assumed to be leaking, which would cause foul sewage to leak into the surrounding ground and potentially form a source of residual contamination. However, all sewers are sited within the London Clay Formation and due to the impermeability of this strata, any contamination is likely to remain localised and therefore represents a risk of minor significance for all application sites.

### **Summary of Conceptual Risk Assessment Model**

- 13.71 Overall, on the basis of the above described conceptual model, it is considered that the site of the three application sites currently poses a **low to medium** environmental risk with respect to ground contamination and contaminative liabilities, as defined under Part IIA of the Environmental Protection Act 1990.

## **POTENTIAL EFFECTS**

### **Demolition and Construction**

- 13.72 There are four main issues that are relevant to the assessment of contamination risk during the demolition and construction works for each of the four Development Scenarios. These are outlined below:
- The potential requirement to remove, and dispose of, contaminated spoil, which may require treatment prior to disposal depending upon identified contamination levels;
  - Potential exposure of construction workers and the public to contamination which has previously been contained beneath existing buildings or hardstanding;
  - Potential for the mobilisation of contamination from soil or groundwater to water resources, which are not currently adversely affected, either through the creation of new migration pathways or exposure of previously sealed contamination to leaching by rainfall; and
  - Potential for demolition and construction activities to cause soil or groundwater contamination, for example, as a result of accidental spillages of fuel or poor construction site housekeeping.
- 13.73 Exposure of existing flora and fauna to potential contamination sources are not considered to be of significance due to the fact that habitats are considered to be of low ecological importance and all Development Scenarios would result in the removal of existing soft landscaping (trees). Consequently, no further consideration is given to ecology within the assessment of potential demolition and construction and resultant contamination risk.
- 13.74 The following text describes the potential effects associated with demolition and construction works for all four Development Scenarios.

## Development Scenarios 1, 2, 3 and 4

*Disposal of Contaminated Spoil*

- 13.75 The total volume of material to be excavated during each Development Scenario is shown within Table 13.5, and is associated with the construction of a two level basement to a maximum depth of approximately 20m Below Ground Level (bgl) beneath Buildings 5, 6b and 7a (within application site 1 and all four Development Scenarios), as well as groundworks and piling associated with the construction of Buildings 6a (within application site 3 and Development Scenarios 1 and 3), 7b and 7c (application site 2 and Development Scenarios 1 and 2).

Table 13.5: Approximate Excavation Volumes per Development Scenario

Development Scenario 1	Development Scenario 2	Development Scenario 3	Development Scenario 4
227,875m <sup>3</sup>	226,868m <sup>3</sup>	226,107m <sup>3</sup>	225,100m <sup>3</sup>

- 13.76 Due to the identified potential for contamination to exist within underlying soils, it is anticipated that a proportion of any excavated material for all four Development Scenarios would be classified as hazardous waste for the purposes of disposal to landfill. This would, however, be confirmed by Waste Acceptance Criteria (WAC) testing to determine waste classification and allow identification of an appropriate disposal facility.
- 13.77 All wastes would then be transported to, and disposed of, at a licensed landfill site with prior consent from the Environment Agency, in accordance with the Duty of Care Regulations and, as applicable, in accordance with Schedule 10 of the Environmental Permitting (England and Wales) Regulations 2007 and/or the Hazardous Waste (England and Wales) Regulations 2005.
- 13.78 Opportunities to re-use excavated materials within the construction of all Development Scenarios, and/or at other construction sites, would be considered by the Applicant. Concrete and other materials which display signs of visual or olfactory contamination shall be segregated for disposal off-site and will not be considered for reuse. Materials surplus to the site construction requirements, if considered for disposal off site, shall be appropriately classified prior to disposal.
- 13.79 Once the aforementioned legislative requirements have been complied with, the disposal of contaminated spoil in relation to all four Development Scenarios would result in **negligible** environmental risks.
- 13.80 The significant excavation of material during the basement dig may improve the sub surface contaminative status beneath the four Development Scenarios, through removal of potential contamination sources. This has the potential to improve the existing risk, resulting in a **long-term, local** effect of **minor beneficial** significance for all four Development Scenarios.

*Risks to Site Workers and the Public*

- 13.81 A previous intrusive investigation within the boundary of the three application sites indicates elevated levels of lead within Made Ground in the vicinity of Victoria Street (application site 1, all Development Scenarios) and immediately to the east of The Stag Public House (application sites 1 and 3, all Development Scenarios). Elevated copper values were also recorded within Made Ground on Allington Street (application site 1, all Development Scenarios) and immediately to the east of The Stag Public House (application sites 1 and 3, all Development Scenarios). Carbon dioxide concentrations of up to 7.6% were also recorded to the east of Victoria Dry Cleaners/Franks & Co. on Allington Street (application site 1, all Development Scenarios), which could potentially build up within excavations.

- 13.82 However, as acknowledged in earlier sections of this chapter, no intrusive site investigations have been undertaken within the three application sites. As such, the presence of additional contamination hotspots cannot be discounted and is indeed suspected given historical and current land uses. On this basis, it is considered that potential risks posed to workers and the public are the same for all three application sites and, therefore, all four Development Scenarios.
- 13.83 In consideration of the above, and in the absence of appropriate mitigation and the use of Personal Protective Equipment (PPE), potential contamination present within underlying soils for all three application sites and four Development Scenarios would present a low to medium risk to construction workers. Worker safety would, however, be the subject of mandatory requirements including the Control of Substances Hazardous to Health (COSHH) Regulations, 2003 (Ref. 13.19) and the Construction Design and Management (CDM) Regulations, 2007 (Ref. 13.20). These regulations set out the extensive requirements for the protection of construction site workers and stress the importance of appropriate procedures in the event of the workforce encountering pockets of unknown contamination. Further details are provided within the mitigation section of this chapter and also within Chapter 6: Demolition and Construction.
- 13.84 Adherence to appropriate legislative requirements would significantly reduce the health and safety risk posed to construction site workers from any contamination within underlying soils and groundwater to a **negligible** level for all four Development Scenarios.
- 13.85 In respect of public safety, as described in Chapter 6: Demolition and Construction, all four Development Scenarios would be fenced off and secured during all stages of the demolition and construction works. The risk to members of the public during all phases of demolition and construction for all four Development Scenarios would therefore also be **negligible**. In addition, dust control measures (as described in Chapter 10: Air Quality) implemented through the adoption of an Environmental Management Plan (EMP) for the construction site of the consented Development Scenario would serve to minimise the potential for exposure to contaminants associated with dust.

#### ***Risk to Water Resources***

- 13.86 Proposed demolition and excavation activities may enable previously covered ground within all application sites, and therefore all four Development Scenarios, to be exposed, thereby allowing increased infiltration of rainwater. Given that the underlying Alluvium and River Terrace Gravels (Minor Aquifers) are likely to be in hydraulic continuity for all three application sites and all four Development Scenario sites, the contamination risk posed to the underlying Minor Aquifer for all four Development Scenarios is considered to be **short-term, local** and of **minor adverse** significance.
- 13.87 The proposed removal of soils during basement excavation works within all four Development Scenarios would serve to remove potential contaminants present within the basement footprint. This would have the potential to lessen contamination risks to the Minor Aquifer, resulting in a **long-term, local** effect of **minor beneficial** significance.
- 13.88 With the exception of piling, which would be conducted in order to minimise the introduction of pathways to groundwater (as described below), the general absence of disturbance to the London Clay aquiclude would restrict risks from vertical migration of contamination from demolition and construction activities to the underlying aquifers to **negligible** for all four Development Scenarios.
- 13.89 Proposed piling through the superficial deposits beneath the four Development Scenarios would mainly be to depths ranging between -30m AOD and -45m AOD (21m to 36m long). However building 6a (Development Scenarios 1 and 3) would require piles to extend into the Thanet Sands with a toe level between -65m AOD and -76m AOD. Therefore, piling could have the potential to create new pathways for contamination into underlying Alluvium and River Terrace Gravel Minor Aquifers for all four Development Scenarios, and into the Thanet Sand Minor Aquifer and Upper Chalk Major Aquifer for Development Scenarios 1 and 3.

- 13.90 With the exception of piling for Building 6a within Development Scenarios 1 and 3, all piling within the four Development Scenarios would terminate within the London Clay deposits, which would afford protection to subsequent underlying aquifers within the Thanet Sands and Upper Chalk.
- 13.91 The precise piling methodology will be subject to a foundation risk assessment, including a quantitative risk assessment. Provided that the anticipated bored piling technique is carried out to high standards of workmanship, there would be no disturbance of the surrounding soil. Furthermore, as the installation of piles would be by a rotary boring method, there would be a negligible risk of soil 'drag-down' and the horizontal displacement of material between geological horizons (e.g. Made Ground and Alluvium). Whilst there would be the potential for the creation of a temporary pathway, typical pile installation times would be in the order of a few minutes and concreting would close this pathway very soon after it forms.
- 13.92 The proposed method described above is considered to be the most appropriate to the conditions present within the sites of the four Development Scenarios. This would, however, be confirmed through further consultation with the EA prior to the commencement of any piling works. It is therefore considered that, in the absence of a head of contaminated liquid, risks of contamination seepage into underlying aquifers as a result of piling will be **negligible** for all four Development Scenarios.
- 13.93 In view of the above and the standard requirement to agree the final piling strategy with the Environment Agency, the potential contamination risk to ground water resources, including the minor aquifers associated with the Alluvium, River Terrace Gravel and Thanet Sands, would be **negligible**. Accordingly, there would be a **negligible** risk posed by potential lateral contamination migration within aquifers to ponds and lakes at Buckingham Palace Gardens and St James Park or to the River Thames.

#### ***Contamination of the Ground during Construction***

- 13.94 The removal and/or diversion of existing combined public sewers, which are assumed to be leaking into surrounding soils due to their age, would be implemented in consultation and agreement with Thames Water. All physical works would also be undertaken in accordance with standard good practice guidance to minimise contamination risks.
- 13.95 Measures to protect the quality of the surface and groundwater as part of an EMP are described in Chapter 6: Demolition and Construction and Chapter 14: Surface Water Drainage and Flood Risk. Adoption of these measures would similarly protect soil quality during the demolition and construction works for all four Development Scenarios. However, a precautionary approach would mean that even with the implementation of an EMP, unforeseen accidental spillages could still occur. Accordingly, it is considered that there would remain a **short-term, local risk of minor adverse** significance relating to contamination of the ground during demolition and construction for all four Development Scenarios.

#### ***Identification and Disposal of Unexploded Ordnance***

- 13.96 As described earlier in this chapter, there are identified areas of high and medium risk of unexploded ordnance located within all four Development Scenarios. As such, and in accordance with the CDM Regulations, 2007 all personnel involved in intrusive works would receive explosive ordnance safety and awareness briefings. These would include the provision of guidance on how to identify unexploded ordnance and what actions to take in order to keep people and equipment away from the hazard. In addition, in the areas of medium and high risks identified within the baseline section of this chapter, an Explosive Ordnance Disposal Engineer would be present at all times during intrusive works to allow visual and instrumental recognition of unexploded ordnance and facilitate appropriate incident management, where required.
- 13.97 Assuming that the aforementioned requirements are adhered to, the presence of unexploded ordnance would result in **negligible** environmental risks for all four Development Scenarios.

### Completed Development

- 13.98 The nature of proposed land uses within each Development Scenario is broadly similar in comprising a mix of commercial, retail and residential uses and associated public realm improvements. It is therefore considered that the potential effects for each Development Scenario on ground conditions and contamination would be largely identical.

### Development Scenarios 1, 2, 3 and 4

#### *Risks to Future Site Occupants and Users*

- 13.99 As described in Chapter 5: The Proposed Development Scenarios, all four Development Scenarios comprise a mix of commercial (office and retail) and residential uses. Areas of public realm would also be provided between/surrounding the proposed buildings. The potential risk posed to future occupants and users from exposure to potentially contaminated soils, groundwater and ground gas within all Development Scenarios is considered to be low for the following reasons:
- The majority of all Development Scenarios would be hard-surfaced, which would form a barrier between people and direct contact with any potentially contaminated soil that might remain following excavation and groundworks, thus breaking the linkage between potential sources and receptors;
  - Public realm space and pedestrian routes would be predominantly hard landscaped and augmented with only limited areas of soft landscaping. Any material used within soft landscaped areas would comprise imported topsoil that is clean and inert;
  - The excavation and appropriate disposal of Made Ground and sub-surface soils associated with the construction of the basement would serve to remove a significant amount of potential contamination sources from the sites all Development Scenarios; and
  - All buildings would be designed to incorporate appropriate ground gas protection measures, if required following further intrusive investigation. The basement, incorporating car parking, energy centre, plant loading and servicing areas, would be waterproofed and adequately ventilated to remove vehicular exhaust emissions and therefore prevent any harmful build up of ground gas.
- 13.100 In light of the above, it is considered that future occupants and users of any of the four Development Scenarios would be unlikely to come into contact with contaminated soil, ground gas and/or groundwater. The risk to future occupants and users of all four Development Scenarios is therefore considered to be **negligible**.

#### *Contamination of the Ground by the Completed Development Scenarios*

- 13.101 The four proposed Development Scenarios do not include land uses that are likely to give rise to the significant contamination of soil or groundwater. In addition, all potentially contaminative materials used on-site during the operation of the consented Development Scenario would be stored and handled appropriately and any spills/leaks cleaned up in accordance with environmental legislation. All properties or future organisations occupying the consented Development Scenario site would be responsible for doing this and would establish related procedures. These responsibilities and procedures would be included, for tenants, as part of lease agreements for properties contained within the area of the consented Development Scenario and in site manuals for training purposes. In light of the above, the risk of soil contamination from operation of the four Development Scenarios is considered to be **negligible**.
- 13.102 However, it is appreciated that accidental contamination events such as spillages of fuel within car park or service yards area cannot be excluded although hard-surfacing across the vast majority of the four Development Scenario areas, together with the implementation of petrol interceptors, where necessary, would serve to significantly reduce any associated risks to underlying soils and groundwater.

13.103 The reconstruction of the local sewer system, renewal of existing infrastructure and separation of foul and surface water flows would replace the existing potentially leaking brick sewers within all four Development Scenarios, thereby removing the current risk of potential sewage contamination to underlying soils and groundwater. The existing risk would therefore be improved giving rise to a **long-term, local** effect of **minor beneficial** significance.

#### ***Risk to Water Resources***

13.104 The four Development Scenarios would not include land uses that are likely to give rise to the contamination of soil or groundwater, as discussed above. Furthermore, surface water sewers within all four Development Scenarios would contain oil interceptors and sediment facilities to prevent contaminants, for example oil leaks from parked cars, entering sewers and being discharged into underlying groundwater or neighbouring water bodies. Indeed, the replacement of the local sewer system is likely to remove an existing source of contamination to water resources. Thus, the risk of contamination of groundwater resulting from the operation of the four Development Scenarios impacting water resources is considered to be **negligible**.

13.105 The underlying aquifers beneath the four Development Scenarios are used for industrial abstraction purposes only and the risk of piles allowing preferential contamination migration pathways would be resolved during the construction period, in consultation with the EA. As such, risks to sub surface water resources from operation of the four Development Scenarios are considered to be **negligible**.

13.106 In addition, given the geographical distance of the nearest ponds and lakes and of the River Thames from the boundary of the four Development Scenarios, the potential risks associated with lateral migration of any groundwater contamination arising from operation of the four Development Scenarios to these surface waters is considered to be **negligible**.

#### ***Risks to Flora and Fauna***

13.107 As noted above, all proposed landscaped areas within all four Development Scenarios would be effectively capped from any underlying residual contamination through the importation of clean, inert topsoil. As such, the potential contamination risk to new flora and fauna associated with operation of the four Development Scenarios would be **negligible**.

#### **MITIGATION**

13.108 This assessment has highlighted the potential for contamination to exist beneath all three application sites and, therefore, all four Development Scenarios. Whilst it is recognised that this is unlikely to deem any of the application sites as contaminated under the EPA 1990, a lack of exhaustive intrusive site investigation data means there is some small residual uncertainty regarding the nature, location, quantum and concentrations of potential contamination hot spots. To this end, and as previously noted, this assessment has taken a precautionary approach, based on professional experience, and has therefore included the provision of appropriate mitigation measures, as set out below.

13.109 Due to the nature of risks being largely identical for each Development Scenario, the mitigation measures prescribed below would be implemented for all four Development Scenarios.

13.110 Consultation with WCC's Environmental Health Department has confirmed the usual requirement for intrusive site investigation, prior to commencement of construction works, across the entire area of the consented application sites. The aim of such an investigation would be to determine the presence, location and extent of any existing soil and/or groundwater contamination.

13.111 There would be no requirement to undertake the site investigation prior to determination of the planning applications as any subsequently identified contamination, within any of the three application sites and, therefore, four Development Scenarios, is likely to be readily remediated through conventional, established means. However, where practicable, any investigation would commence within areas of the consented applications owned by the Applicant, prior to demolition

works. Further ground investigation would be undertaken following demolition works but prior to construction, to ensure complete coverage of all areas.

- 13.112 Initial recommendations regarding the site investigation methodology proposed for any of the Development Scenarios are provided within Technical Appendix 13a and include:
- A number of exploratory positions penetrating the full depth of the Alluvium and Taplow Terrace River Gravels should be completed to provide the data for a detailed assessment of groundwater flow, hydraulic continuity and water quality;
  - Trial pits and cable percussion boreholes should be undertaken to provide groundwater and ground gas monitoring data within shallow horizons; and
  - The Phase II Site Investigation report should specifically address the potential pollutant linkages identified within the Phase 1 Desk Study (as summarised in this chapter).
- 13.113 The detailed methodology for the site investigation would be agreed in consultation with the EA and WCC prior to the commencement of any works. Furthermore, any future site investigations would need to be conducted in line with PPS23 and CLR11, as required by the EA. The results of the site investigation would then be used to determine the precise scope of any remediation required to ensure that ground conditions are appropriate to the proposed uses within the consented Development Scenario.

### **Demolition and Construction**

#### **Development Scenarios 1, 2, 3 and 4.**

##### ***Pre-treatment of Spoil and Waste Disposal***

- 13.114 All material to be excavated and removed off-site would be subject to waste classification sampling and analysis in accordance with the requirements of the Hazardous Waste Regulations, 2005 and the List of Waste Regulations, 2005
- 13.115 In the event that future site investigation reveals elevated levels of contamination within material scheduled for excavation and disposal, such material may require on-site treatment to reduce contamination levels prior to disposal to landfill or indeed re-use within construction.
- 13.116 Groundwater contamination encountered within 'hotspot' excavations would be pumped out and either treated prior to disposal to sewer under a Trade Effluent Consent from Thames Water Utilities Ltd (TWUL), or disposed of to a suitable licensed treatment facility. Groundwater encountered in other excavations would require analysis prior to determining the most appropriate method of disposal.
- 13.117 Spoil containing 'leachable' (i.e. soluble or mobile) contaminants would be identified through the proposed site investigation works detailed above, and suitably contained by bunding or other containment measures, as set out within an Environmental Management Plan (EMP) for the demolition and construction works (refer to Chapter 6: Demolition and Construction). Such measures would serve to prevent the release of contaminated run-off from this material and thus protect underlying soils, groundwater and surface water resources.

##### ***Protection of Site Workers and the Public***

- 13.118 Worker safety throughout the construction phase would be the subject of mandatory requirements including the Control of Substances Hazardous to Health (COSHH) Regulations, 2003 and the Construction Design and Management (CDM) Regulations, 2007. These regulations set out the extensive requirements for the protection of construction site workers and stress the importance of appropriate procedures in the event of the workforce encountering pockets of unknown contamination. Further details are provided within Chapter 6: Demolition and Construction.

- 13.119 During demolition and construction, precautions would be taken to minimise the exposure of workers and the general public to potentially harmful substances. Attention would be paid to restricting possible off-site nuisance such as dust and odour emissions. Such precautions would be included within the aforementioned EMP and include:
- Personal hygiene, washing and changing procedures;
  - Personal protective equipment, including disposable overalls, gloves and particulate filter masks to be worn in line with HSE Guidance Note HS(G)66 (Ref. 13.21);
  - Adoption of dust suppression methods, such as water spraying and wheel washing facilities for vehicles leaving the site. Given the generation of stockpiled materials, principally from basement excavation, dust control measures (as described in Chapter 10: Air Quality) would be implemented through the adoption of an EMP and serve to minimise the potential for exposure to contaminants associated with dust;
  - Measures to avoid surface water ponding and collection and disposal of all on-site run-off; and,
  - Regular cleaning of all site roads, access roads and the public highway.
- 13.120 The above measures would be carried out in accordance with the HSE publication 'Protection of workers and the general public during the development of contaminated land' (Ref. 13.22) and CIRIA Report 132 'A guide for safe working on contaminated sites' (Ref. 13.23). The appointed contractor would, prior to construction, provide a Safety Method Statement which would show how the safety of the workforce and the public would be addressed.
- 13.121 Adherence to appropriate legislative requirements would significantly reduce the health and safety risk posed to construction site workers from any contamination within underlying soils and groundwater to **negligible**.
- 13.122 In respect of public safety, as described in Chapter 6: Demolition and Construction, boundaries would be hoarded and secured during all stages of the demolition and construction works.

### ***Piling***

- 13.123 The EA guidance document on piling on contaminated land (Ref. 13.24) describes various methods and scenarios for piling through contaminated land. The report recommends that a Foundation Works Risk Assessment Report is prepared in such cases and in this regard, such a risk assessment would be prepared, and agreed with the EA, for whichever consented Development Scenario prior to the onset of any piling works, as described earlier in this chapter.

### ***Unexploded Ordnance***

- 13.124 During all intrusive ground works, specific measures would be taken to ensure that the risk of encountering unexploded ordnance is managed. In accordance with the CDM Regulations, 2007 all personnel involved in intrusive works would receive explosive ordnance safety and awareness briefings. In addition, in the areas of medium and high risks identified by the BACTEC report, an Explosive Ordnance Disposal Engineer would be present at all times during intrusive works to identify unexploded ordnance and facilitate appropriate incident management, where required.

### **Completed Development**

- 13.125 As previously highlighted, an intrusive site investigation would be undertaken in order to inform an appropriate remediation strategy for the consented Development Scenario, prior to construction works. Given that each of the proposed Development Scenarios would remove and appropriately dispose of potentially contaminated material and provide a substantial physical barrier (or 'capping layer') to isolate future occupants and users from underlying soil, it is unlikely that any additional remedial measures would be required. However, this would be subject to continuing review and consultation with the EA and WCC throughout the works.

## RESIDUAL EFFECTS

### Demolition and Construction

- 13.126 The following section sets out the anticipated residual effects of the four Development Scenarios on ground conditions and contamination following the implementation of the aforementioned mitigation measures, both during demolition and construction and following completion of works. In accordance with the assessment of potential effects, the residual effects are deemed identical for all four Development Scenarios.

#### Development Scenarios 1, 2, 3 and 4

##### *Disposal of Contaminated Spoil*

- 13.127 The disposal of any contaminated spoil during the demolition and construction stage of all four Development Scenarios would be subject to appropriate legislative and regulatory control. As such, the residual effect would remain as **negligible**.
- 13.128 Furthermore, the significant excavation of material during the basement dig of all four Development Scenarios may improve the sub surface contaminative status of underlying soils. This would maintain the improvement of the potential risk of sub-surface contamination at a **long-term, local** effect of **minor beneficial** significance.

##### *Risks to Site Workers and the Public*

- 13.129 As highlighted above, the legislative and regulatory framework set out to protect construction site workers and the public would be implemented as part of demolition and construction works for all four Development Scenarios, including implementation of an EMP. The EMP would also serve to reduce contamination risks posed by construction works, through adoption of appropriate site practices, e.g. storage of materials. Consequently, the residual risk to construction workers and the public would remain **negligible** for all four Development Scenarios.

##### *Risk to Water Resources*

- 13.130 The potential risks to underlying aquifers from all piling works associated with all four Development Scenarios would be minimised through the adoption of best practice and appropriate piling methods, in accordance with EA guidance and a Foundation Works Risk Assessment Report, which would be agreed with the EA. As such, the residual effect of piling upon water resources would remain **negligible** for all four Development Scenarios.
- 13.131 Accordingly, the risk posed by potential lateral contamination migration within aquifers to ponds and lakes at Buckingham Palace Gardens and St James Park or to the River Thames would remain **negligible**.

##### *Contamination of the Ground during Construction*

- 13.132 Despite the adoption of an EMP, a precautionary approach should be taken to account for any unforeseen accidental spillages of pollutants during construction. As such, a **short-term, local risk** of **minor adverse** significance relating to contamination of the ground during construction for all four Development Scenarios would remain.

##### *Identification and Disposal of Unexploded Ordnance*

- 13.133 The management of potential unexploded ordnance, as described above, would follow legislative requirements and best practice. As such, the residual risks posed by unexploded ordnance for all four Development Scenarios would remain **negligible**.

### Completed Development

#### Development Scenarios 1, 2, 3 and 4

##### *Risks to Future Site Occupants and Users*

- 13.134 The inherent hardstanding capping layer within the four Development Scenarios would encapsulate any residual underlying contamination. Furthermore, areas of soft landscaping would be set within an appropriate thickness of clean, inert material. As such, the residual risk to future occupants and site users would remain at a **negligible** level.

##### *Risk to Water Resources*

- 13.135 Assuming the correct and appropriate installation of piles, the residual risk of the four Development Scenarios to ground and surface water resources would remain **negligible**.

##### *Risks to Flora and Fauna*

- 13.136 The inherent capping of all landscaped areas from the prevailing ground conditions would maintain the residual risk to flora and fauna as **negligible**.

##### *Contamination of the Ground by the Completed Development Scenarios*

- 13.137 The proposed land uses within the four Development Scenarios do not pose a significant risk of contamination to underlying soils or groundwater and as such, the residual effect of all four Development Scenarios would remain **negligible**.

### SUMMARY AND CONCLUSIONS

- 13.138 This assessment has identified the potential sources, pathways, and receptors associated with the sites of the three applications and, therefore, the four Development Scenarios. In summary, there is a recognised potential for contamination within underlying soils and groundwater from historical operations. However following the implementation of appropriate mitigation measures (including further detailed site investigation and the implementation of an EMP) and adoption of best practice guidance, risks to identified receptors during both the demolition and construction and completed stages of all Development Scenarios are considered to be **negligible**. Furthermore, the removal of a significant volume of potentially contaminated material, particularly through excavation of the basement, as well as the upgrading of the ageing sewer system, may result in long term improvement to underlying soil contamination levels.