West Southall Masterplan Environmental Statement Volume 3 Technical Appendices October 2008

On behalf of:
National Grid Property Limited

TECHNICAL APPENDICES 3

Appendix 13.1 Baseline Conditions

Baseline conditions

The site has been subject to extensive investigation since c. 1998 by White Young Green and third parties. The following baseline conditions have been reported either through the extensive site investigation / survey works, from existing environmental databases and information provided by statutory authorities and consultees. For full details of the historic use of the site refer to Chapter 12, Ground Conditions.

Hydrogeology and Hydrology

The summary of the hydrogeology and hydrology presented is based upon readily available sources including the British Geological Surveys 1:50,000 Map sheet no. 270 titled 'South London', Groundwater Vulnerability Map of West London sheet no. 39 and findings from Main Site investigation works.

Hydrogeology

The ground beneath the site is classified by the Environment Agency as a Major Aquifer within the shallow strata of Taplow Gravels and also the deeper chalk formation. The classification suggests that the underlying strata is a significant resource and is able to support large abstractions. Soils beneath the site are classified as having a high leaching potential with respect to migration of contamination to the designated controlled water (Major Aquifer).

Groundwater flow within granular material comprising the Made Ground, brickearth / alluvium and gravel is a function of inter-granular flow with the permeability controlled by the fine material, especially clays and silts, occupying the pore spaces between the larger sand and gravel particles.

Groundwater flow directions are influenced by the fact that the subsurface down to a significant depth (2 – 5m) within the Taplow gravels is not homogenous, the naturally occurring structure has been significantly disturbed by both the removal of strata (gravel / brickearth) and the presence of subsurface obstructions within the Main Site. Furthermore the overall extent of the site and the variable presence and integrity of hardstanding have a controlling effect on rainfall infiltration. Hence variable groundwater recharge may possibly distort local groundwater flow patterns. The presence of three infilled docks adjacent to the canal are likely to influence groundwater flows locally.

Groundwater flow has local variations across the Main Site but can generally be interpreted as flowing towards the Yeading Brook in the western and central areas, with apparent local variation to this general trend in the extreme eastern areas of the Main Site. The gradient is very shallow and may locally and periodically alter. These observations indicate that a significant potential exists for the recharging of the Yeading Brook from the Taplow Gravel aquifer.

There is one obsolete abstraction license within 2000m west of the Main Site at Apexes Works, it is understood that proposals have been made to demolish this abstraction location if not already done so, therefore it is of limited sensitivity to impact from the site. There is one active abstraction approximately 2100m east of the site with a minor abstraction rate of $2m^3$ per day for a local remediation project. The limited abstraction rate combined with the distance from the site indicates it is unlikely to be significantly influenced by the proposed development site.

Hydrology

Surface watercourses adjacent to the site comprise the Grand Union Canal (level with or slightly below the level of the site) and Yeading Brook (approximately 3 - 4m below the level of the site), which are both located adjacent to the north western boundary of the Main Site. Additionally, an engineered, concrete-lined flood relief channel is present running parallel to the Hayes Bypass. This channel would be crossed by the proposed Pump Lane Link Road. It has not been classified by the Environment Agency in relation to its quality designation.

Grand Union Canal

The Grand Union Canal flows in a north to south direction and forms the northwestern boundary of the Main Site. Historical information suggests that the canal was constructed using brick walls locally repaired with sheet piles to form the banks with the base sealed from the underlying Taplow Gravels by a puddled clay liner. Discussions with British Waterways, the owners and operators of the canal, indicate that in places this lining may be missing, however the hydrogeological assessment for the site indicates that waters from the canal will preferentially leak into the site as opposed to groundwaters below the site recharging the canal. Three docks historically provided access from the canal into the Gas Works. These are understood to have been infilled between 1966 and 1979 with demolition and hardcore material, the mouths sealed with steel sheet piles and possibly also puddle clay (the integrity of this sheet piling has not been determined). It is assumed that the likely construction sequence for infilling would have been to place the hardcore and then use this to provide a firm base from which the sheet piles could be installed. During ground investigation works groundwater seepages within the infilled docks were encountered between 0.8 and 3mbgl.

Three discharge points have been identified to drain into the Yeading Brook. A large concrete drain discharge is situated just north of the sites boundary. Previous site inspections have noted a rusty brown discolouration of outflow in this location. A small drain discharges close to the large Grand Union Canal overflow 'weir'. This too has recorded a discolouration and foaming in the outflow in the past. The third drain connects to the canal overflow weir system.

The Canal is classed as a Poor (Class E) quality watercourse. Surface water samples taken at an up, down and mid stream location, recovered in 2000 as part of the site investigations reported the canal to have levels of ammonium and phenol above the Environmental Quality Standards (EQS) set by the EA, which are currently the most appropriate guidelines for surface water chemistry in the UK.

Samples from 2003 indicate that Polyaromatic Hydrocarbons (PAH) is in excess of the EQS in the canal section adjacent to the Main Site, although up and downstream PAH levels fall back to below the EQS. Also the Chemical Oxygen Demand (COD) and the Biological Oxygen Demand (BOD) of the canal were in excess of site screening values adjacent to and downstream from the Main Site.

Yeading Brook

The Yeading Brook flows in a northeast to southwest direction and is located to the north of the Grand Union Canal. The surface water of the area has the potential to be influenced by the groundwater conditions of the Main Site via groundwater flow within the gravel and via man-made conduits such as sewers. Drainage points are known to discharge into the Yeading Brook and small pipes, locally, into the Canal. Yeading Brook water samples from 2001 show levels of ammonium above the Environmental Quality Standard, there were also some limited occurrences of elevated PAH, cyanide and chromium although they were not considered widespread. Discussions with the EA indicate that the quality of the Yeading Brook is being impacted to some extent by activities and discharges upstream of the site.

White Street sewer is located between the existing NGG gasholders east compound and decommissioned west compound (now part of the development site) and has historically been used to drain residential/industrial areas to the south. It is now thought to have been decommissioned, although it is still present below the Main Site and passes below the Grand Union Canal, via a siphon, ‘discharging’ into Yeading Brook. The sewer has been surveyed using close-circuit television (CCTV) to establish serviceability and current state of repair, which has been determined as poor.

<u>Surface Water Drainage</u>

Drainage on the Main Site has been greatly affected by its historical redevelopment phases and demolition. At present surface water is observed to pond in some areas whilst infiltrating through permeable deposits in others. Surface water drainage of impermeable hardstanding areas comprises a combination of recently installed local drainage and connection to historic drainage networks especially in the proximity of the gas holder area.

Rainfall upon permeable site surfacing will infiltrate rapidly through soil strata providing direct recharge to groundwater. The overall extent of the former Gas Works and the variable presence of hardstanding will have a controlling effect on rainfall infiltration and hence groundwater recharge possibly sufficient to locally distort groundwater flow patterns.

Drainage outside of the Main Site in the areas of the proposed access routes is currently almost wholly by direct infiltration into the ground. With relation to the Eastern access, the urban profile of the local area will ensure that surface water is directed into the local drainage and sewerage network.

<u>Discharges</u>

There are three discharge consents identified within 1000m of the centre of the site. One is for a sewage over flow 400m northeast of the site, the other two are for roof water drainage to the River Crane from buildings at an industrial estate 700m north to northwest of the site.

Flood Potential

The Main Site does not fall within the floodplain of the Yeading Brook however, the proposed access routes, Pump Lane Link Road, Minet Country Park Footbridge and the Springfield Road Footbridge are to be constructed partly within or span over the Functional Floodplain (land where water has to flow or be stored in times of flood) of the Brook. Therefore, a Flood Risk Assessment (FRA) has been completed to address the hydrological and hydraulic implications of these identified access routes. Detailed information is provided in the "Southall Gas Works Flood Risk Assessment Report" – March 2008. The Environment Agency is the regulator in relation to flood risk and detailed consultation has been completed both historically and recently in relation to the potential for flooding.

During periods of heavy rainfall, ponding of water on the Main Site surface has been observed, due to the current variable managed drainage which is suspected to be inadequate. A new effectively designed system would address this. The Main Site is elevated approximately 3 - 4 metres above the Yeading Brook 100-year flood plain so flood potential, on the main site has not been considered further.

Rainfall

The average annual rainfall for the site is advised by the Meteorological Office to be in the region of 700mm/year, with a net infiltration estimate for the site being 88.8mm/year.

Summary of Site Investigations

During the course of the borehole investigations on the Main Site, groundwater was encountered at all locations. Groundwater ingress was observed at depths varying between 0.2 and 4.5m bgl (below ground level).

Local minor ingress within the Made Ground generally occurred rapidly rising from between 1.3 and 0.2mbgl to between 1.2 and 0.2mbgl in 20 minutes.

Groundwater strikes in the Made Ground generally occurred only in the western area of the former Gas Works. Detailed assessment of groundwater within the Made Ground has been undertaken and is discussed in Appendix 13.1. In summary, it is assessed that perched groundwaters within the Made Ground will be in hydraulic continuity with those contained within the Taplow Gravels. Indeed there is little obvious differentiation between the two.

The report (Appendix 13.1) notes that ingress within the Terrace Gravels generally occurred rapidly, rising from between 4.5 and 2.00mbgl to between 3.5 and 1.4mbgl in 20 minutes. Groundwater strikes in the Terrace Gravel were almost ubiquitous across the site and it represents by far the dominant water body. In boreholes 103,109,112 and 114 (see Figure 13.1) groundwater was struck twice. An oily sheen and oil contamination was noticed on groundwater from boreholes 102, 103, 104, 106, 111, 112 and 114.

Subsequent monitoring of groundwater in standpipes installed to respond to water in the gravel (which corresponds to a basement car parking level after the site's development of approximately 31 to 32.8m AOD) indicated groundwater levels ranging between 0.45 and 2.7mbgl. The interpretative contours of the groundwater monitoring results are presented in Figures 13.2 - 13.9.

Permeability tests undertaken on the gravels indicate values of between $7x10^{-6}$ and $2x10^{-5}$ m/day.

Interpretation of Groundwater Regime

The groundwater regime at the Main Site has been shown to be complex, of very gradual gradient and variable, likely to be strongly influenced by the underground structures, services and past mineral extraction activities, as well as by the prevailing natural geological conditions. A diagrammatical interpretation of groundwater flow during the site monitoring is presented on Figures 13.2 - 13.9 showing general low gradients towards the Yeading Brook, with associated mounding in the centre of the site.

Groundwater influenced by the site has been identified as two bodies; <u>perched</u> groundwater in the Made Ground and <u>shallow</u> groundwater in the Terrace Gravel deposits. Deep groundwater at the site, present in the Chalk deposits, has not been investigated due to the thickness, and the low permeability, of the overlying London Clay. Subsequently groundwater within the Chalk is not considered to be at significant risk from contamination originating at the former Gas Works Site.

The perched water in the Made Ground was encountered mainly in the western area where separate strikes were recorded both in the Made Ground and the Terrace Gravel Deposits. In the eastern area groundwater strikes were generally recorded in the Terrace Gravels only. Perched water is not consistent across the site and is likely to be in continuity with shallow groundwater.

From the initial and subsequent monitoring visits, shallow groundwater flow directions are estimated to be generally towards the Yeading Brook. The flow is slow and sensitive to changes in weather and seasons etc. A locally radial flow is seen towards the southeastern boundary of the former Gas Works, in the general direction of the Grand Union Canal, 1km to the south. As a result of the differences in the levels of water in the Canal and those within the ground it has been assessed, in agreement with the Environment Agency and British Waterways, that groundwaters beneath the site will not recharge those within the Canal. Indeed, as a result of the thinning of the lining within the Canal, waters contained therein are assessed likely to leak into the aquifer. However general groundwater movement is proven towards the Yeading Brook.

It is known that in central (Area D, Figures 12.4 and 12.5) and northeastern (Area B) areas of the Main Site, brickearth has been extracted historically. Subsequent backfilling to permit development with higher permeability material appears to have had the result of creating localised sumps, draining the shallow groundwater towards their lowest points. Leakages into service drainage pipes, which are anticipated to be in the vicinity of this area, are also possible sources of variations within groundwater flow. The location of one of the former canal docks, now infilled, is judged to traverse this area of the site, approximately to the north of BH101 and BH105. It is likely that this has had a significant effect on the groundwater flow patterns in this area of the site.

The groundwater levels are recorded as highest in February, as expected after characteristic groundwater re-charge over the winter months. As a result, the hydraulic gradient across the site is steeper at this time, thus the flow of groundwater is likely to be increased, but still at a very slow rate.

Interpretation of Surface Water Regime

The relationship between the Canal and the Brook is illustrated on the schematic conceptual cross section of the site presented in Figure 13.20. The Canal is clay lined and set at a higher level than the Brook, therefore it is likely to be hydraulically isolated from groundwater in the gravel and surface water in the Brook. Although in the past flow into the Canal has been reportedly observed from the infilled docks, on site, and overland across the towpath, no evidence for ongoing contamination has been identified from the results of this monitoring or observations.

The Yeading Brook has the potential to be influenced by the groundwater conditions within the Main Site via groundwater flow within the gravel and via man made conduits such as surface water sewers e.g. the White Street sewer.

The results of recent monitoring indicate very little evidence of significant contamination in the Yeading Brook or the Canal as a result of the Main Site, especially in the area context.

Groundwater Contamination – Main Site

Groundwater impact from the presence of phenols and to a lesser extent PAH has been identified over large areas of the former Gas Works Site. The results of site investigation works undertaken by WYG and others confirmed the presence of these two contaminants although at relatively different concentrations and at slightly differing geographic localities. This is to be expected given the dynamic nature of groundwater and the time elapsed between surveys.

The results of monitoring of the distribution of groundwater contamination across the site indicate that significant fluctuations in the concentration of contaminants occur, but with generally consistent elevated areas identified throughout the monitoring period. The distribution of phenol and PAH contamination is illustrated on Figures 13.10 - 13.19.

Elevated concentrations of phenols were consistently identified from Borehole (BH) 106 immediately to the west of the NGG holder areas, and from the borehole (BH101) installed in the central eastern area of the site in the approximate locality of the area of former mineral extraction. Elevated concentrations of

PAH were consistently identified to the southwest and north of the NGG holder area. Generally the highest concentrations on the site were identified in the former process areas of zone D, however other significant exceedances in areas away from the historical defined process areas, also exhibit phenol and PAH contamination particularly below the decommissioned holder area which is now incorporated into the development. The eastern site area and the areas southwest of the gas holders exhibited the most significantly elevated levels of TPH. Localised elevated chromium was recorded in the eastern area of historic spent oxide, coke and coal storage. Benzene, cyanide and ammonium were detected site wide at elevated concentrations.

The Quantitative Risk Assessment (QRA) exercise highlighted that the western area of the Main Site represented a risk to the Yeading Brook from contamination with PAH's, aliphatic and aromatic TPH's and ammonium in both areas. Additionally, Phenols, BTEX and cyanide were identified in the east of the site. The QRA also highlighted that a risk to the Yeading Brook may be present from ammonium and aromatic TPH concentration in soil of the western area of the Main Site. The QRA indicated the Grand Union Canal may be at risk from concentrations of benzene and aromatic TPH band C_8-C_{21} in the eastern part of the site where a gravel pit was formerly located.

Supplementary groundwater monitoring undertaken in October 2007 indicates widespread groundwater contamination beneath the site, consistent with previous groundwater data. Groundwater encountered within the western gasholder area consistently recorded elevated concentrations of speciated PAH compounds. Heavy metal compounds were also recorded.

A single groundwater sample obtained from the eastern gasholder area noted that contamination in this area was considerably lower in this area than in other investigated areas.

Recent monitoring has identified consistently high concentrations of speciated PAH compounds and heavy metals across the southwestern and northern areas of the site.

Groundwater Feasibility Trials

Four remedial techniques were trialled for removal of organic contaminants from groundwater between June and August 2004. In summary these techniques were; Soil Vapour Extraction (SVE), Bio-Sparging, Steam Injection and Chemical Oxidation. On the basis of the success of various remediation techniques the recommended remediation techniques to deal with the removal of organic contaminants from the shallow aquifer at the site are a combination of Steam Injection and Soil Vapour Extraction.

Pump Lane Link Road – Groundwater Contamination

As detailed in 13.3.11, ground investigation works consisting of 4no. cable percussive boreholes and 27no. trial pits were carried out on this site. chemical analysis of groundwater samples indicates some degree of groundwater impact to the northeast of the propose road through the presence of traces of Nickel, Chromium, Cadmium, Copper, Selenium Zinc, Thiocyanate, Total Cyanide, PAHs and TPH (predominantly diesel-range compounds) in certain zones only within the shallow aquifer. This is assessed as **low** risk.

Analysis of samples taken from the Yeading Brook indicated that the water quality at both up and down stream sampling locations is comparable. Slightly elevated concentrations of TPH and Zinc were recorded in both the up and down stream samples.

Springfield Road Footbridge – Groundwater Contamination

Chemical analysis of soil leachate samples obtained within the recent WYG ground investigations indicates slightly elevated Copper (14µg/l), lead (45 µg/l), zinc (34 µg/l) and anthracene (0.02 µg/l) in soil leachate samples. Some limited groundwater impact was detected with slightly elevated copper (5 µg/l) and zinc (18 µg/l) were recorded in groundwater. This is assessed as l**ow** risk.

Eastern Access (linking to South Road) – Groundwater Contamination

It is considered unlikely that significant areas of contamination exist along the route. Subsequently it is assessed that the risk posed from the generation of leachate is **low**.

Minet Country Park Footbridge – Groundwater Contamination

Groundwater chemical analysis obtained during the recent ground investigation indicate slightly elevated copper (6.3 µg/l), lead (7.6 µg/l) and zinc (20 µg/l) in soil leachate samples. Some limited groundwater impact was encountered with slightly elevated sulphate (280,000 µg/l), anthracene (0.03 µg/l), lead (5.4 µg/l) and zinc (8.1 µg/l). This is assessed as **low** risk.

Surface Water Conditions

The summary of the results during the recent site investigation and the location of sampling points for the Grand Union Canal and the Yeading Brook are illustrated in Figure 13.20.

Grand Union Canal

Samples of canal water collected in February 2000 recorded a slight presence of phenol (C5, 18.1µg/l). Repeat sampling in June 2000 (C8) indicated lower concentrations. Canal sampling localities are indicated on Figure 13.20. Some traces of phenol occurred both upstream (i.e. before any potential Gas Works influence) and downstream of the site and given area context and water classification 'E' (poor) this is not an unexpected situation.

Samples of Canal water collected during October 2007 in the three locations (upstream, downstream and adjacent to the site) indicates slightly elevated concentrations of heavy metals, copper, lead and zinc, total ammonium and total cyanide and iron.

Yeading Brook

Samples of Yeading Brook river water collected in February 2000 showed the Brook to have levels of ammonium significantly above the Environmental Quality Standard, also cyanide was also detected in one instance. Although a source has not been identified contaminant levels within the Brook as it enters proximal to the site suggest contamination sources exist upstream of the main site.

In March 2002 the chemical and biological oxygen demand (COD & BOD) of the water bodies mainly fall within the EQS guidelines. However, the BOD is in slight exceedance in one instance indicating the river could potentially be eutrophic although the oxygen levels are not likely to be excessively depleted.

The data from the Brook for May 2003 shows once again that the BOD is elevated at the sampling point adjacent to the Main Site; this once again indicates the possibility of river de-oxygenation. However, the levels up and downstream of the site are below levels of concern indicating if there is any such problem it may well be influenced by the site but on a localised basis with little impact of the Brook in its entirety. There is one notable level of PAH detected in the Brook at the upstream of the site which indicates it to be an off site influence.

Chemical analysis of surface water samples taken from the Yeading Brook at locations up, adjacent to and downstream of the site during October 2007 indicate chemical impact of heavy metals copper, lead and zinc and dissolved iron both up and down stream of the site. Notable levels of speciated PAHs were identified in samples taken from the Yeading Brook, particularly in the downstream sample which may indicate impact from onsite sources.

Quantitative Risk Assessment

The results of the chemical analyses from the above detailed investigations were input into a Quantitative Risk Assessment model in order to derive the basis for determining potential environmental risk to controlled water receptors in accordance with latest UK guidance (ref Planning Policy Statement PPS23, and associated DEFRA, Contaminated Land Exposure Assessment (CLR) report 11). No investigation data was available for the four access routes when the QRA was undertaken and as such it does not include for these although their influence compared to site impact is considered likely to be negligible. The results supported the determination and agreement for the appropriate remediation criteria for soils and groundwater. In order to facilitate a manageable model, reflecting the size of the site, the large dataset of information, inconsistencies in the hydrogeological regime and the soil contaminant profile, the site was split into three sub areas, represented by three sub-models.

The models were employed to facilitate the QRA modelling in order to assess potential risks to the Yeading Brook, Grand Union Canal (note; this is not the Grand Union Canal Paddington Branch adjacent to the site's northern boundary but the main Grand Union Canal 1km to the south of the site), and a hypothetical 'sentinel' abstraction located 500m down hydraulic gradient to the south. A 'sentinel' borehole is a hypothetical tool used to emulate the sensitivities of an actual abstraction borehole providing enhanced levels of conservatism to the model. It should be noted that the Grand Union Canal

(Paddington Branch) flowing immediately adjacent to the Main Site's northern boundary was not included within this stage of risk assessment. This was agreed with the EHO of Ealing Borough Council and the Environment Agency (surface water division). This is as a result of the assessment that groundwaters from beneath the site pass under the Canal and are not re-charging the waters contained therein, therefore they are not at risk from contamination identified within the groundwater.

The QRA identified that baseline risks were posed to the Yeading Brook (the primary environmental receptor) by the presence of four organic contaminants, and also from ammonia. Summary tables indicating which 'Contaminants of Concern' the QRA has shown for each distinct area in a site specific context, are presented later in this Chapter.

The QRA was further used to derive site specific remediation target criteria (listed in Table 13.5 below) for the site and agreed with the statutory authorities. This enabled detailed consideration of the scope for the environmental remediation strategy. Following groundwater remediation trials the QRA is to be enhanced and the values are to be confirmed.

Table 13.5 Site Specific Remediation Criteria

	Yeading Brook		Grand Union Canal
	West Area	North Area	East Area
	mg/l	mg/l	mg/l
Ammonia*	11.613	None Required	None Required
Benzene*	None Required	None Required	16.214
PRO (C5-C10)	0.232	None Required	5.405
Napthalene (C12)	0.232	None Required	5.405

The 'Do Nothing Scenario'

If the site were to retain its current site status with the same management applied it is expected that the baseline conditions as described above relating to groundwater and surface water would be anticipated to remain broadly the same.

West Southall

Flood Risk Assessment

For National Grid Property

OCTOBER 2008

DOCUMENT VERIFICATION

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CONTENTS

APPENDICES

FOREWORD

a) Planning Submission

1. This Report is one of a series of documents that has been prepared on behalf of National Grid Property Limited (NGPL), to support an outline planning application with details of all proposed accesses submitted in full for the comprehensive redevelopment of 44.7 hectares of land known as the Southall Gas Works site ('the Application Site'). This Report should be read in conjunction with the drawings and other documents submitted as part of this application, as follows:

- Environmental Statement, including a Non-Technical Summary
- Design and Access Statement (including Landscape and Accessibility Strategy)
- Development Specification
- Planning Statement
- Transport Assessment
- Framework Travel Plan
- Retail Assessment
- Sustainability Strategy
- Energy Strategy including Renewables
- Regeneration Strategy
- Housing Strategy
- Health Impact Assessment
- Remediation Strategy
- PADHI Report
- General Management Strategy
- Statement of Community Involvement

b) Local Planning Authority

2. The application is submitted to both the London Borough of Ealing (LBE) and the London Borough of Hillingdon (LBH) as the Application Site straddles the borough boundaries.

c) Application Proposals

3. The proposals are for a high quality residential-led mixed use development comprising the following:

An outline application for the demolition of the following properties: 16-32 (even) The Crescent; 1-11 (odd) Randolph Road; 137-143 (odd), 249 and 283 Beaconsfield Road; 30 The Grange; the remediation of the land and the redevelopment of the site to deliver a mixed use development for up to: 320,000sqm of residential, up to 14,200sqm for non-food retail, up to 5,850sqm of food retail, up to 1,750sqm of Class A3-A5 uses, up to 9,650sqm of hotel, up to 3,000 sqm of conference and banqueting, up to 4,700sqm of leisure forming a cinema, up to 2,550sqm of health care facilities, up to 3,450sqm of education facilities, up to 3,500sqm of office/studio units, up to 390sqm of sports pavilion, up to 600sqm of energy centre, up to 24,450sqm of multi-storey car park and associated car and cycle parking, landscaping, public realm, open space and children's playspace; and details are submitted for full approval (layout, scale, appearance and landscaping) of the following accesses:

- Pump Lane Link Road – New access road from the Hayes bypass to the Application Site for vehicle, cycle and pedestrian access, including drainage and a flood relief pond.
- Eastern Access – New access road from Southall centre to the site, including land currently occupied by properties on The Crescent.
- Minet Country Park Footbridge – Central pedestrian and cycle access to the Minet Country Park, bridging over the Canal and Yeading Brook.
- Springfield Road Footbridge – Northern pedestrian and cycle access to Minet County Park and Springfield Road.
- Widening of South Road across the railway line - Widening of south road over the railway line for the creation of a bus lane.
- Accesses (3no.) onto Beaconsfield Road.

4. The development shall be carried out in accordance with the Development Specification and the Parameter Plans appended to that document. An illustrative Masterplan (Drawing Ref. 0317_P1017Rev 00) has been devised to demonstrate how the application proposals could be delivered. Further details of the Application Site and proposed development are set out in the Design and Access Statement accompanying the outline planning application.

d) <u>Application Site</u>

5. The Application Site lies to the north of the Wales and Great Western Mainline Railway (with commercial uses beyond), to the south east of the Grand Union Canal (with Minet Country Park beyond) and to the south of residential developments in Southall, extending off Beaconsfield Road. A Grade II Iisted water tower is now in residential use, located adjacent to the south eastern corner of the Application Site. A retained operational gas works compound is located approximately mid-way along the southern boundary of the site. This comprises one working gasholders that creates the principal landmark within the Application Site. Please refer to the Design and Access Statement for further details

1.0 INTRODUCTION

a) Preamble

1.1 National Grid Property is proposing to redevelop the former Gas Works Site at Southall, which lies adjacent to the Yeading Brook. The approximate grid reference for the centre of the site is 512570, 179880.

1.2 This report addresses three matters relating to flood risk: hydrological and hydraulic implications of the proposed accesses across the Yeading Brook; hydrological and hydraulic implications of the Eastern Access; and matters relating to surface water drainage.

1.3 The proposed Pump Lane Link Road, Springfield Road Bridge and Minet Country Park Foot/Cycle Bridge are to be constructed across the Yeading Brook.

1.4 By way of background, a Flood Risk Assessment submitted in 2002 by National Grid considered an alternative alignment for the Pump Lane Link Road. Planning permission was granted for this link road route in the western corner of the former Gas Works site. However, this was subject to certain reserved matters, which had been addressed in a separate Environmental Statement (Pump Lane Link Road Reserved Matters Application Environmental Statement, May 2005). A further FRA (dated July 2006) addressed the Pump Lane Link Road alignment, a vehicular link road to Springfield Road and a foot/cycle bridge (Minet Foot/Cycle Bridge). Each of these were proposed to cross the Yeading Brook as part of the redevelopment proposals. These FRAs were subject to detailed consultation with the Environment Agency.

1.5 The Environment Agency advised in their letter, dated 14 November 2006, that they would not object to applications for the crossings on flood risk grounds if they complied with the recommendation of the FRA (reference Appendix FRA 2). Objections to the principle of Minet Foot/Cycle Bridge and Springfield Road Link Road, however, were maintained on the basis that the Environment Agency considered that the Pump Lane Link Road provided adequate access from the site to the Minet County Park and wished to avoid multi-river crossings.

1.6 The Environment Agency provided an updated hydrological model of the River Crane catchment, but advised that the physical data for the study area section of the model had not changed since the 2002 FRA report.

1.7 This Environment Agency model data was used as a base for a new model to assess the effect of the proposed structures. The new model also incorporated additional topographic data available for the site. The results of the model runs were extracted from the July 2006 report for use within the Version 2 assessment, issued March 2008. Local hydraulic modelling using the HECRAS programme was used to assess the effects of revised arrangements of the watercourse.

1.8 The Environment Agency has since advised that new mapping and modelling has been carried out for the River Crane. These latest flow and level details have been obtained and are used within this report.

1.9 Associated, but integral issues such as ecology, landscaping and ground conditions, have been considered holistically and are reported within complementary documents submitted in support of the planning application.

b) Brief

1.10 This FRA is prepared in accordance with the requirements of Planning Policy Statement (PPS) 25, 'Development and Flood Risk' published by the Department of Communities and Local Government. PPS 25 sets out the framework for planning decisions made by the local, regional and national government and the Environment Agency (EA). In order that planning authorities can make informed decisions on the development of sites in areas at risk of flood, PPS 25 requires the developer to carry out an assessment of flood risk.

1.11 This report addresses the requirements given in Annex E of PPS 25 and other issues which are deemed relevant to flood risk. These requirements include the following:

- Assessment of the magnitude and severity of flood risk to the site.
- Assess suitability of site and development through the use of the Sequential Test & Exception Test (if required).
- Assess impact of proposed development on flood risk to adjacent developments.
- Determine ability of existing and proposed drainage to accommodate development flows with respect to surface flooding.
- Demonstrate that appropriate mitigation measures have been taken to prevent flooding.
- Demonstrate that appropriate emergency situations have been considered e.g. overland flow paths, evacuation routes.

c) <u>Description of the Site</u>

1.12 The redevelopment site is located at the western edge of the London Borough of Ealing and the site has an elongated triangular shape formed by the Grand Union Canal to the north and northwest, and by the Great Western Railway to the south. The Application Site is circa 44ha, and has a maximum dimension, north to south, of about 450 metres and a maximum dimension east to west of about 1500 metres.

1.13 National Grid Gas (NGG) are retaining a single operational gasholder station along the southern boundary of the Application Site. Where appropriate, allowance for draining this area has been made in the infrastructure proposals for the surrounding redevelopment site.

1.14 Due to the previous use of the site as a gasworks, since Victorian times, contamination of the ground has occurred and the drainage systems take this into account. For example, soakaway systems are avoided, as agreed with the Environment Agency. Details of the proposed remediation to facilitate the redevelopment are details in the Remediation Strategy accompanying the planning application;

1.15 The site is generally level and flat, with a slight fall towards the canal and river, to the north and an embankment that rises to meet South Road as it crosses over the railway. A location plan can be viewed in Appendix A. Redevelopment proposals introduce some very gradual level changes.

1.16 Of the area for redevelopment, several large areas of the site are presently used for at grade car parking for users of Heathrow Airport, and other car areas for storage providers. The balance of the site is general disused or overgrown with bases, slabs and foundations of previous industrial developments remaining.

1.17 The area of land proposed for the Eastern Access currently comprises houses, small commercial and industrial units and an area (1500 sqm) of public open space. This will lead to the demolition of some of the properties in this area, as detailed in the description of development. A plan of the existing site can be viewed in Appendix B.

1.18 The site has remnants of the former surface water drainage system, some remaining live, some blocked, and a live waste water system primarily draining the eastern active NGG holders and compound.

d) <u>Location and Watercourses</u>

1.19 The Application Site is located between Hayes and Southall, approximately 1.5km north of Junction 3 of the M4. Refer to Figure 630.

1.20 The Pump Lane Link, Springfield Road Foot/Cycle Bridge, and the Minet Park Foot/Cycle Bridge would all cross the Yeading Brook floodplain.

1.21 The Yeading Brook rises in Harrow approximately 11km north of the site. It then flows south into the River Crane and then eastwards to join the River Thames at Isleworth.

1.22 The River Crane was the subject of a flood alleviation scheme in the early 1990s. This scheme included two flood storage reservoirs in the upper part of the catchment and channel works at five locations. One of the River Crane's flood relief channels is located just east and parallel to the Hayes bypass and joins the Yeading Brook immediately upstream of the railway bridge.

1.23 North of the study area, the Yeading Brook flows in a confined channel between an industrial estate and a housing area. It then enters a wide, flat valley and meanders to the western edge of the study area, where it outfalls through a bridge under the main railway line (which runs from London to the southwest).

1.24 Towards the northern edge of the study area the Brook receives flow from an overflow weir on the Grand Union Canal and a Thames Water surface water drainage discharge which crosses the study area.

1.25 The Paddington Branch of the Grand Union Canal follows a course along the south east side of the valley and adjacent to the site. It is an artificial waterway located at a higher elevation than the predicted flood levels. The proposed accesses would also cross this Canal. This will require clear span bridges, with clearance for barges and space on the banks for towpaths, maintenance, etc. As such, the canal crossings have a major effect on the vertical alignment of the access routes.

e) Hydrology and Existing Hydraulic Performance

1.26 The River Crane catchment, had been, historically, the subject of an area flood study by Peter Brett Associates (PBA) on behalf of the Environment Agency. The report by PBA identified the critical storm duration to be 15.5 hours for this reach.

1.27 Further studies had been carried out by the Environment Agency. The resulting model was utilised in conjunction with updated topographic survey data to more accurately assess potential flood levels and the effect of construction bridges across the brook. The Environment Agency floodplain map, as published on the internet, is shown in Fig 643.

1.28 Subsequently, the catchment has been remodelled as part of a Strategic Flood Risk Assessment. Outputs from this study have been provided and are contained in Appendix FRA 2. This latest information has been overlaid on the topographic survey to identify the functional floodplain and the 1:100 year flood outline. It is understood that the new model was based on Liddar Ground Level data. Some adjustments have been made to the plots in areas where high ground levels have been missed from the Liddar data due to interpolatation across wooded areas. Figure 632/B shows the 1:100 year flood outline, i.e Flood Zone 3, and Figure 643/A shows the 1:20 year flood outline.

1.29 Downstream of the confluence the railway line is carried over the river by a brick arched bridge (Photo 1). The bridge has a limited effect on the flow, with a head loss of 90mm for 1:100 year flood flows.

1.30 It can be seen that the floodplain is contained within an undeveloped valley upstream of the railway bridge. This extends north for approximately 1km as far as Beaconfield Road and Yeading Football Club. Any works proposed would limit any hydraulic effects to within this area.

f) Flood Risk to the Existing Site

1.31 The nearest watercourse to the Application Site is the Yeading Brook, which is located 1km west of the access road network. Interpretation of the Environment Agency's Flood Zone Map Appendix C, indicates that the site is within Flood Zone 1 (land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)); and is therefore suitable for all development, according to PPS25 Table D1.

g) <u>Existing Development Drainage</u>

1.32 Currently all surface water drains into the Thames Water Surface Water Sewers via gullies located along the road networks and parking areas, and pipes and guttering from the houses etc, Appendix D.

<u>Total Area North of the Railway</u> ***10,700 m^2*** *approx* (1.1ha)

<u>Impermeable Areas</u>

Crescent Road	1,400 m^2 approx
South Road	2,600 m^2 approx
Water Tower Roads	1,050 m^2 approx
Garage area	800 m^2 approx
Houses in Crescent Road	850 m^2 approx
Houses in Randolph Road	500 m^2 approx
Play Area	300 m^2 approx
Total Impermeable	***7,500 m^2***

<u>Permeable Areas</u>

Public Open Space	1,600 m^2
Garden	850 m^2
Railtrack	450 m^2
Highway Embankment	300 m^2
Total Permeable	***3,200* m^2**

Typical run-off rates from the existing development north of the railway, for a time concentration of 30 minutes, are presented in Table 2.1.

TABLE 2.1: APPROXIMATE RUNOFF RATES EXISTING SITE (0.75Ha Impermeable Area)

Return Period yrs	Modified Rational Method Calculations		
	30 min FEH Storm (mm)	Storm Volume V (m^3)	Peak Flow Q (l/s)
2	11.5	86.00	47.9
10	21.4	160.00	89.2
20	27.2	204.00	113.3
50	37.0	278.00	154.2
100	46.2	347.00	192.5

h) <u>Existing Sewer Network</u>

1.33 The Thames Water sewer records show a surface water sewer running around Crescent Road and discharging via a 300mm pipe into South Road and hence north.

1.34 A secondary connection at the head of the sewer will allow excess flow to pass down a further sewer in Randolph Road. Whilst we have no knowledge of surface water flooding in the area, the estimated gradient of the sewer is 1:272. This will give a pipe full capacity of around 67l/s. This is close to the Q_5 runoff value for the whole area. Surcharging would provide some extra capacity and it is also likely that the area around the Water Tower drains into the gas works system. The existing system can thus be expected to provide around a 1:5 year return period capacity provided there is no reduction in capacity downstream.

1.35 South of the railway the existing development drains into a 225 mm diameter public sewer which flows to the south. Insufficient details are available to enable an estimate of the capacity of this sewer to be made.

i) <u>Vulnerability Classification</u>

1.36 PPS 25 Table D.2 provides a detailed list of which types of development fall into the vulnerability classifications also defined within PPS 25. This list is recognised as not being exclusive and provides guidance on the various uses and their subsequent Flood Risk Vulnerability Classification.

1.37 The proposed re-development of the West Southall site will provide a mix of uses which will be residential led but also include retail, employment, leisure and community facilities including a health Centre and primary School. Therefore, the flood risk classification indicates that this falls within the **"More Vulnerable"** classification for the residential development, health and educational components and **"Less Vulnerable"** for the employment and retail components.

j) <u>Sequential Test</u>

1.38 A sequential test has not been undertaken by the local planning authorities, either in compliance with PPG 25 or PPS 25. However, this is not applicable in this case, because the site is located in Flood Zone.

2.0 YEADING BROOK

a) Proposed Structures

2.1 There are three proposed structures over the Yeading Brook (reference Figure 644), which comprise:

a) Pump Lane Link Road Crossing
b) Minet Park Foot/Cycle Bridge
c) Springfield Road Foot/Cycle Bridge

2.2 In addition, all the structures would need to cross the Grand Union Canal, and Pump Lane Link Road would also cross the Yeading Brook flood relief channel.

b) Pump Lane Link Road Crossing

2.3 This crossing is required to carry a three-lane road across both the Yeading Brook and the flood relief channel (a short distance from their confluence), as well as over the Canal, and forms essential access infrastructure for the overall development.

2.4 No suitable alternative sites for the link road have been identified. Alternative alignments of this crossing were the subject of Flood Risk Assessments, carried out by White Young Green in November 2002 and 2006.

2.5 The Environment Agency's previously approved solution comprised a highway embankment with a 17.5m span bridge over the Brook, a 5.5m span culvert over the flood relief channel, a diversion of the flood relief channel to minimise the length of culvert required, compensation storage formed by excavating within the bank of the flood relief channel north of the crossing, and flow attenuation provided for the peak run off from the new highway.

2.6 A similar strategy has been adopted for the new crossing. However, with the revision of the route to the north, the opportunity has been taken to provide enhancement to the diversion of the flood relief channel and a corresponding greater span over the combined Brook and channel, thereby avoiding culverting, which was not an Environment Agency favoured solution in the previous application.

2.7 This crossing creates the majority of new impermeable area of around 4,800m^2.

2.8 This can be considered in three sections:-

- The extreme western section has an existing drainage system discharging into the Yeading Brook. This will be maintained as far as possible. Some relocation of gullies will be required.

- From the edge of the existing Pump Lane carriageway to the Grand Union Canal. It is intended to drain this area to the low point in the region of the existing by-pass channel.

2.9 The discharge flow will need to be reduced to a peak of 11.5l/s for flows generated by rainfall of up to 1:100 year return period together with a 30% increase to allow for climate change.

2.10 This will require around 260m^3 of storage. It is anticipated that this will be contained within the modified upper section of the abandoned flood relief channel. The calculations show that for the volume of storage assessed, the peak can be restricted to a maximum of 11.5 l/s using a Hydrobrake control. If a throttle pipe is used the predicted discharge increases to 12.8 l/s for the 100 year plus 30% climate change event. However, the storage volume used excludes the volume available north of the embankment and as a throttle pipe is hydraulically inefficient a closer match to lower return period greenfield run-off rates will be achieved. Therefore, it is recommended that the outflow should be controlled by a throttle pipe. An overflow weir would be provided to protect the bank of the Brook.

- East of the Grand Union Canal – this will discharge in to the main site drainage system.

2.11 A schematic layout of the Link Road drainage system is depicted in Figure 649.

Sequential and Exception Tests

2.12 The floor of the valley is predominantly Flood Zone 3b (functional floodplain). PPS 25 Table D.1 states:

> "**Zone 3b the Functional Floodplain**
>
> **Definition**
> **This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).**
>
> **Appropriate Uses**
> **Only the water-compatible uses and the essential infrastructure listed in Table D.2 that has to be there should be permitted in this zone. It should be designed and constructed to:-**
>
> - **Remain operational and safe for users in times of flood.**
> - **Result in no net low of floodplain storage.**
> - **Not impede water flows.**
> - **Not increase flood risk elsewhere.**
>
> **Essential infrastructure in this zone should pass the exception test.**
>
> **FRA Requirements**
> **All development proposals in this zone should be accompanied by an FRA. See Annex E for minimum requirements.**
>
> **Policy Aims**
> **In this zone, developers and local authorities should seek opportunities to:-**
>
> - **reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and**
> - **relocate existing development to land with a lower probability of flooding."**

2.13 PPS 25 Table D.3 requires that the exception test be passed for essential infrastructure to be constructed in Flood Zone 3b, stating:-

> **"D9. For the exception test to be passed:-**
>
> **a) It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by an SFRA where one has been prepared. If the DPD has reached the 'submission' stage – see Figure 4 of PPS 12: *Local Development Frameworks* – the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal.**
>
> **b) The development should be on developable[23] previously developed land or, if it is not on previously developed**

land[24], that there are no reasonable alternative sites on developable previously developed land, and

c) An FRA must demonstrate that the development still be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall."

2.14 In respect of (a) above the benefits to the community conveyed by the overall development are presented in other reports submitted with the application.

2.15 In respect of (b), the section of the link road crossing the flood zone is on undeveloped land. A road link from the development into Hayes and linking into the area network is essential and must cross the Yeading Brook. The only other possible location was a link to Springfield Road at the north of the Application Site. This was less suitable in terms of highway capacity and community impact. During negotiations in respect of the previous applications the local planning authority received consistent objections from the Environment Agency on the basis that they did not consider it to be necessary.

The approximate location of the crossing is thus fixed. However, the new alignment has now been adjusted to minimise impact on the floodplain whilst avoiding construction in close proximity to Network Rail's land.

2.16 Item (c), flood risk and hydraulic design are discussed below.

Flood Relief Channel Diversion

2.17 This involves the abandonment of around 225m of highly engineered U-shaped concrete channel.

2.18 The alignment of the proposed Pump Lane Link Road has presented the opportunity to create an enhanced diversion, in a more natural channel, provide a larger full span bridge for the crossing and avoid culverting.

2.19 The proposal includes provision for the flood relief channel to be directed to the left and join the existing brook just upstream of the link road.

2.20 An enlarged, combined channel would then follow the route of the Yeading Brook until it reaches the existing hard engineered section just upstream of the existing railway bridge confluence.

2.21 The channel will be a 2 stage channel and have a trapezoidal low flow channel with a circa 2.0m bed width with a high flow section of approximately 2m ledge width. Bank slopes will be an average of 1:3. Hydraulic calculations (Appendix FRA 6) show that as a result water levels upstream of the bridge will increase by between 20mm and 40mm for the flows analysed. This is negligible within the context of the valley and the back water effect will result in unchanged water levels within a short distance upstream.

2.22 Yeading Brook at this location is in close proximity to major infrastructure - the Hayes by-pass, the proposed link road and the main London to the West of England railway line. It is therefore necessary to ensure that the channel does not change course. Whilst flow velocities are predicted to be relatively low, constant flow and wavelets can cause significant erosion over time.

2.23 It is, therefore, intended that the low flow channel banks shall be protected by sensitively detailed rock armour at bends and junctions. This form of protection naturalises rapidly above the water surface, particularly if the surface is topsoiled, and provides a variation in habitat below the water surface, essentially providing an area of large gravel. Other forms of protection may be considered during the detailed design phase, e.g. pre-planted coir rolls (Photos 3 & 4 show typical uses of rock armour elsewhere).

2.24 The establishment of mature vegetation on the higher levels of the banks will provide protection during the shorter duration of flood flows.

2.25 The proposed route of the diversion is shown on Figure 646 and typical construction details on Figure 647.

2.26 Land drainage consent will be required for these proposals.

Yeading Brook/Flood Relief Channel Bridge

2.27 As a result of combining the channels, the bridge will be required to pass a $Q_{100+20\%}$ flow of $25.95m^3/s$ without affecting other properties. A clear span of 23m would achieve these objectives.

2.28 In order to maintain a wildlife corridor along the watercourse, a clear width of 4m will be provided between the main channel bank top and any abutment.

2.29 The soffit of the bridge would be a minimum of 600mm above the $Q_{100+20\%}$ flood level. The bridge levels are constrained by the existing road levels at Pump Lane and the need to pass over the Grand Union Canal. It is anticipated that the soffit will be around 1.5m above bank level at the west end and 2.5m above bank level at the east.

2.30 The local hydraulic model (Appendix FRA 6.1) indicates a 10 mm increase in the upstream water level compared to the proposed channel configuration without the bridge.

2.31 The total predicted increase in water level is thus between 30mm and 50 mm immediately upstream of the bridge for all the flows analysed. This rise is too small to affect the plotted extent of the floodplain.

2.32 The global model used in the previous FRA indicated that a 12mm increase in backwater had reduced to zero within 200m upstream.

Road Support Embankment

2.33 The proposed Pump Lane Link Road would be constructed on an embankment across the floodplain. The embankment's footprint will reduce the potential volume of flood storage by approximately $3,400m^3$. This volume is too small to have any impact on flood flows as assessed by the river model.

2.34 Notwithstanding the above, the effects of loss of storage are cumulative and so it is proposed to excavate an equivalent volume upstream of the crossing outside of the existing floodplain as agreed previously with the Environment Agency.

2.35 In discussions with the Environment Agency and Hillingdon Council's Conservation Officer, an area adjacent to the flood relief channel was identified as being a suitable location for a compensatory storage site. The storage would be formed by excavating a layer from the channel bank which is already an artificially formed surface.

2.36 Embankment volumes within the floodplain and excavation volumes in the proposed storage area were obtained from the design drawings using MX 3D software. The results are presented in Appendix FRA 6.3 and demonstrate that a close correlation in volumes can be achieved.

2.37 It should be noted that in order to achieve the match, a large volume of material (approximately $8,000m^3$) will have to be excavated from above the predicted $Q_{100+20\%}$ flood level for Pump Lane.

2.38 This may be of consideration in assessing other development proposals in the valley, e.g the possible expansion of Yeading Football Club.

2.39 It is anticipated that, subject to geotechnical assessment, the excavated material will be utilised to form the Pump Lane embankment.

2.40 Typical details of the compensatory storage area are given in Figure 648.

2.41 In addition, a tunnel would be provided through the embankment, in the form previously agreed with the Environment Agency, to mitigate any obstruction to wildlife movement.

c) <u>Minet Country Park Foot/Cycle Bridge</u>

2.42 A new bridge is required to provide pedestrian and cycle access for the new development, across the Canal and Brook into the Minet Country Park area. This is presented as both desirable and essential infrastructure as evidenced by the other supporting documents in the planning application and responses to requests of the planning authorities. PPS 25 requires the exception test to be passed if the structure is within Flood Zone 3. Parts (a) and (b) of the exception test are covered in other supporting documents. Flood risk is considered below.

2.43 The bridge would be formed from a series of three interlocking hyperbolic paraboloids providing a span of around 60m across the floodplain, with a central foundation between the Canal and the Yeading Brook, and end supports. The soffit would be a minimum of 600mm above the $Q_{100+20\%}$ level (Appendix FRA 4). The footings for the bridge are all in Flood Zone 1, i.e. low risk.

2.44 Analysis of the latest Environment Agency's flood model results show that the ground outside the bank tops is above the functional floodplain and that the Flood Zone 3a area to the west of the brook is actually protected. It is noted, however, that there is a gap in the defence embankment, around 200m upstream of the bridge. At this point the top of bank level is approximately 77.45m AOD. The predicted Q_{100} level at this location is approximately 27.3m AOD and the predicted $Q_{100+20\%}$ is approximately 27.44m AOD.

2.45 As the western end of the bridge gives access to the parkland, it is intended that the landing from the abutment will follow the top of the existing flood defence embankment. This alignment keeps the pedestrian access outside the 1:100 year floodplain and also avoids the Yeading Football Club pitch (and a proposed relocation of the pitch).

2.46 The landing also crosses a drainage ditch which serves the lower lying area behind the river bund. A pipe culvert will be provided so as to maintain a drainage connection to the football pitch area.

2.47 The proposed layout of the paths and ditches in this location are subject to amendment as proposed improvements to Yeading Football Club facilities may also impact this area.

2.48 Passages for wildlife would be available both sides of the ramp until the entire area is inundated. At the closest point, the abutment would be at least 4m from the top of the bank.

2.49 The main spans of this bridge will have no effect on the impermeable area of the floodplain, as it is proposed to form the deck from perforated steel plate allowing run-off to fall in close proximity to its natural landfall.

2.50 There will be a short ramp at the western end. A ramp length of around 55m will be needed to bring the footway down to existing ground level. It is anticipated that this will be formed from permeable or semi-permeable material. The runoff volumes will be too small to permit any practical methods of attenuation.

d) <u>Springfield Road Foot/Cycle Bridge</u>

2.51 A new bridge is required to provide cycle and pedestrian access from the north west of the development to Springfield Road.

2.52 This is presented as both desirable and essential infrastructure as evidenced by the other supporting documents in the planning application and responds to requests of the planning authorities. PPS 25 requires the exception test to be passed if the structure is within Flood Zone 3.

2.53 The route is dictated by the connection point to the development and the requirement to connect to Beaconfield Road.

2.54 The bridge would comprise a two span structure from the northwest of the Gas Works Site to Beaconsfield Road north of Yeading Football Club ground. The alignment utilizes space provided by Yeading Football Club, which is relocating approximately 30m to the south as part of planned improvement works for the football pitch.

2.55 The spans average 49m over the Brook and 56m over the canal.

2.56 There will be an intermediate support founded on buried pile caps. This is outside Flood Zone 3 and is approximately 11m from the Yeading Brook bank top at its closest point.

2.57 An approach embankment is required at the northern end of the bridge. This will be based on ground above the 1:100 year floodplain and would be a minimum of 4m from the bank top of the conveyance channel. The main spans of this bridge will have no effect on the impermeable area of the floodplain, as runoff will be directed over the sides to fall in close proximity to its natural landfall.

2.58 The ramp from the bridge to Springfield Road will create around 200m^2 of impermeable surface. This is too small an area to allow practical methods of flow attenuation and so it is anticipated that drainage will utilise existing facilities in the area. Additionally, it is likely that most of the ramp length will simply drain over the edge into adjacent landscaped areas.

e) <u>Construction Stage Flood Risks</u>

2.59 In parallel with consideration of the impact of the completed crossings, it is also critically important to establish an Construction Environmental Management Plan (CEMP), which considers the potential flood risks during the construction stage. This would seek support through pre-works consultation with the Environment Agency.

2.60 Such risks are most likely to arise through major activities and short-term storage within the floodplain area. Therefore, the principle would apply within the CEMP that all activities and storage would be planned outside the floodplain area where practical. However, when access is needed, this would be within a framework of minimization and monitoring of weather conditions to allow withdrawal or cancellation of such works during high risk periods.

2.61 In addition, the area required for construction would be minimized so as to limit the impact on ecology and the environment as discussed in complementary reports submitted in support of the planning application.

2.62 This aspect is covered in more detail in the Construction chapter of the ES.

2.63 The construction works will require temporary bridges over the watercourses. These together with any works within 8 m of the bank top will require temporary land drainage consents from the Environment Agency.

f) <u>Surface Water Drainage</u>

2.64 The proposed crossings would increase the impermeable area of the Yeading Brook valley by around 4,800m^2. The Environment Agency requires that discharges from land being developed should match greenfield flow rates for 1:100 year peak flows.

2.65 Using the IOH 124 method (reference 3), the greenfield runoff rates for this area are estimated to be Q_{bar} = 8/l/s/ha and Q_{100} = 24 l/ls/ha. This value is very conservative when compared to runoff figures obtained by the ADAS 345 method.Calculations in respect of greenfield runoff rates and attenuation volumes are presented in Appendix FRA 6.2.

2.66 The detailed design would ensure that runoff from the roads would initially pass through Class 1 bypass interceptors and then be held in underground retention tanks or open ponds before being discharged to the Brook or flood relief channel via a controlled outlet.

g) Summary

2.67 The Yeading Brook and its floodplain are proposed to be crossed by a new road and two pedestrian/cycle bridges.

2.68 The **Pump Lane Link Road Crossing** would be constructed to create:

a) The diversion of 225m of concrete lined channel into 120m of new open channel and 170m of combined, improved channel, with the Yeading Brook.

b) A 23m clear span bridge over the combined Yeading Brook/flood relief channel with 600mm freeboard to the soffit above the $Q_{100+20\%}$ flows and 4m clearance from the channel top of bank edge to each abutment.

c) A mammal tunnel along the line of the abandoned flood relief channel formed from 1.0m diameter pipes with the invert filled with natural ground.

2.69 Surface water discharges would be limited to a peak flow of 11.5l/s for 1:100 year return period rainfall events, with a 30% allowance for climate change. This will require a volume of around 260m^3 which can be contained within the upper section of the abandoned flood relief channel.

2.70 The **Springfield Road** foot/cycle bridge would pass over the floodplain on two spans totalling 105m.

2.71 The western abutment will be sited in Flood Zone 1, a minimum of 4m from the bank top.

2.72 The central support will be located between the Brook and the Grand Union Canal in Flood Zone 1, in an area not used for conveyance of flood flows and a minimum of 4m from the Yeading Brook bank top.

2.73 The main structure of the support will be a buried pile cap with only the supports required for the bridge bearings protruding above existing ground levels.

2.74 The bridge structure will not affect surface water runoff. However, the access ramp will create a small increase in impermeable area that will drain via the existing facilities.

2.75 Interference with river flow would be negligible and the narrow deck and relatively high clearance would minimise impact on the ecology of the floodplain below.

2.76 The **Minet Park Foot/Cycle Bridge** will comprise two spans totalling 129m over the floodplain with a minimum freeboard of 600mm above the $Q_{100\ +\ 20\%}$ level.

2.77 Interference with river flow would be negligible and the narrow permeable deck and relatively high clearance would minimise impact on the ecology of the floodplain below.

h) Compensatory Storage

2.78 The construction of the embankment for the Pump Lane crossing will reduce the floodplain storage available. An area has been identified adjacent to the flood by-pass channel that could be excavated to provide level for level compensatory storage. The total volume required will be approximately 3,400m^3 for $Q_{100+20\%}$ levels.

i) Conclusions

2.79 The proposed structures are essential for the development of the Southall Gas Works site and there are no locations available away from the river corridor. They thus pass the sequential test and parts A and B of the exception test required under PPS 25.

2.80 The proposed structures would have a negligible effect on the hydraulic regime of the floodplain. An increase in flood level of up to 50mm is predicted immediately upstream of the Pump Lane Link Road Crossing. This backwater will reduce rapidly once the river is confined to channel and is expected to be negligible by the Minet Foot/Cycle Bridge with no appreciable increase in flood levels upstream of the foot/cycle bridge.

2.81 Compensatory storage would be provided for floodplain volume removed by embankments. Therefore, there would be no additional adverse flooding effect on properties either upstream or downstream from the study area in this context.

2.82 The structures, therefore, also pass Part C of the exception test according to PPS 25.

2.83 Surface water runoff from the new roads would be attenuated and treated prior to discharge, which would primarily be into the Yeading Brook.

2.84 All the structures would require land drainage consent from the Environment Agency and may be subject to certain changes as required by the detail design process which naturally follows planning approval to comply with such consents.

3.0 EASTERN ACCESS

a) Proposed Development

Development Description

3.1 The Eastern Access Road will provide entry to the proposed development at the former Southall Gas Works site; and will aim to provide suitable traffic flows between the West Southall development and the existing traffic network.

3.2 This proposal consists of the construction of a new junction onto South Road just north of the station, the construction of a new length of highway to serve the main site, amendments to the South Road/Beaconsfield Road junction, and minor connecting roads to serve properties no longer served by the original Crescent Road.

3.3 Ultimately, it is anticipated that in the future the bridge over the railway will be widened and the junction with Southbridge Way and The Green improved.

3.4 The proposed works to The Crescent will result in the removal of residential properties along the southern half of The Crescent (No's 20 to 32); a motor repair garage, and an area of public open space (0.15ha). 6 houses in Randolph Road will also be demolished.

3.5 As the public surface waster sewer is the only outfall available for the site flow, reduction methods are restricted to those constructed using 'hard' engineering techniques.

Proposed Drainage

3.6 Drainage of the proposals can be considered in respect of 4 zones(Reference: Appendix E):-

1. The junction of the straight and Randolph Road.
2. The new West Southall Access Road.
3. South Road north of the railway.
4. South Road south of the railway.

3.7 Flow reduction to the Environment Agency's requested standard would require discharge rates to be reduced to 23.9l/s/ha for a 1:100 year event including a climate change allowance.

Flood Risk from the Development

Foul Water Drainage

3.8 The new road link will result in a reduction in foul water flows from the site. Therefore, no additional infrastructure or changes to the existing network are proposed; except the abandonment of some pipes along The Crescent (subject to survey and the agreement of Thames Water).

Surface Water Drainage

3.9 Currently all surface water drains into the Thames Water Surface Water Sewers via gullies located along the road networks along Beaconsfield Road, The Crescent and Randolph Road and pipes and guttering from the houses etc.

3.10 The proposals will result in a reduction in impermeable area due to the removal of buildings and paved surfaces and the introduction of landscaped areas as follows:

North Area

***10,700* m^2** *approx* (1.1ha)

Impermeable Areas

South Road	2,600 m^2 approx
Remains of the Crescent	100 m^2 approx

New Access Road	1,800 m^2 approx
Water Tower Roads	1,050 m^2 approx
Residents' Access	650 m^2 approx
Plaza	550 m^2 approx
Total Impermeable	***6,750 m^2***

Permeable Areas

Play Area	1,050 m^2 approx
Plaza	550 m^2 approx
Southern Strip	1,550 m^2 approx
Misc	800 m^2 approx
Total Permeable	***3,950 m^2***

3.11 The resulting runoff rates from the proposed development, without attenuation, during a 100-year rainfall event 30-minute storm duration are presented in Table 3.1.

TABLE 3.1: APPROXIMATE RUNOFF RATES PROPOSED DEVELOPMENTS (0.67Ha Impermeable Area)

Return Period yrs	**Modified Rational Method Calculations**		
	30 min FEH Storm (mm)	**Storm Volume V (m^3)**	**Peak Flow Q (l/s)**
2	11.5	77.00	42.8
10	21.4	144.00	79.7
20	27.2	182.00	101.2
50	37.0	248.00	137.7
100	46.6	312.00	173.4

3.12 PPS 25 Para F6 states that:

> **"Surface water from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, whilst reducing the flood risk to the site itself and elsewhere, taking climate change into account. This should be demonstrated as part of the flood risk assessment."**

3.13 This is further clarified in the Planning Policy Statement 25 Practice Guide, June 2008 which states within Para 5.50:

> **"Runoff from previously developed sites should be compared with existing rates, not greenfield rates for the site before it was developed. Developers are, however, strongly encouraged to reduce runoff rates from previously developed sites as much as is reasonably practicable."**

3.14 The runoff rates presented in Table 3.1 when compared to Table 2.1 demonstrate that the proposals in themselves will reduce runoff by around 11%.

3.15 However, the new drainage system should be designed for no surface flooding for a 1:30 year return period storm in accordance with Sewers for Adoption 6 Edition. Additionally, the Environment Agency has requested that the discharge should be limited to undeveloped greenfield runoff rates, wherever practical. This standard is more severe than the Environment Agency's published policy (under PPS25 and the Environmental Agency/DEFRA Document "Preliminary Rainfall Run-off Management for Development, 2007").

3.16 The design should also take future climate change into account. PPS 25 recommends an increase in design rainfall rates of 30% up to the year 2115.

3.17 The incorporation of flow reduction facilities into existing infrastructure is not always practical. The opportunities to meet the requested standards are discussed in the following sections.

SUDS Options Matrix

3.18 An objective of this FRA is to investigate the feasibility of using SUDS to achieve the required reduction in runoff rates post development. A detailed drainage design for the proposals will be carried out in due course, once the concepts presented in this FRA have been agreed with the EA.

3.19 This following table provides an overview, in the form of a matrix, of the feasibility of a range of SuDs techniques, in order to identify which measures may be suitable for the proposed development.

TABLE 3.2: SUDS FEASIBILITY MATRIX

Technique	***Physical Constraints***	***Feasibility***
Permeable pavement/ porous hardstanding areas	Requires a reasonably level site	Not Feasible
Green roofs	Roof slope for proposed buildings will preclude their use; flat roofs are ideal; also known as brown roofs and garden roofs.	Not Applicable
Bio-retention – shallow landscaped infiltration areas	Primarily used to remove pollutants from runoff and due to their shallow nature are not as effective at runoff attenuation as other SUDS techniques.	Not Feasible, requires large areas of land
Soakaways and infiltration trenches	Require infiltration rates of 1 x 10^{-6} m/s or greater. Shallow soakaways or infiltration trenches would be required where groundwater is shallow (i.e. less than 2.0 mbgl).	Maybe considered subject to site investigation and agreement with Thames Water
Cellular Storage	Modular plastic Geocellular systems with a high void ratio that can be used to create a below ground infiltration (soakaway) or storage structure.	Not Feasible under major access road
Grassed filter strips – wide gently sloping areas of grass or other vegetation	Normally used to treat polluted runoff from car parks or roads. Not as effective at runoff attenuation as other SUDS techniques.	Not Feasible, require large area May be limited potential to residential access

TABLE 3.2: SUDS FEASIBILITY MATRIX		
Technique	***Technique***	***Technique***
Infiltration basins / swales	Are widely applicable for attenuation and treatment of surface runoff by infiltration into the ground. Require slope of no more than 4-10% and can act as a substitute for soakaways where groundwater is shallow – need to consider the impact these techniques have on local groundwater levels.	Limited potential - as for filter strips
Non-infiltration swales	Used in the same concept as carrier ditches or storage bunds.	Feasible; subject to agreement with Thames Water
Filter drains	These are normally used adjacent to areas of car parking or roads and convey runoff via flow through an engineered substrate (normally gravel).	Feasible; may use for access road with option of perforated pipe to convey water to other storage system for extreme storms
Balancing ponds	These are permanent ponds that provide storage above the resting water level in the pond. Are appropriate for most sites but require suitable space. Require impermeable soils, or can be lined.	Not Feasible
Rainwater Harvesting	The collection and recycling of rainwater to be used for irrigation and other non-potable use	Not Applicable
Balancing Tanks	Storage tanks; can be located inside buildings or underground; can work in conjunction with oversize pipes; location for this site would be beneath public highway.	Not Feasible or required
Oversize Drainage Pipes	Usually last resort when no other techniques possible. Generally only feasible where a minor reduction in peak flow is required.	Not Suitable

3.20 On the basis of the SUDS feasibility study, there are only a very few techniques that would be appropriate for use at this site. According to the building regulations, the preferred option would be to utilise infiltration-based methods, such as swales and infiltration basins and/or soakaways, which would mimic a natural hydrological regime at this site and provide recharge of any underlying aquifer.

3.21 The use of these methods is not generally suitable in the Greater London area due to clay sub suds. However, this is subject to geotechnical investigation results. Thames Water has advised that they will not accept discharge from open attenuation ponds or soakaways.

b) <u>Surface Water Attenuation</u>

<u>Zone 1</u>

3.22 This is an area of approximately 1,650m^2 which will drain via the existing public surface water sewer in Randolph Road. Flows to this sewer will be reduced by around 32% due to the demolition of 6 properties on Randolph Road.

3.23 Further reduction flows to undeveloped runoff rates would require a small diameter control. For this area the Q_{100} flow would be 3.9l/s and a typical control would be a 43mm orifice. This would be prone to blocking and is not practicable (reference CIRIA CR609, Sustainable Drainage Systems).

Zone 2

3.24 This zone would be the subject of major reconstruction and will require a new drainage system. It covers an area of approximately 7,200m^2. It would, therefore, be feasible to provide attenuation storage as part of the works.

3.25 The main runoff collection route is down the new access to the south-west of the zone and then into a diverted public sewer.

3.26 Areas of open space that would have potential for use as ponds are addressed as follows:-

(a) South of the access road: Part of this area is at a suitable low level but is located behind the Network Rail boundary and hence is not available.

The remaining section is infill between the higher ground of the access road, piazza and south Road, dropping down to meet the railway.

Use of this area would require gradients of 1:3 or steeper resulting in a very artificial depressed area.

(b) There is a small area of landscaping at the end of Randolph Road. This again would require steep slopes but would still not provide a significant volume of storage.

(c) The play area at the north of the site:
Existing ground levels are above the surrounding areas to the north and west. Excavation to produce a pond would destroy the existing mature trees which are intended to remain. The use of a play area to attenuate any but the more infrequent storms is not desirable.

3.27 In addition to the above, Thames Water has indicated that they would consider drainage connections from open areas to be ‘land drainage’ and would not accept any flows from these areas.

3.28 Accordingly, the only practical means of attenuation for this area is by the provision of a tank under the new highway.

3.29 The undeveloped Greenfield runoff rates from this area for a 1:100year storm would be 15.1l/s. This could be achieved (including a 30% climate change allowance) by the construction of a 150m^3 attenuation tank, with the outlet controlled by a 25m X 100mm diameter throttle pipe. This will give a reasonable match to undeveloped flow rates from more frequent storms (see Appendix G).

Zone 3

3.30 This comprises South Road to the centre of the railway bridge.

3.31 The road is to be widened, resulting in a slight increase in area draining to the existing sewer connection. However, a section of The Crescent will be removed from the main site drainage. This leaves the impermeable area draining to the connection manhole almost unchanged at approximately 2750m^2. Attenuation to undeveloped run-off rates would require around 150m^3 of storage, similar to the main site. This would need to be installed under a major traffic route incurring additional expense and disruption to the public. Accordingly, it is proposed to continue to utilise the existing 225 mm diameter public sewer as the outfall.

Zone 4

3.32 Zone 4 is an area of highway improvements to the south of the railway line and extends over an area of around $4000m^2$. Of this $230m^2$ is a landscaped island and $300m^2$ is located over Network Rail land, the remainder being fully paved.

3.33 The junction improvements will result in all the area being hard surfaced, an increase of 15%.

3.34 It is not practical to construct a large attenuation tank (approx. $250m^3$) under a large major junction as would be required to reduce the run-off from the whole area to undeveloped sites.

3.35 The new area would have an approximate rate of run-off of 1.3 l/s. This would require a storage volume of around $32m^3$ for a Q_{100} + 30% event with a 25mm diameter orifice as the control. The control size is too small to be practicable. However, subject to available space between utility services, it would be possible to provide this volume by means of an off-line 1.2m diameter pipe 29m long within the footprint of the current island. The discharge will be effectively limited by the capacity of the existing 225mm pipe, which will remain unchanged.

c) Conclusions

3.36 Interpretation of the Environment Agency's Flood Zone Map indicates that the site is within Flood Zone 1 (land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%); and is therefore suitable for all development.

3.37 The proposals will actually result in a reduction of impermeable area through removal of buildings and the introduction of landscaped areas in and around the development. As a result flood risk elsewhere will be reduced.

3.38 The proposals thus meet with the requirements of PPS 25 and hence the Local Plans without the incorporation of any additional attenuation.

3.39 Greenfield run-off from the existing site, north of the railway, as defined by PPS 25, is estimated to be 173.4 l/s for a 1:100 year 30 minute storm.

3.40 The Environmental Agency have requested that flows are reduced to undeveloped Greenfield rates. This is a requirement more severe than required by either PPS 25 or the Environmental Agency's published policy.

3.41 The undeveloped Greenfield run-off rates north of the railway have been estimated using the I0H124 method to be 25.6 l/s/ha for a 1:100 year event.

3.42 Based on the findings of this report, it is considered that there will be no increase in flood risk either to the development or to other properties as a result of implementing the proposals. The development thus meets the requirements of PPS 25.

3.43 It is not practicable to provide attenuation in all zones of the development due to either a zone being too small to have an effective control or an attenuation facility would involve major excavation in a heavily used highway.

3.44 The new works do provide some opportunity to provide attenuation. A tank of $150m^3$ with a 25m x 150m dia through pipe control will reduce the Q_{100} + 30% peak flow from Zone 2 from 95 l/s to the undeveloped Q_{100} flow of 15.1 l/s.

3.45 South of the railway a $32m^3$ could be installed within the current landscaped area, subject to the presence of other utilities. This would allow the flow from the local increase in surface area to be reduced to Greenfield rates.

4.0 SURFACE WATER DRAINAGE

a) Flood Hazards

Sources of Flooding

Fluvial

4.1 Fluvial flooding is flooding caused by rivers and occurs when the river channel capacity is exceeded by the flow. Most rivers have a natural floodplain which in built up areas is sometimes encroached upon by development.

4.2 The nearest watercourse to the site is the Grand Union Canal, immediately adjacent to the north-west boundary of the site. However, the nearest designated main river is the Yeading Brook, which runs roughly parallel to the north-west boundary of the site and Grand Union Canal at a distance from the site boundary varying from 50m to 150m and at a lower topographical level. The Yeading Brook is not tidal.

4.3 The river Crane is located, at the closest point to the site, about 0.25Km to the west. The Yeading brook is a tributary of the Crane, which in turn enters the Thames at Isleworth, about 6km to the south east of the site.

4.4 The site itself is higher than the Brook and its flood potential and is not considered as vulnerable to fluvial flooding.

Tidal

4.5 Tidal flooding from the sea occurs when high tides and storm surges raise the level of tidal waters above the level of the shore or river bank. They can be sudden and severe, but are dependent upon a number of factors.

4.6 The site is not considered as vulnerable to tidal flooding.

4.7 The general level of the site approximately 30.0 to 33.0 metres AOD is comfortably above the 1 in 1000 year event (0.1%) level of the tidal River Thames, approximately 5.20m AOD.

Overland Flow

4.8 Within a highly dense urban area where there are large areas of impermeable surfacing, e.g. roof areas, car parking and roads, it is possible for high intensity rainfall storms to exceed the available capacity for water not be able to soak into the ground or enter the man made drainage system at a quick enough rate to cope with the volume of water. Where this occurs, the excess water can flow across land and potentially cause flooding.

4.9 In order to assess the flood risk to the site from this source of flooding, the site needs to be analysed in the larger context. To the North, the land form falls toward the Yeading Brook, and the site is significantly higher than the Brook and its floodplain. Whilst the Grand Union Canal, (Paddington Branch) lies between the site and the Yeading brook, it too is slightly lower than the site as it is connected to an overflow spillway down to the Brook.

4.10 To the South, the site is bounded by the Great Western Railway. Because the railway is on embankment, it protects the site from any potential overland flow from the south.

4.11 Overland flow is conceivable from the direction of South Road, which is to the east, and from the existing densely built up residential area of Beaconsfield Road to the north and north east.

4.12 Since in overland flow conditions, the water will find the easiest way to the lowest point, which in this case will be extensive road network around the site, the risk of flooding due to overland flow can be minimised by sympathetic design adopted for the levels regime of the site itself.

Groundwater

4.13 In areas where the level of groundwater is high, rainfall that soaks into the ground can raise it to a level where structures within the ground are at risk of flooding. Structures such as basements or detention ponds can be at risk, although this is dependent upon the ground conditions of the site.

4.14 From the Wallingford Winter Rainfall Acceptance Maps, the site is located within W.R.A.P class 2, which given the information from the EA regarding the permeability of the soils in the area would indicate that the soil is:

"(i) Very permeable soils with shallow ground water"

4.15 The extensive ground investigation for the site revealed groundwater in the majority of the boreholes and trial pits, varying from seepages to rapid inflows, and at depths ranging from 0.3m to 4.5m but in general circa 2m down. The direction of groundwater flow is from south east to northwest, i.e. towards the water bodies of the grand Union Canal and Yeading Brook. Groundwater flow is very slow and assessed as very complex and affected by underground obstructions. It is seen to vary seasonally too. It is likely to be altered to some extent at near surface levels by the introduction of new below ground drainage to serve the proposed development.

4.16 The EA have no record of any flooding occurring due to groundwater on the site. The risk of flooding due to groundwater is likely to reduce due to, first, the installation of new positive well designed drainage systems, and second, the increase in impermeable cover due to buildings, roads and external pavings.

Sewers

4.17 Flooding from sewers occurs when the quantity of water flowing into the sewers exceeds the capacity of the sewer and backs up to an extent where it floods out of manholes or gullies. Alternatively and more commonly, sewers flood when a blockage occurs in a pipe. This is more likely on private sewers, but is usually less severe than flooding from larger public sewers which can cause extensive flooding due to the greater quantity of surface area which they drain.

4.18 At the present time the site is substantially devoid of a fully active and positive drainage systems, other than the sectional remains of old systems that used to serve the previous industrial uses of the site. Completely new systems for below ground drainage are necessary for the redevelopment of the site. Separate systems will be provided for surface water and foul. These will be designed in accordance with contemporary drainage standards and built out in increasing capacity to suit the phasing programme.

4.19 At just two locations, within the entire main site, there are existing sewers that pass through the site. The surface water sewer, mid way along the site, is intended to be re-laid as part of the development, and will be designed to comply with current standards, that require, at minimum, the design to demonstrate no flooding in a 1 in 30 year event.

4.20 The foul sewer that passes through the narrow western end of the site has been assessed by Thames Water to have adequate capacity.

4.21 In the event that any sewer, new or existing, became blocked or overloaded, the resultant surface flood that might occur in consequence would disperse via the road network in the direction of the prevailing fall, towards the north. Property thresholds would be protected by judicious setting of finished floor levels with an appropriate "freeboard" above the surrounding external ground level, and a fully co-ordinated scheme of and external works levels schemes.

Artificial Sources

4.22 The Grand Union Canal, a man-made structure, is located immediately adjacent the site on its north side. The length of the Grand Union Canal in question is the Paddington Branch.

Canals are normally isolated from other watercourses, and therefore do not generally receive storm-water from streams, rivers or sewers. Accordingly, they are impacted by rainstorms only to the extent of the precipitation falling on their plan area and adjacent verges banks and tow path areas. The latter are typically not impermeably surfaced, especially in rural areas. So if, say, 50mm of rain were to fall on a section of canal between adjacent lock structures, its water level would raise by the same amount, 50mm. The Paddington Branch of the Grand Union Canal is set at a slightly lower level than the site, and in the event of an unprecedented inflow of storm water, or failure of a bank, the canal would spill northwards towards the Yeading Brook noting that there is an existing spillway in place midway along the site boundary. Accordingly there is no conceivable mechanism for flooding of the site from the canal.

b) <u>Description of Flooding</u>

4.23 The analysis of the sources of flooding has indicated that the most significant source in the wider area is that of fluvial flooding from the Yeading Brook. Other sources of flooding are considered as insignificant when compared with the fluvial event.

4.24 In a 1 in 100 year fluvial event, the Yeading Brook would come out of bank and occupy its floodplain. The modelled $Q_{100+20\%}$ flood level at the location of the proposed Springfield Road footbridge is 27.75m AOD. The lowest point on the main site, at approximately 30.00m AOD, therefore has a 2.25m freeboard above the worst 1 in 100 year flood.

4.25 In a 1 in 100 year fluvial event, the Yeading Brook would come out of bank and occupy its floodplain. The modelled $Q_{100+20\%}$ flood level at the location of the proposed Springfield Road footbridge is 27.75m AOD. The lowest point on the main site, at approximately 30.00m AOD, therefore has a 2.25m freeboard above the worst 1 in 100 year flood.

4.26 Historically the EA have no record of this main site flooding from a fluvial event or from groundwater. In addition Thames Water has no record of the site flooding due to sewers.

c) <u>Flood Zone Delineation</u>

4.27 From the analysis of the various flood events, the main scenario that could be a potential concern because of its severity is that of fluvial flooding from the Yeading Brook.

Modelled interpolated flood levels for present day:
1 in 100 year event (1%)+20% for climate change = 27.75m AOD

Existing site levels:

Typical minimum level:	30.25m AOD
Typical maximum level:	32.95m AOD

4.28 Based on a simple inspection of the current modelled flood levels for the Yeading Brook, the site appears to have better than 1 in 1000 year protection against flooding on account of its elevation.

4.29 Accordingly, the site is at a level raised adequately above the worst flood level in the Yeading Brook, as described in PPS 25, to meet the desirable, and proposed, Zone 1 classification.

d) <u>Surface Water Drainage</u>

4.30 New drainage systems for collecting and dissipating surface water will be provided. The outfall will be to the Yeading Brook. Attenuation to the allowable run-off discharge based on Greenfield run off rates will be incorporated. The new system(s) will be designed to cope with storms of 1 in 30 year return period without flooding, allowing for the elevated level of storm water in the Yeading Brook. Additionally, the site will be laid out, and the drainage systems designed, to ensure that in storms of up to 1 in 100 year return period including an additional 30% for climate change, all storm water will be held within the site except for the Allowable Run-off Discharge Rate.

Strategic Flood Risk Assessment Implications

4.31 Since there is no SFRA available for this area no comment can be made on its implications. It is noted that at the time of writing one is understood to be advanced in its course of preparation.

Probability of the Site Flooding

4.32 Based on the information and analysis, it is concluded that the probability of wide-scale or catastrophic flooding due to fluvial or tidal events is low.

4.33 Nonetheless, the possibility remains of localised flooding in the event of blocked drains, defective rainwater goods or short duration localised rain storm events. Detailed design of the project will consider how to best mitigate damage to property and disruption to normal activity due to these eventualities.

Climate Change

4.34 The factors for climate change that will affect the design 1 in 100 year flood level of the Yeading brook adjacent to the site have been included in the hydraulic analysis carried out in the complimentary river FRA report.

4.35 The 1 in 100 year flood level in the Yeading brook, including climate change, is as quoted in this report, and includes for a 20% increase in peak flow allowance for climate change.

4.36 The other climate change factor that will affect the site is that of the increased rainfall event. From Table B.2 of PPS 25, the design peak rainfall intensity applicable until 2115 is + 30%. This figure will be incorporated into the design of the on-site drainage system.

Development Proposals and Layout

4.37 The proposed re-development of the West Southall site will provide a mix of uses which will be residential led but also include retail, employment, leisure and community facilities, including a health centre and primary school.

4.38 These are illustrated on the extracts from the Design and Access Statement, which has been prepared by Make Architects, in support of the planning application, and which are included at Appendix E.

Existing Drainage Arrangements

4.39 The site is in the natural catchment of the Yeading Brook, a watercourse classified as main river and in the control of the Environment Agency. The Yeading Brook is located to the north and northwest of the site, separated from the site by the Grand Union Canal.

4.40 Some significant areas of the site are covered in hard paving, albeit less than the impermeable cover intended when redeveloped. A proportion of the existing paved areas have positive drainage, with gully outlets and manholes, generally connecting to an existing 300mm diameter public sewer that crosses the site from south to north and discharging into the Yeading Brook. Minor outfalls to the canal are also seen to exist. Some incomplete records of these systems exist but cannot be relied upon.

4.41 The balance of the site area, not positively connected by the public sewer referred to above, is informally drained by infiltration. It is understood that infiltrating surface water is potentially in continuity with the Yeading Brook, through the underlying soils, especially the gravels, but is impeded by obstructions and the Minet tip feature.

4.42 There are public foul sewers at two locations within the site. A 300mm diameter public sewer enters the western tip of the site from under the Great Western Railway, and leaves in a westerly direction, crossing the valley of the Yeading Brook and under the Grand Union Canal, to join the Crane Valley trunk sewer some 300 metres further west. In addition, a smaller diameter sewer leaves the site in a southerly direction from the vicinity of the NGG, now decommissioned, gasholders compound. At this location holder water historically was drained into an open triangular holding pit from where it was pumped to the 225mm via public sewer referred to above. However, these water sealed holders are now decommissioned and the function no longer exists.

Surface Water Drainage Proposal (SuDS)

4.43 A range of sustainable options for inclusion within a satisfactory surface water drainage system have been considered by WYG. The Environment Agency and Thames Water have previously been consulted about the applicable policies, site restrictions, preferences and available option.

4.44 Infiltration techniques will not be utilised within the proposed drainage scheme as agreed with the Environment Agency due land contamination history and remediation strategy associated with the site.

4.45 The relevant authorities are in support of the level of structuring shown on the current plans. Therefore, it is not possible to set aside large open areas for sustainable drainage alone.

4.46 Although there is restricted opportunity for the inclusion of certain SuD's solutions for reasons stated above, there are many other methods of SuD's that can be incorporated into the development proposals. Therefore, drain will be to the Yeading Brook, restricted to the natural greenfield runoff rate and on-site storage will be provided to contain the critical 1 in 100 year plus climate change storm event. On-site storage will be provided via the following methods during the stated storm events below.

During storm events up to the critical 1 in 30 year:

- Adopted large diameter pipes/box culverts.
- Private geo-cellular/steel tanks
- Wetland features (to be construction in later phases)

Consideration will be given during the detail drainage submission of all phases to the use of:

- Green roofs (assumed zero storage)
- Rain water harvesting (assumed zero storage)

During storm events between the critical 1 in 30 year and 1 in 100 year plus climate change:

- Permeable paving, with lined sub base storage, where the land use is deemed appropriate.
- Above ground storage, in the form of controlled area ponding.
- Lined swales (if land becomes available following detailed design).
- Dry detention basins (where land is available following detailed design).
- Private geo-cellular/steel tanks (should lined swales/dry detention basin be proven not to be feasible as a first option due to site density within a particular phase).
- Wetland features (to be constructed in later phases).

During storm events between the critical 1 in 30 year and 1 in 100 year plus climate change the SuDs Hierarchy Table below should be used to provide the most Sustainable Solution:

Most Sustainable	SUDS Techniques	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
↑	**Living roofs**	√	√	√
↑	**Basins & Ponds** - wetland - balancing pond - detention basin - retention pond	√	√	√
↑	**Filter Strips & Swales**	√	√	√
↓	**Infiltration** - soakaways - infiltration trenches - infiltration basin	√	√	√
↓	**Permeable Surface & Filter Drains** - gravelled areas - paving blocks - porous paving	√	√	
↓ **Least Sustainable**	**Tanked Systems** - oversized pipes & box culverts - storm cells	√		

4.47 The exact SuDs methods used will depend on which phase of the development is being constructed. The density of any particular phase once the detail layout and level design has been finalised will greatly influence the SuDs methods chosen during the detailed drainage design. It should also be reinforced that infiltration techniques are not permitted due to contamination issues on-site. Therefore other storage techniques such swales, ponds, permeable paving etc will require lining to prevent infiltration as well.

4.48 Additional features of the surface water scheme proposals, and considerations affecting the choice and type of system are as follows:

a) There are two options in respect of piped outfall connections to the Yeading Brook. Option 1 is based on two outfalls, while Option 2 is based on only one outfall, being the refurbished existing public surface water sewer outlet.

b) The existing surface water sewer which crosses the site from south to north will be diverted in order to follow the new street pattern and to avoid “building over”, as it is believed to be in an aged state.

c) The public sewer diversion described in b) will be constructed in extra large diameter pipes, of 1.8 m, 2.1 m or 2.4 m diameter, in order to provide balancing and storage of storm water.

d) The existing public sewer outfall to Yeading Brook, laid underneath the Grand Union Canal, is to be retained and potentially refurbished, subject to condition survey. The additional public sewer outfall to the Yeading Brook, proposed for Option 1 is the preferred solution, subject to reaching agreement with the British Waterways as this will require temporary closure of the canal to enable constructing it in temporary coffer dams unless other jacked methods prove economically feasible.

e) Allowable Flow Rates: discussion and correspondence received from the Environment Agency have confirmed that the site shall discharge at the natural greenfield run-off rate as detailed in this report and Appendix D.

f) Petrol/oil interceptors, on larger car parking areas and service areas will be incorporated, in line with Environment Agency document PPG3, typically installed upstream of the connection into the adoptable surface water sewer in the adjacent road.

g) Roof water will by-pass the petrol/oil interceptors, in line with Environment Agency's recommendations, wherever practical and be used if feasible in mains water harvesting systems.

e) <u>Allowable Run-Off Rates</u>

4.49 After consultation with the EA, the aspiration for greenfield run-off in the London area is acknowledged. PPS 25 recommends in strong terms that any new development should replicate the greenfield run-off rate where possible, unless there are mitigating circumstances. Frequently sites enjoy prescriptive rights to discharge to adjacent water courses, and compliance with the PPS25 recommendation, is an onerous requirement for the site infrastructure.

4.50 The greenfield run-off rates for central London are generally considered to be in the range 2 to 8 litres per second per Hectare (l/s/h) depending upon soil type and topography.

<u>Existing Run-off Rate – Discussion</u>

4.51 Whilst parts of the site have been positively drained in previous uses, mainly for gas production and other industrial uses, it cannot be demonstrated that the site is extensively connected by below ground pipes to the outfall watercourse. Some below ground piped gravity drainage systems are shown on historic site plans, and a public surface water sewer crosses the site.

4.52 However the process of the past and recent demolitions appears to have removed the visible evidence of existing systems – typically, manholes have their tops removed and are in-filled with demolition rubble.

4.53 The public sewer is known to be in poor condition – several attempts to prove its condition were frustrated by the presence of debris, so it not known if the debris is loose or corresponds to a collapse of the pipe. The Statutory Sewerage Undertaker, Thames Water, who own are responsible for the maintenance of the sewer have advised that it is in very poor condition, and should be re-laid.

4.54 Whilst some of the car parking facilities now occupying the site are informal hard-standings comprising gravel spread over compacted demolition rubble, others have entailed re-surfacing work in dense bitumen macadam, which is effectively impermeable. Run-off from these areas is guided by surface falls to existing outlets or to new gullies and channel drains. It is unlikely that new mains drainage was installed, and more likely that systems were located and new connections made. The extent to which these outlets now connect directly to the existing 300mm Dia. public surface water sewer and hence to the Yeading Brook cannot be determined, because there is little or no access through which a CCTV survey could be carried out.

<u>Existing Outfall via Public Sewer</u>

4.55 A further factor in analysing the existing run–off rate to the Yeading Brook is the finite capacity of the single 300mm Dia. pipe that connect the entire site – its capacity is very much lower than the developed, un-attenuated discharge rate from the site would be.

<u>Existing Run-off Rate – Summary</u>

4.56 In summary, most of the site presently drains surface water by infiltration, and a small proportion drains via former systems understood to be in poor condition These may in turn drain by infiltration into the ground at blockages and collapses. However, it may connect, perhaps slowed by passing through silted pipes, to the main outfall to main river.

Policy for PPS 25

4.57 PPS 25 states that *"The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development…"*

4.58 Given the foregoing, it is proposed that the new development will discharge at the green-field rate, as determined by an acceptable hydraulic estimation method.

4.59 It is proposed that allowable rates will be based on the Institute of Hydrology Report IH124, which was used to produce the computer output reproduced at Appendix D.

4.60 It is proposed that on-flow rates will be controlled with regard to rainstorm severity, so as to mimic the corresponding undeveloped run-off rate. In order to mimic the higher on-flow rates in more severe storms, the outflow control mechanisms will incorporate multiple orifices, weirs, vortex flow controllers or pumps, (or a combination of these) as appropriate. The construction of the flow restriction mechanism is subject to detailed design in due course.

4.61 Based on the net site area, IH124 gives the following run-off rates for each of the storm return periods shown:-

Return period.	**Allowable Run-off, litres per second**
1 year	49.4
2 years	51.2
5 years	74.4
10 years	94.1
20 years	116.4
25 years	124.8
30 years	131.7
50 years	152.2
100 years	185.4

4.62 These figures are proposed in undertaking the detailed design of the drainage system.

Storage Calculations

4.63 The proposed development will be constructed in phases. The initial phasing of the development can be seen in the drawing in Appendix G.

4.64 Calculation sheet A17014_3201_C_001 in Appendix H demonstrates the approximate greenfield runoff rates for each phase base on the rates provided. It also provides approximate storage requirement for each phase during storm events up to the 1 in 30 year and storm events between the 1 in 30 year and 1 in 100 year plus climate change.

4.65 The storage requirement up to the 1 in 30 year event will be provided using underground attenuation. The additional storage requirements during storm events between the 1 in 30 year and 1 in 100 year plus climate change will be provided within an above ground open storage system. Only when the density of the development will not allow this, will underground storage be used to provide the additional attenuation required.

4.66 Drawing No. A17014_3201_C_600_P1 in Appendix G shows potential areas for above ground storage within each phase. The above ground storage requirements and available land for each phase has been considered and approximate flood depths calculated as shown on Calculation sheet A17014_3201_C_001 in Appendix H.

4.67 The above calculations demonstrate that it is possible to provide the required on-site storage for the 1 in 100 year plus climate change storm event. The required storage will also be provided using a wide range of Sustainable Drainage Systems (SuDs) as previously discussed.

4.68 The required storage volumes and greenfield run-off rates will vary for each phase depending on the exact impermeable areas proposed during the detailed layout design. Therefore during the detail drainage design the exact storage volumes and greenfield run-off rates should be calculated for each phase accordingly and implemented into the detailed drainage design.

Development Phasing

4.69 The construction and occupation of the West Southall redevelopment is planned to be phased over a number of years and, as such, the drainage demand will increase over a period of years. Preliminary phasing plans of the site have shown there to be a total of thirteen phases as shown in the drawing in Appendix G.

4.70 The provision of adoptable mains drainage, both surface water and waste, can be phased to cope with such.

4.71 Conventional arrangements for accessing and servicing of a major development could typically entail the construction of infrastructure, comprising adoptable roads, mains drainage and incoming mains services, in advance of the construction of individual buildings. When buildings are completed, they may then be connected directly to incoming mains supplied and waste water systems for commissioning and early occupation.

4.72 Conventional arrangements for accessing and servicing of a major development could typically entail the construction of infrastructure, comprising adoptable roads, mains drainage and incoming mains services, in advance of the construction of individual buildings. When buildings are completed, they may then be connected directly to incoming mains supplied and waste water systems for commissioning and early occupation.

4.73 Due to the size of this development and a period of build, circa 15 years, it is practical to phase drainage provision to match demand, such phases being constructed to a pre-determined strategy and plan.

4.74 The design of the adoptable waste and surface water mains drainage infrastructure will therefore be given careful consideration at the detail design stage, in conjunction with the Developers and the Adopting Authority – Thames Water Utilities. Factors to be taken into account include:

- Meeting the minimum hydraulic loading on gravity pipelines to provide adequate velocities for self cleaning flow regime.
- Configuring pump stations and rising mains so that part loaded systems have a satisfactory hydraulic regime. In particular, design against septicity in rising mains will require close attention, and it may be necessary to add flushing and/or dosing equipment into the foul pumping stations.
- An optional strategy for the design for phased completions associated with the installation of twin rising mains in place of one single pumped main of larger size. This would be subject to detailed design and the agreement of the adopting authority.
- It is possible that at the earliest stages in the development it will be appropriate to make temporary connections into existing outfalls, such as the existing public surface water and foul sewers respectively. These temporary arrangements may also be applicable for the drainage of temporary construction site welfare facilities.

4.75 More specifically for the waste water system, once the primary connection is made to the main sewer passing below the Brent Road tunnel, phasing will progressively add local gravity systems each with its own gravity pipe network and pump stations.

4.76 Each local pump station, of which there is estimated to be three or more will then discharge via the rising mains which may be multiple in nature as discussed above. Thereby the distribution of new “first time” drainage availability can match the increasing development demand, generally moving from north east to west.

4.77 More specifically for the surface water system, once the existing outfall under the Grand Union Canal is regenerated, phased local systems, including storm water storage, can be established (including any primary infrastructure system below main roads connecting to the outfall) allowing progressive satisfaction of demand. Subsequently the second, western half of the site, can similarly progress linked to the second outfall system, assuming that Option 2 is taken up.

4.78 In such a manner, the phased increasing demand can be practically satisfied by a sectional completion of drainage designed to an overall agreed design strategy at the outset.

Detailed Design

4.79 It is proposed that the mitigation measures set out above are controlled by condition to the planning consent which will be approved by the LPA and their consultees.

f) Off Site Impacts

Impact of Development on Hydrological Morphology

4.80 Additional flood risk in the catchments of the River Crane and Yeading Brook due to the proposed development is fully mitigated by the proposals for surface water drainage within the site for storms of up to 1 in 100 year return fluvial including climate change.

g) Waste Water (Foul) Drainage Proposals

4.81 It is proposed that the individual plots within the development will be served by a conventional system of adoptable below ground drainage, featuring sewers laid within the new street pattern, with manholes at suitable maximum spacing intervals, junctions and major building connections. All foul discharge/waste water will be connected into Thames Water's maintained system at a point having adequate hydraulic capacity.

4.82 On account of the length of the site, and that it is effectively topographically level from end to end, it will be necessary to install intermediate pump stations. A gravity outfall from end to end of the site would be too deep to be practical and difficult to construct.

4.83 A scheme has been conceived which relies upon 3 pump stations. Space will be provided within these stations as appropriate to facilitate additional capacity for long term future redevelopment of the remaining single operational eastern gasholder land.

4.84 Rising mains laid under the new streets will connect each of the three pump stations to the outfall, an existing manhole at the western end of the site.

4.85 It is envisaged that all of the main foul sewers located within the new street layout, together with the three pump stations and their associated rising mains, will be the subject of a Section 104 Agreement for their adoption by Thames Water.

4.86 Following consultations with Thames Water, and in order to determine that the existing Thames Water system will be capable of receiving the new additional waste water flows from the redevelopment, a study is being carried out by Thames Water, commissioned by the Developer and at his cost, to carry out flow monitoring and to appraise the available spare capacity in the existing system. The study confirmed that the existing foul sewerage system is capable of receiving the predicted waste water flows volumes generated by the development. This study was competed in March 2005, and the report is included at Appendix F and remains fundamentally valid at the time of reporting.

4.87 In order for the foul drainage system described above to become vested as public sewer, and to be maintained by Thames Water in perpetuity, it will require to meet the all relevant Thames Water Utility specifications including the nationally recognised "Sewers for Adoption, 6th Edition" specification.

4.88 The strategic design shown on drawing number 305/P1 is subject to further design development of the site plans, detailed design development of the sewage system, detailed design of the pump station compounds and the approval of Thames Water Utilities.

4.89 The existing single eastern holder compound foul system will remain as existing.

h) Residual Risks

Remaining Flood Risks

4.90 It has been established that risks due to fluvial and tidal flooding are minimal. The site is not reliant upon any maintained defences. However, some risk remains of flooding due to sewer failure onto overland flows. These residual risks should be taken into account in the detailed design of the site, for instance by construction such that:

- Building thresholds are set higher than adjacent works areas and semi basement and basements are sympathetically designed.
- Adoptable drainage systems meet the requirements of "Sewers for Adoption" and Thames Water in all regards.
- Non adoptable drainage systems are adequately maintained, such as by twice yearly inspections and cleaning out as and when necessary.

i) Conclusions

4.91 WYG's investigations have determined that viable solutions exist in principle to draining the redevelopment of Southall Gasworks. They are illustrated on the enclosed plans.

4.92 These solutions will ensure that flood risk to the main site is satisfactorily mitigated.

4.93 Results of preliminary consultations with the Environment Agency and Thames Water Utilities have been incorporated into these proposals.

4.94 Thames Water's Impact Study established that there is adequate capacity in the existing public wastewater drainage system to which it is proposed the site will connect.

4.95 SUDS opportunities have been investigated for feasibility and are proposed for inclusion where practical.

FIGURES

APPENDIX FRA 1

Topographic Survey

APPENDIX FRA 2

Environment Agency Correspondence

FRA 2.1	**May 2008 Flood Data**
FRA 2.2	**Response to FRA version 3**
FRA 2.3	**Response to FRA version 2**
FRA 2.4	**Original Correspondence**

APPENDIX FRA 2.1

Environment Agency Correspondence 2.1

May 2008 Flood Data

APPENDIX FRA 2.2

Environment Agency Correspondence

Response to FRA version 3

APPENDIX FRA 2.3

Environment Agency Correspondence

Response to FRA version 2

APPENDIX FRA 2.4

Environment Agency Correspondence

Original Correspondence

APPENDIX FRA 3

Pump Lane Link Road Bridge Details

APPENDIX FRA 4

Minet Park Foot/Cycle Bridge General Arrangement

APPENDIX FRA 5

Springfield Road Foot/Cycle Bridge

APPENDIX FRA 6

Calculations

APPENDIX FRA 6.1

Flood Relief Channel Diversion

APPENDIX FRA 6.2

Surface Water Attenuation

APPENDIX FRA 6.3

Compensation Volumes
APPENDIX FRA-E A

Location Plan

APPENDIX FRA-E B

Existing Site Plan

APPENDIX FRA-E C

Flood Zone Map

APPENDIX FRA-E D

Thames Water Sewer Plans

APPENDIX FRA-E E

Drainage Schematic

APPENDIX FRA-E F

Topographic Survey

APPENDIX FRA-E G

Calculations

APPENDIX A – Topographic Survey

APPENDIX B – Communications with the Environment Agency

APPENDIX C – Thames Water Asset Records

APPENDIX D – Allowable Run-off Rate Calculations

APPENDIX E – Proposed Development

APPENDIX F – Foul Impact Study Report

APPENDIX G – Preliminary Phasing/Above Ground Storage Areas

APPENDIX H – Storage Calculation/Above Ground Storage Depths

White Young Green

Extended Phase 1 Habitat Survey

Southall Gasworks

thinking beyond construction

EXTENDED PHASE 1 HABITAT SURVEY

SOUTHALL GAS WORKS

FOR

NATIONAL GRID PROPERTY LTD.

Reference: E00357 Southall Gasworks PH1 VEA			
Issue		Prepared by:	Reviewed & Verified by:
v1	**JUL 07**		
		VICTORIA ALEXANDER **Ecologist**	**ADRIAN HUTCHINGS** **Principal Ecologist**
File Ref: H:\Data\Projects\E00001 - E01000\E00357 Southall Gasworks\4004\E00357\Ecology from 2007\Report\E00357 Southall Gasworks PH1 VEA.doc			
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CONTENTS

0.0 EXECUTIVE SUMMARY

<table>
<tr><td>Site Location</td><td>The site is located west of Southall station, on the northern bank of the railway line and is centred on National Grid Reference TQ115800.</td></tr>
<tr><td>Previous Surveys</td><td>Phase 1 surveys were undertaken by WYGE on the adjacent link road access sites of Pump Lane and Springfield in Aug ’02 and July ’03 respectively. The reports identified the need for further surveys for bats, water voles and invertebrates. These surveys were undertaken by WYGE in Oct ’04.</td></tr>
<tr><td>WYGE Survey</td><td>Extended Phase 1 habitat and protected species evaluation survey update.</td></tr>
<tr><td>Site Overview</td><td>The site comprises of a gas works and a long-term car park. Two proposed link roads will affect the adjacent areas of Springfield and Pump Lane. Habitat of the former is predominantly hardstanding with some areas of grassland and tall ruderal.
There is a large amount of japanese knotweed and giant hogweed scattered across the site. The latter link road sites area located within Minet Country Park and habitats include dense continuous scrub, grassland, Yeading Brook and Grand Union Canal.</td></tr>
<tr><td>Evaluation and Constraints</td><td>Birds - Habitats suitable for nesting birds in the form of scattered trees and hedgerows were noted. Consequently, the site has high potential to support nesting birds. No bird nests where observed upon the gas tower within the site boundary.

Reptiles – The areas of grassland and tall ruderal to the east of the site have low to moderate potential to support a reptile population. The areas for the proposed access roads at Springfield and Pump Lane were not considered to be suitable for reptiles and therefore no further surveys are needed in these areas.

Bats – The adjacent Grand Union Canal and Minet Country Park have the potential to support roosting/foraging bats. Consequently the site has a moderate potential to support bats.

Invasive Species – There are several areas of dense growth of both Japanese knotweed and giant hogweed. This means that there will be a high potential for impact for development.

Water Voles – Yeading Brook has moderate potential to support water voles due to the earth banks and good vegetation cover.</td></tr>
<tr><td>Recommendations and Opportunities</td><td>Before development or preparatory works commence, it is recommended that:
There is a Japanese knotweed and giant hogweed eradication and management plan in place.
A reptile presence/absence survey is undertaken in the area of grassland and tall ruderal to the east end of the site.
A bat activity survey is undertaken along the Grand Union Canal is undertaken.
A water vole presence/absence survey is undertaken along Yeading Brook and Grand Union Canal.
The site is likely to support nesting and breeding birds and as such a breeding bird survey is recommended if tree or scrub clearance is undertaken during the breeding bird season (March – August).</td></tr>
</table>

	It is recommended that guidance provided in BS 5837 'Trees in relation to Construction' and NHBC Standards 'Building near trees' is followed in order to minimise any negative impacts upon retained trees. It is recommended that any landscaping proposals associated with the proposed development consist of native, locally-sourced plants, including the planting of native trees.

1.0 INTRODUCTION

White Young Green Environmental (WYGE) was commissioned by National Grid Property Ltd. to undertake an Extended Phase 1 Habitat Survey of the Southall Gasworks and associated link road areas in order to identify any potential ecological constraints to development.

The overall assessment comprised:

- A desktop review of existing information from readily available databases;
- Site-specific biological information gained from statutory and non-statutory consultation; and
- A day site walkover and ecological survey.

The walkover survey was undertaken by WYGE ecologists Daniel Hone and Victoria Alexander on 26th and 27thth June 2007.

1.1 Site Description

Located to the west of Southall station (National Grid Reference TQ115800; see SK.01), the main site comprises of a gas works and a long-term car park. Habitat is predominantly hardstanding with some areas of grassland and tall ruderal. There is a large amount of Japanese knotweed and giant hogweed scattered across the site.

The proposed link roads would intersect Minet Country Park at Springfield and Pump Lane, crossing Yeading Brook and Grand Union Canal.

The site is bounded to the south by the rail line to the north and east by Beaconsfield Road and a residential area. To the west is the Grand Union Canal. The opposite side of which is an area of trees and scrub contained by the Yeading Brook and Minet Country Park.

1.2 Background

WYGE have undertaken preliminary survey work for the Southall site and surrounds in addition to reviewing historical survey work of the study area in order to provide an Ecological Impact Statement for the proposed development and associated access roads at Southall Gasworks. This preliminary survey work and desk study identified the site and immediate vicinity as having the potential to support water voles, reptiles, invertebrates and bats. These surveys were undertaken by WYGE in Oct '04. As such it is necessary to update these reports with follow up surveys. This report forms the basis for the follow up survey.

1.3 Report Conditions

For a detailed review of the extent and limitations of this report, attention is drawn to the report conditions in Appendix A and WYGE tender document, 'E000157 Southall ECO P01 GAC', May 2007.

2.0 METHODOLOGY

2.1 Desk Top Review

A review of readily available ecological information and other relevant environmental databases was undertaken for the site and general environs. This provided the overall ecological context for the site and surrounding areas and potential basis for the habitat and protected species surveys.

2.2 Consultation

Site and species specific information was been sourced through direct consultation with Greenspace Information for Greater London (GIGL), the biological records centre for the London region. In addition, the Borough Council was contacted in relation to the presence of protected species, designated sites or areas of particular regional, national or international importance.

The response from GIGL is presented in Appendix B and a summary is provided in Section 3.2 below.

2.3 Site Survey

Flora

Habitat types were classified using the standard extended Phase 1 methodology (JNCC, 2003) and target notes were prepared describing any notable features identified during the survey. A habitat plan illustrates the results (see ECO.01).

Fauna - Protected Species

A walkover survey was undertaken to establish the likelihood of protected species being present. This involved identifying possible refugia, breeding sites and foraging areas by the following features and/or signs, as well as the animals themselves.

Badgers (*Meles meles*)
setts (main, annex, bolt-holes)
grubbed up grassland (caused by the animals digging for insects)
latrines
paw prints
fur snags on wire and brambles

Bats (Chiroptera)
mature or veteran trees with holes and/or ivy cover
old buildings
recent buildings with cracks or crevices or other features serving as entrance or exit holes

Great Crested Newts (*Triturus cristatus*)
small, still ponds or water bodies (potential breeding sites)
areas of woodland or grassland (potential foraging and/or hibernation sites) where there is optimal invertebrate potential

Water Voles (*Arvicola terrestris*)
ditches, rivers, dykes and lakes with holes and runs along the banks
latrines, piles of food

Reptiles
Including grass snake (*Natrix natrix*), smooth snake (*Coronella austriaca*), adder (*Vipera berus*), common and sand lizard (*Lacerta vivipara and L. agilis*) and slow worm (*Anguis fragilis*):
open areas of low, uneven height vegetation (such as heathland)
adjacent grassland or scrub (well drained and frost free so animals can survive the winter) areas of suitable refugia for basking and shelter.

Nesting and feeding birds
potential trees
areas of scrub
building ledges
hedgerows
active bird nests

Invertebrates
areas of scrub
mature trees
species-rich grassland
dense areas of nettle
damp or wet areas

Other Fauna
Biodiversity Action Plan priority species
During the course of the walkover survey, effort was made to establish the potential for the site to support species that are identified within the UK and/or Oxfordshire's Biodiversity Action Plan. Plants and animals included within these BAPs are considered to be of conservation merit, and although not protected by statute, effort should be taken to ensure that any impact upon such species is reduced or eliminated.

3.0 BASELINE CONDITIONS

3.1 Desktop Review

According to the MAGIC and Natural England 'Nature on the Map' websites, there are no statutory designated sites or areas of semi-natural ancient woodland within 2km.

3.2 Consultation

Records obtained from the consultees provide a context in which the recent ecological surveys are framed and provide a supplementary source of ecological data.

Designations

Biological records held by GIGL and communication with Natural England has confirmed that there are no statutory designations which fall within a 2km search area.

The data search undertaken by GIGL flagged up three non-statutory designated sites within the 2km search area. These are Grand Union Canal, Yeading Brook and Minet Country Park.

Grand Union Canal is part of London's Canals which support a wide range of aquatic flora, invertebrate fauna and a diverse fish community. Yeading Brook and Minet Park comprises reclaimed derelict land of rough grassland with areas of older natural meadow. It has damp habitats including lesser reedmace, water figwort and arrowhead. The park and brook also support pheasant, snipe, kingfisher and skylark.

Table 3.1 - London Habitat and Species Action Plans relevant to the site and surrounds.

Local Habitats	Built up areas and gardens Canals Parks, Squares and Amenity Grassland
Priority Species	Grey Heron Cornflower House Sparrow Bats Kingfisher Water Vole

Species Records

Records for a surrounding 2km area have been provided by GIGL, who hold the Area's biological records (Appendix B). Species of note include pipistrelle, brown long-eared bat and kingfisher all occurring within the Minet Country park.

In addition to the above, Ealing Borough Council have confirmed that there are no Tree Preservation Orders (TPOs) coincident with the site.

3.3 Description of Site Ecology

3.3.1 Detailed Description of Site: Habitats

The habitats present within the study area consist of:

- **Buildings (J3.2)**
- **Hardstanding (J4)**
- **Tall Ruderal (C3.1)**
- **Poor Semi-improved Grassland (B6)**
- **Dense Continuous Scrub (A2.2)**
- **Amenity Grassland (J1.2)**
- **Running Water (G2)**

Summary of Habitats

Within the site boundary, habitats are restricted to hardstanding and tall ruderal with a small area of grassland in the easternmost section of the site. The majority of buildings comprise of brick and concrete construction with flat roofs, lacking roof voids. There is, scattered throughout the site, a large amount of Japanese knotweed and some giant hogweed. These are, however, concentrated in the eastern end of the site particularly two fields separated from the rest of the site by high metal fencing.

The two proposed link road sites at Springfield and Pump Lane are within Minet Country Park and consist of dense scrub, woodland, tall ruderal, grassland and amenity grassland habitat.

Yeading Brook intersects these sites and Grand Union Canal runs along the western perimeter of the Gasworks site.

Target Note 1
Hardstanding with occasional metal fencing. There are scattered waste ground plants growing around the edges including frequent ragwort (*Senecio jacobaea*), buddleja (*Buddleja davidii*), hedge mustard (*Sisymbrium officinale*), bramble (*Rubus fruticosus* agg.), mugwort (*Artemisia vulgaris*), ribwort plantain (*Plantago lanceolata*), cleavers (*Galium aparine*), perforate St. John's-wort (*Hypericum perforatum*), goat willow (*Salix caprea*), great mullein (*Verbascum thapsus*), broadleaved willowherb (*Epilobium montanum*), silver birch (*Betula pendula*), perennial rye-grass (*Lolium perenne*), Yorkshire fog (*Holcus lanatus*) and wall barley (*Hordeum murinum*).

Target Note 2

Japanese Knotweed (*Fallopia japonica*) – Very large dense stand interspersed with silver birch, and ephemeral tall ruderal around the perimeter dominated by mugwort and hedge mustard. Surrounded by hybrid black poplar (*Populus x canadensis*).

Target Note 3
Area dominated by poor semi-improved grassland surrounded by tall ruderal with areas of hardstanding and bare soil.
Grassland – Dominated by false oat-grass (*Arrhenatherum elatius*) with common bent (*Agrostis capillaris*) and perennial sow-thistle (*Sonchus arvensis*).
Tall Ruderal – Wild mignonette (*Reseda lutea*), common nettle (*Urtica dioica*), rosebay willowherb (*Chamerion angustifolium*), bramble, fat-hen (*Chenopodium album* agg.), mugwort (*Artemisia vulgaris*), hedge mustard, great willowherb (*Epilobium hirsutum*), hogweed (*Heracleum sphondylium*) and teasel (*Dipsacus fullonum*).

Target Note 4
Giant Hogweed (*Heracleum mantegazzianum*) stands are scattered over this area.

Target Note 5
Grand Union Canal Bank (Springfield Link Road End) – False oat-grass, greater willowherb, common nettle and bramble are dominant, with, goat willow (*Salix caprea*), grey willow (*Salix cinerea*), cock's-foot (*Dactylis glomerata*), Yorkshire fog, gypsywort (*Lycopus europaeus*) and creeping buttercup (*Ranunculus repens*). A large, mature hybrid black poplar has moderate bat roost potential due to a number of cracks in the trunk and branches.

Target Note 6
Grand Union Canal (Pump Lane End) - To the western most point of the canal adjacent to the site, the general bankside flora is similar to TN5, however, there are patches of giant hogweed on both banks with common reed (*Phragmites australis*) locally abundant.

Target Note 7
Broadleaved woodland and scrub – Dominated by hawthorn (*Cretaegus monogyna*) and blackthorn (*Prunus spinosa*) with abundant wild plum (*Prunus domestica*), bramble, common nettle and hogweed.

Target Note 8
Yeading Brooke Banksides – Indian Balsam (*Impatiens glandulifera*) is locally dominant, with creeping thistle (*Cirsium arvense*), willow, bramble, reed canary-grass (*Phalaris arundinacea*) and broadleaved willowherb. No macrophytes within stream.


Target Note 9
Inaccessible highly contaminated area. Giant hogweed is abundant throughout.

Target Note 10
Pump Lane Link Road Site – Predominantly dense continuous scrub of hawthorn, blackthorn and wild plumb with some areas of tall ruderal dominated by brambles, nettles and giant hogweed. The drainage channel here is heavily canalised with no aquatic macro fauna and is heavily overshadowed by the scrub mentioned above.




Target Note 11
Springfield Link Road Site – Predominantly tall ruderal of false oat-grass, common nettle, mugwort, broad-leaved dock, cow parsley and hedge bindweed. Behind this and adjacent to Yeading Brook is a line of scrub consisting of hawthorn and blackthorn. This is adjacent to an area of amenity grassland which is heavily managed as a cricket ground. Area has negligible reptile potential due to level of management and lack of structural diversity.

3.3.2 Detailed description of site: Protected species potential

Badgers (*Meles meles*)
No evidence of badgers was found.

Bats
All buildings on site have negligible potential to support bats and there are no suitable foraging areas on site. The potential for the site to support roosting or foraging bats is therefore **negligible to low**.

The Grand Union Canal immediately adjacent to the site is a wide canal with tree lined banks which provide good foraging potential for bats as does the scrub and trees of the associated Minet Country Park, particularly large hybrid black poplar in the area. The potential for this area of the site to support bats is **high**.

Great crested newts (*Triturus cristatus*)
There were no still water bodies within 500m and no suitable terrestrial habitat.

Water Voles (*Arvicola terrestris*)
During the survey no signs of water voles were observed, however, Yeading Brook is of suitable habitat and has a **moderate** potential to support water voles.

Reptiles
No direct evidence of reptiles was noted during the survey. The majority of habitats on site and in the adjacent land are not considered to be suitable for reptiles due to the presence of large expanses of hard standing.

The Pump Land and Springfield link road areas are not considered suitable for reptiles due to a lack of structural diversity within the vegetation and a lack of suitable refugia.

There is an area of grassland to the west of the site which contains a diversity of structure including open areas for basking, grassland for foraging and large piles of debris and soil that would be ideal for refugia. The potential for this area of the site to support reptiles is therefore **low to moderate**.

Nesting birds
The site contains habitats suitable for nesting birds in the form of scattered trees. Therefore, the site has **high** potential to support nesting birds.

4.0 LEGISLATIVE CONSIDERATIONS

a) Bats and great crested newts

Great crested newts and all seventeen British bats are listed in Schedule 5 of the Wildlife and Countryside Act, 1981 (as amended) and under Annex IV of the Habitats Directive, 1992 as a European protected species. Furthermore, the Countryside and Rights of Way Act, 2000 (Schedule 12, Paragraph 5) has amended Section 9 of the 1981 Act. They are therefore fully protected under Section 9 of the 1981 Act and under Regulation 39 of the Conservation (Natural Habitats &c.) Regulations, 1994, which transposes the Habitats Directive into UK law.

This makes it an offence to:
- intentionally kill, injure or take any bat or great crested newt as well as
- intentionally or recklessly damage, destroy or obstruct the access to the place of shelter or protection or disturb the animal while it is occupying it
- damage or destroy a breeding site or resting place of such animals.

This legislation applies to all life stages.

Consequently, attention should be given to dealing with the modification or development of an area if aspects of it are deemed important to bats (such as flight corridors and foraging areas) or great crested newts (such as breeding ponds or hibernation sites).

Furthermore, in terms of national conservation policy, 7 of the 17 British species of bat are listed as UK Biodiversity Action Plan (BAP) priority species, which highlights the importance of certain threatened habitats to species in the UK

b) Birds

All birds, their nests and eggs are protected by the Wildlife and Countryside Act 1981 (as amended), Part 1. It is thus an offence to intentionally:

- Kill, injure or take any wild bird.
- Take, damage or destroy the nest of any wild bird while it is in use or being built.
- Take or destroy the egg of any wild bird.
- (Intentionally or recklessly) disturb any wild bird listed on Schedule 1 while it is nest building, or at a nest containing eggs or young, or disturb the dependent young of such a bird.

The presence of breeding birds should be considered a constraint if vegetation clearance is undertaken during the bird breeding season (March - August).

c) Reptiles

All native reptiles are protected in Britain under the Wildlife and Countryside Act 1981 and its subsequent amendments. It is an offence to intentionally or recklessly kill, injure or sell (or advertise to sell) any of the six native species.

d) Water Vole

The water vole receives limited protection through its inclusion on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) Section 9 (4). Legislation protects the water voles places of shelter and protection but does not protect the voles themselves. Legal protection makes it an offence to intentionally:

- Damage or destroy or obstruct access to any structure or place which water voles use for shelter and protection.
- Disturb water voles whilst they are using such a place.

The water vole is also one of twelve Priority Species of British terrestrial mammals identified in the UK Biodiversity Steering Group Report (1996) as needing conservation action. As such the UK Water Vole Steering Group was established and resulted in the production of the UK Water Vole Species Action Plan (1997).

e) Japanese knotweed and giant hogweed

Japanese knotweed and giant hogweed are included in Schedule 9, Part II of the Wildlife and Countryside Act 1981 (as amended). Under section 14 of the Act it is an offence to “plant or otherwise cause to grow in the wild any plant which is included in Part II of Schedule 9”.

The spreading or relocation of either plant material or contaminated soil around the site, for example, via vehicle tracks and wheels, to areas not currently infected would “cause to grow” and consequently constitute an offence.

All parts of these plants are to be considered as controlled waste under The Controlled Waste Regulations, 1992. Rhizomes may spread several metres from the parent plant and soil within this distance should also be treated as controlled waste

Section 34 of the Environmental Protection Act, 1990 places a duty of care on all waste producers (i.e. the developer) to ensure that the disposal “off site” of all parts of the plant and contaminated soil is carried out at a licensed landfill. It is the waste producer’s responsibility to provide the landfill site operator with accurate, written description of the waste, and of any specific harmful properties of it and hauliers should be in possession of a Waste Transfer Document prior to the transportation of the waste.

Nature Conservation Evaluation

4.1 Preliminary evaluation methodology

The following section considers the intrinsic value of the habitats and then the protected species most likely to be present. It does so in the context of the actual development proposal, thereby adopting a 'risk-based' approach to ensuring that any notable ecological feature is safeguarded. In assessing importance of a feature or species, a range of guidelines has been referred to, including:

The UK BAP (from www.ukbap.org.uk)
London's Biodiversity Action Plan
A Nature Conservation Review (Ratcliffe. 1977), and
Guidelines for Ecological Impact Assessment in the United Kingdom (IEEM, 2006)

4.2 Habitats

Many of the habitats within the site boundary are of limited intrinsic ecological interest although they may be important for species that they support.

Scattered trees

Numerous native scattered trees were recorded. The trees provide 'multiple' habitats in the form of ground, trunk and canopy, and together with their different types and heights, make a significant contribution to the sites biodiversity. Taking into account these attributes, the scattered trees are of **local** value.

Poor semi-improved grassland

The area of grassland to the western end of the site is dominated by false oat-grass. The plants and grasses are generally widespread and common in a local, regional and national sense. The nature conservation value of the amenity grassland is therefore considered to be of no more than of value **within the zone of influence** only.

Tall Ruderal

There are several areas of tall ruderal located in the western end of the site, the plants and grasses are generally widespread and common in a local, regional and national sense, therefore, the nature conservation value is **within the zone of influence** only.

Surrounding Habitats

Much of the bordering habitat consists of roads and residential properties. The Grand Union Canal and the adjacent Minet Country Park with Yeading Brook support a range of locally rare habitats and species. The nature conservation value is, therefore, of **local** value.

Dense Scrub

The areas of dense scrub relatively mature and as a result there is little diversity. The scrub is only broken by areas of giant hogweed. The species present are generally widespread and common in a local, regional and national sense, however, they provide nesting for birds and foraging for other species. The nature conservation value for these areas is, therefore, of **local** value.

4.3 Protected species

The proposed infrastructure changes would involve dismantling/demolition of all buildings, warehouse and hardstanding. There are a number of scattered trees on site, as a result the development may have the potential to impact on nesting birds.

Also a redevelopment would destroy the area of grassland and tall ruderal, as a result there is the potential for impact on reptiles in these areas.

The presence of Japanese knotweed and giant hogweed across the site and in the adjacent land means that any development has a high potential to cause the spread of these invasive species.

Yeading Brook and The Grand Union Canal have been assessed as having a **Moderate** potential to support water voles and roosting and foraging bats which suggests that the development is likely to impact on these species. As such further protected species surveys are recommended to asses their activity and status on site and within the adjacent Minet Country park.

4.4 Summary Evaluation

- All buildings on site have negligible value for roosting bats.
- Although the trees have low potential to support protected animals, they provide some intrinsic ecological value also birds may nest in trees and shrubs within the development footprint.
- The site has the potential to support reptiles in the western most section of the site.
- The Japanese knotweed and giant hogweed are both highly invasive and the latter is a health and safety risk.
- Yeading Brook has the potential to support water voles.
- The Grand Union Canal and its associated trees and scrub have high potential to support roosting/commuting bats.

6.0 MITIGATION

The following statement provides an indication of the likely extent of the mitigating works necessary to limit the potential ecological impact of the re-development of the garden centre.

Bats - There are no buildings within the development foot print that have potential to support bats, however the Grand Union Canal and Minet Park immediately adjacent to the area have several hedgerows, areas of scrub and trees in the vicinity that have potential to support roosting/foraging bats. If roosting bats are confirmed, mitigation measures are likely to be required and Natural England must be consulted before anything is done which would affect the bats or their roost. Deliberate damage or destruction is illegal, but the roost may be destroyed if this was "*the incidental result of a lawful operation and could not reasonably have been avoided*" - section 10(3) (c)[1]. If demolition or clearance is proposed, the destruction of a roost would need to be covered by a licence from DEFRA and compensatory measures adopted.

Reptiles – If reptiles are confirmed on site, mitigation measures are likely to involve the relocation of species within the development area to a pre-designated receptor site that has the potential to support the translocated population. Alternatively there may be an opportunity to simply manipulate the existing vegetation to encourage reptiles to move elsewhere by making the habitats gradually less desirable.

Water Voles – If water voles are confirmed on site, mitigation measures are likely. The preferred course of action is to leave wildlife corridors along the brook as water voles confine the majority of their activity to within 2m of the watercourse. These corridors perform an additional function of linking together vole populations and are recognised as a useful contribution to nature conservation. If retention of corridors and buffer zones is not possible, mitigation measures are likely to include the trapping, removal and release of water voles from the proposed development area into an enhanced receptor site of at least the same size as that lost.

Invasive Species – The Japanese knotweed and giant hogweed on site should be eradicated prior to any disruptive works taking place that may result in their spread. This can be achieved in a number of ways but it is likely that a feasibility study and management plan will be required in order to adopt the appropriate techniques. Additionally, all workers on site should be made aware of the health and safety implications of working near giant hogweed.

Birds - If possible, scrub, tree and other nesting habitat should not be removed during the breeding season (March to August). If nesting habitat is removed during the breeding bird season, a nesting bird survey will be required prior to vegetation removal.

Trees & Scrub - the trees within the site should be retained within the development if at all possible. Where removal of these features cannot be avoided, appropriate compensatory planting comprising locally sourced, native plants, should be incorporated within the design proposals.

General Landscaping - It is recommended that any landscaping proposals associated with the proposed development consist of native, locally-sourced plants. Landscaping

[1] The 'Habitats' Regulations have been reviewed, and revised legislation will come into force on 21 August 2007, which will remove this derogation.

should include a mosaic of habitat types that provide a network of habitats within the development, including the planting of native trees.

Site investigation works and construction works can potentially impact on trees and cause significant damage to the root system. As such, it is important to follow the guidance provided in BS 5837 'Trees in relation to Construction' and NHBC Standards 'Building near trees' in order to minimise any negative impacts upon retained trees.

7.0 RECOMMENDATIONS FOR FURTHER WORK

Providing the following measures are adopted, no further survey work is recommended:

Birds - The site is likely to support nesting and feeding birds and as such tree or shrub clearance should be undertaken outside the bird breeding season (March – August). However, birds will sometimes nest outside these months and the relevant legislation will still apply if a nesting bird is found.

Bat Activity Survey - It is recommended that three evening and two dawn activity surveys are undertaken along the Grand Union Canal in order to determine the use of the woodland and trees by bats.

Reptile Presence/Absence Survey - The edges of the fields and woodland areas could support reptile populations and as such it is recommended that a reptile presence/absence survey is undertaken to establish the species and distribution of reptiles. This will require six site visits to be undertaken between late March and early October in suitable sunny, dry and warm conditions.

Invasive Species – An invasive species assessment and management plan should be provided in order to appropriately eradicate Japanese knotweed and giant hogweed form the site.

Water Vole Presence/Absence Survey – A survey to assess the presence/absence of water voles along the Yeading Brook is recommended to update the previous survey undertaken by WYGE.

It should be noted that failure to undertake appropriate ecological safeguard measures could result in non-compliance with some aspects of the legislation governing wildlife protection.

Documents Consulted

Consultation responses.

London's Biodiversity Action Plan.

IEEM (2006). Guidelines for Ecological Impact Assessment in the United Kingdom.

Joint Nature Conservation Committee (2003). Handbook for Phase 1 Habitat Survey: A Technique for Environmental Audit. JNCC, Peterborough.

Joint Nature Conservation Committee (2003) *Herpetofauna Worker Manual*, JNCC, Peterborough.

Joint Nature Conservation Committee (2004) *Bat Workers Manual*, JNCC, Peterborough.

Office of the Deputy Prime Minister (August 2005). Planning Policy Statement 9: Biodiversity and Geological Conservation (PPS 9). HMSO, London.

Ratcliffe, D. A. (ed.) (1977). *A Nature Conservation Review*. Cambridge University Press, Cambridge.

The UK Biodiversity Steering Group Report. Volume 2. Action Plans. HMSO, (1995), London.

Wildlife and Countryside Act 1981. HMSO, London.

APPENDICES

APPENDIX A
Report Conditions

WHITE YOUNG GREEN ENVIRONMENTAL LTD

C1 - REPORT CONDITIONS

Southall Gasworks
Extended Phase one Habitat Survey

This report is produced solely for the benefit of National Grid Property Ltd. and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYGE. In time improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of WYGE using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to WYGE by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

Whilst skill and care have been used, no investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather related conditions.

Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the representativeness of data used by the model and the assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions.

The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYGE accept no liability for issues with performance arising from such factors.

APPENDIX B
Consultation Responses

GiGL

Greenspace Information for Greater London
the open space and biodiversity records centre

An Ecological Data Search for Southall Gas Works

Produced by
Lauren Alexander
Information Officer

Greenspace Information for Greater London
(GiGL)

11 July 07

On behalf of
White Young Green

Report reference 07/274

Based at London Wildlife Trust, Skyline House, 200 Union Street, London, SE1 0LX
T: 020 7803 4271 Fx: 020 7633 0811 E:enquiries@gigl.org.uk

Contents

1.0 Introduction

An ecological data search for Southall Gas Works and surrounding land to a 1km radius on behalf of White Young Green.

The following report was compiled by Greenspace Information for Greater London (GiGL) on behalf of White Young Green, to provide ecological information for the above site for an Environmental Impact Assessment and a planning application. This report may include information on statutory sites, non-statutory sites, species records, habitat or open space information held by GiGL, as requested for the above search area. The boundaries of this search area are defined in the maps in Annex A and lie within the London Borough(s) of Ealing and Hillingdon.

2.0 Statutory Sites

A desk-based search shows that there are no sites with statutory designation within the search area and no LNRs.

Any citations currently available for the statutory sites (SACs, SPAs, Ramsar, SSSIs, NNRs and LNRs) within the search area can be seen on the following pages.

Please note that statutory citations are legal documents, the content of which is fixed and true at the time of designation. Species referred to in the citations may not be present on site today. Citations may have been written based on data not held by GiGL.

3.0 Non-Statutory Sites

A desk-based search shows that there are 2 SINCs and no LWT reserves within the search area.

3.1 Sites of Importance for Nature Conservation

Introduction

Sites of Importance for Nature Conservation (SINCs) are non-statutory and are identified by the Greater London Authority on account of their flora and fauna. They are of Greater London or regional importance. For further explanations of the designations and a list of the documents that most recently define the sites please see the "Supporting Information" annex.

The Sites of Importance for Nature Conservation have been identified since 1986 using procedures that have now been adopted by the Mayor of London. They are recommended for protection in planning. The boundaries and site grades reflect the most recent consideration of each site, details of which are available from the Greater London Authority. Note that boundaries and grades may change as new information becomes available.

Citations

Citations currently available for SINCs within the search area can be seen on the following pages.

Please note that the content of SINC citations is reviewed periodically and that species referred to in the citations may not be present on site today. Citations may have been written based on data not held by GiGL.

Site of Metropolitan Importance for Nature Conservation

Site Reference: M006

Site Name: London's Canals

Summary: London's canals provide a home for many fish and aquatic plants, and are a great way to enjoy the natural world in some of the city's most built-up areas.

Grid ref: TQ 202 833

Area (ha): 177.92

Borough(s):

Brent, Camden, Ealing, Hackney, Hammersmith and Fulham, Hillingdon, Hounslow, Islington, Kensington and Chelsea, Tower Hamlets, Westminster

Habitat(s):

Bare ground, Canal, Ruderal, Scattered trees, Scrub, Secondary woodland, Semi-improved neutral grassland, Tall herbs, Vegetated wall/tombstones, Wet woodland/carr

Access: Free public access (all/most of site)

Ownership: British Waterways

Site Description:

London's canals support a wide range of aquatic flora, amongst which are found a number of locally uncommon species. These include narrow-leaved water plantain (Alisma lanceolatum), rigid hornwort (Ceratopyllum demersum) and shining pondweed (Potomageton lucens), all species of clean, clear waters. Many waterside plants, including several London rarities, also grow on the brickwork and banks of the canal. The canals also support an important invertebrate fauna (including several species of dragon/damselflies), a diverse fish community, and breeding waterfowl. London's network of canals fulfill an important function in allowing nature into heavily built-up environments. The towpath and associated areas of waste ground, especially in East London, support a number of uncommon species of disturbed ground. The whole of the Grand Union Canal system in London, including the Regent's and Hertford Union Canals, is included in this single Metropolitan site.

Site first notified:	01/04/1986	**Boundary last changed:**	30/11/2005
Citation last edited:	01/12/2005	**Mayor Agreed:**	25/11/2002
Defunct:	N		
Last Updated:	21/03/2007		

Site of Borough Grade I Importance for Nature Conservation

Site Reference: HiBI11

Site Name: Yeading Brook, Minet Country Park and Hitherbroom Park

Summary: A site centering on the reclaimed, derelict land of Minet Country Park.

Grid ref: TQ 109 802

Area (ha): 67.86

Borough(s):

Hillingdon

Habitat(s):

Amenity grassland, Bare ground, Hedge, Marsh/swamp, Planted shrubbery, Pond/lake, Ruderal, Running water, Scrub, Secondary woodland, Semi-improved neutral grassland, Tall herbs, Unimproved neutral grassland

Access: Free public access (all/most of site)

Ownership: London Borough of Hillingdon, British Waterways

Site Description:

Minet Country Park partly comprises reclaimed derelict land; it was opened in 2003 and includes an information and education centre with classroom facilities run by A Rocha UK, who warden the site. Much of the country park is recently-created rough grassland, with areas of older, more natural meadow. The flora of the disturbed soil includes pale persicaria (Persicaria lapathifolia), squirrel-tail fescue (Vulpia bromoides) and foxtail barley (Hordeum jubatum), whilst spiked sedge (Carex spicata) corn mint (Mentha arvensis) and musk mallow (Malva moschata) grow in the meadows.
Damp and aquatic habitats include lesser reedmace (Typha angustifolia), water figwort (Scrophularia auriculata), water chickweed (Myosoton aquaticum), arrowhead (Sagittaria sagittifolia), pepper saxifrage (Silaum silaus), marsh woundwort (Stachys palustris) and fennel pondweed (Potamogeton pectinatus).
The park is a great place for birdwatching. Birds recorded include pheasant, snipe, kingfisher, skylark, whinchat, mistle thrush, Dartford, sedge, reed and willow warblers, linnet, redpoll, meadow pipit, hobby, bullfinch, reed bunting and common sandpiper. Grass snakes and smooth newts are both found at the site. The Essex skipper butterfly is abundant, and five nationally scarce species of water beetle have been recorded from seasonal ponds to the north of the site.
To the east of the country park is Minet Tip, a private site owned by British Waterways. The scrubby pits and hillocks support a rich flora and diverse birdlife.
To the north-east of the country park the banks of the Yeading Brook are clothed in scrub and small trees. A small stream with largely natural banks runs eastwards through Hitherbroom Park to meet the Yeading Brook in the Country Park. The nature conservation management plans of these sites should be integrated with respect to the watercourse. The stream is largely lined with large crack willows (Salix fragilis).
Wetland flora includes abundant arrowhead, water forget-me-not (Myosotis scorpioides), flowering rush (Butomus umbellatus) and a water starwort (probably Callitriche platycarpa).
Minet Tip and part of a flood-relief channel to the west of the Country Park site, and the culverted section of Yeading Brook are not accessible. There are also small inaccessible areas to the north of the site. The bulk of the site has free public access.

Site first notified: 01/01/1988 **Boundary last changed:** 08/09/2005

Citation last edited: 22/03/2006 **Mayor Agreed:**

Defunct: N

Last Updated: 15/08/2006

4.0 Species

A list of protected species* and those that are National or London Biodiversity Action Plan (BAP) priority species can be seen on the following pages.

Note that GiGL does not currently hold comprehensive species data for all areas. Even where data is held, a lack of records for a species in a defined geographical area does not necessarily mean that the species does not occur there – the area may simply not have been surveyed.

Distances and direction to each species record are calculated from the centre-point of a search area. Note that because the resolution of grid references varies between surveys the accuracy of these figures will also vary.

The species, listed by taxon name, were recorded from a broad range of surveys - from public and species specific surveys to formal surveys carried out during the GLA's rolling program. Bat records collected by the London Bat Group are provided in a separate section (below).

If you would like further information regarding rare, notable and protected species please contact a relevant person listed in the Further Contacts section of this report.

* Protected species are those listed on EC Habitats Directive – Annexes II and IV, EC Birds Directive – Annex I, Conservation (Natural Habitats) Regulations 1994 – Schedules 2 & 4, Wildlife and Countryside Act 1981 (as amended) – Schedules 1, 5 & 8, Protection of Badgers Act 1992

4.1 Protected and BAP Species

Taxon Name	Common Name	Protected Status	Distance (m)	Bearing	Date
Centaurea cyanus	Cornflower	BAP Priority National	480	W	28/07/2004
			649	W	30/07/2004
Ardea cinerea	Grey Heron	BAP Priority London	106	SE	12/12/2004
			897	NE	10/08/2004
			922	NE	21/07/2005
Sterna hirundo	Common Tern	Birds Dir Anx 1	106	SE	12/12/2004
Alcedo atthis	Kingfisher	W&CA Sch 1 Part 1 Birds Dir Anx 1	605	W	30/07/2004
			788	W	12/06/2006
Passer domesticus	House Sparrow	BAP Priority London	110	E	22/07/2005
			626	NW	28/07/2004
			637	NE	2002
Vespertilionidae	Bats	Conservation Regs 1994 Sch2 W&CA Sch 5 Sec 9.1 W&CA Sch 5 Sec 9.2 W&CA Sch5 Sec 9.5a W&CA Sch5 Sec 9.4a W&CA Sch5 Sec 9.5b W&CA Sch5 Sec 9.4b W&CA Sch 5 Sec 9.1 Hab&Spp Directive Anx 2np BAP Priority London	396	SW	14/07/1986
Pipistrellus	Pipistrellus	Conservation Regs 1994 Sch2 W&CA Sch 5 Sec 9.1 W&CA Sch 5 Sec 9.2 W&CA Sch5 Sec 9.5a W&CA Sch5 Sec 9.4a W&CA Sch5 Sec 9.5b W&CA Sch5 Sec 9.4b W&CA Sch 5 Sec 9.1 Hab&Spp Directive Anx 2np BAP Priority National BAP Priority London	175	SE	08/08/1994
			201	NE	08/08/1994

Taxon Name	Common Name	Protected Status	Distance (m)	Bearing	Date
Plecotus auritus	Brown Long-Eared Bat	Conservation Regs 1994 Sch2 W&CA Sch 5 Sec 9.1 W&CA Sch 5 Sec 9.2 W&CA Sch5 Sec 9.5a W&CA Sch5 Sec 9.4a W&CA Sch5 Sec 9.5b W&CA Sch5 Sec 9.4b W&CA Sch 5 Sec 9.1 Hab&Spp Directive Anx 2np BAP Priority London	455	E	07/09/1987

London Bat Group

Affiliated to the Bat Conservation Trust

The London Bat Group is a registered charity no: 1068048

Southall Gas Works and surrounding land to a 1km radius.

White Young Green (07/274)

Reports giving only the genus indicate identification to genus level only – Vespertilionidae indicates unidentified bat species. The data is a collection of incidental reports and is not the result of any systematic survey.

All information provided here has been collected by a London Bat Group Recorder and is believed to be correct. However, no responsibility can be accepted by the London Bat Group or any of its partners or officers for any consequences of errors or omissions, nor responsibility for loss occasioned to any person acting or refraining from action as a result of this information and no claims for compensation for damage or negligence will be accepted.

This information is provided solely for the purpose of aiding an assessment of the potential impact of a proposal on bats. The absence of records does not mean that bats are not present or have a place of shelter within any particular site or area. The London Bat Group advises that competent personnel should survey and assess any site, structure or tree that may be affected by any planned work at the earliest possible stage, and certainly before any proposed work starts.

NOTE: TO ENSURE COMPLETENESS DATA COLLECTED BY THE LONDON BAT GROUP ALSO APPEARS IN THE PROTECTED AND NOTABLE SPECIES LIST.

London Bat Group

Affiliated to the Bat Conservation Trust

The London Bat Group is a registered charity no: 1068048

4.2 Bat Roosts

There are no bat roost records for the search area.

London Bat Group

Affiliated to the Bat Conservation Trust

The London Bat Group is a registered charity no: 1068048

4.3 Bat Sightings

Taxon Name	Common Name	Protected Status	Distance (m)	Bearing	Date
Vespertilionidae	Bats	Conservation Regs 1994 Sch2 W&CA Sch 5 Sec 9.1 W&CA Sch 5 Sec 9.2 W&CA Sch5 Sec 9.5a W&CA Sch5 Sec 9.4a W&CA Sch5 Sec 9.5b W&CA Sch5 Sec 9.4b W&CA Sch 5 Sec 9.1 Hab&Spp Directive Anx 2np BAP Priority London	396	SW	14/07/1986
Pipistrellus	Pipistrellus	Conservation Regs 1994 Sch2 W&CA Sch 5 Sec 9.1 W&CA Sch 5 Sec 9.2 W&CA Sch5 Sec 9.5a W&CA Sch5 Sec 9.4a W&CA Sch5 Sec 9.5b W&CA Sch5 Sec 9.4b W&CA Sch 5 Sec 9.1 Hab&Spp Directive Anx 2np BAP Priority National BAP Priority London	175 201	SE NE	08/08/1994 08/08/1994
Plecotus auritus	Brown Long-Eared Bat	Conservation Regs 1994 Sch2 W&CA Sch 5 Sec 9.1 W&CA Sch 5 Sec 9.2 W&CA Sch5 Sec 9.5a W&CA Sch5 Sec 9.4a W&CA Sch5 Sec 9.5b W&CA Sch5 Sec 9.4b W&CA Sch 5 Sec 9.1 Hab&Spp Directive Anx 2np BAP Priority London	455	E	07/09/1987

5.0 Habitats

A list of habitats within the search area can be seen on the following pages. **It can be cross-referenced with the Survey Parcels Map in the report Annex.**

Habitats have been recorded as part of a formal survey carried out during the GLAs rolling program of habitat surveys and occasionally by other organisations.

The GLA habitat classification system is used - for further details of categories please also refer to the Supporting Information section of the Annex.

Note that GiGL does not currently hold habitat data for all areas. Even where data is held, a lack of records in a defined geographical area does not necessarily mean that the habitat does not occur there – the area may simply not have been surveyed.

Note also that grid references refer to the centre-point of a survey parcel.

Parcel Id.	Grid Ref.	Date	Habitat Type	Area (%)	Area (ha)
26190/01	TQ1109480498	28/07/2004	Neutral grassland (semi-improved)	60	7.79
			Ruderal or ephemeral	19	2.47
			Bare artificial habitat	15	1.95
			Amenity grassland	5	0.65
			Scattered trees	1	0.13
26190/02	TQ1110780774	28/07/2004	Tall herbs	40	0.05
			Ruderal or ephemeral	40	0.05
			Improved or re-seeded agricultural grassland	20	0.02
26190/03	TQ1122380464	28/07/2004	Neutral grassland (semi-improved)	50	0.68
			Tall herbs	30	0.40
			Ruderal or ephemeral	20	0.27
26190/04	TQ1115680217	28/07/2004	Tall herbs	30	0.44
			Ruderal or ephemeral	30	0.44
			Bare soil and rock	25	0.36
			Neutral grassland (semi-improved)	10	0.14
			Bare artificial habitat	5	0.07
26190/05	TQ1082680036	30/07/2004	Neutral grassland (semi-improved)	25	1.67
			Native hedge	25	1.67
			Running water (rivers and streams)	20	1.34
			Scrub	20	1.34
			Scattered trees	10	0.67
26190/06	TQ1090779964	30/07/2004	Neutral grassland (semi-improved)	60	1.88
			Neutral grassland (herb-rich)	20	0.63
			Scrub	10	0.31
			Bare soil and rock	5	0.16
			Scattered trees	5	0.16
26190/07	TQ1107779795	30/07/2004	Neutral grassland (herb-rich)	40	1.00
			Neutral grassland (semi-improved)	35	0.87
			Native hedge	15	0.37
			Scrub	10	0.25
26190/08	TQ1095479951	30/07/2004	Running water (rivers and streams)	30	0.48
			Neutral grassland (herb-rich)	20	0.32
			Wet marginal vegetation	20	0.32
			Neutral grassland (semi-improved)	20	0.32
			Scrub	5	0.08

Parcel Id.	Grid Ref.	Date	Habitat Type	Area (%)	Area (ha)
			Scattered trees	5	0.08
26190/09	TQ1124179833	30/07/2004	Neutral grassland (herb-rich)	45	0.49
			Neutral grassland (semi-improved)	30	0.32
			Scrub	15	0.16
			Scattered trees	10	0.11
26190/10	TQ1143679939	30/07/2004	Amenity grassland	80	1.82
			Bare artificial habitat	10	0.23
			Tall herbs	5	0.11
			Scattered trees	5	0.11
26190/11	TQ1107280008	28/07/2004	Ruderal or ephemeral	50	3.54
			Neutral grassland (semi-improved)	30	2.12
			Tall herbs	10	0.71
			Bare soil and rock	10	0.71
26190/12	TQ1084979643	30/07/2004	Native broadleaved woodland	50	1.46
			Neutral grassland (herb-rich)	25	0.73
			Scrub	20	0.58
			Native hedge	5	0.15
26190/13	TQ1155980033	30/07/2004	Amenity grassland	40	0.18
			Roughland (intimate mix of 9, 14 and 6)	30	0.14
			Ruderal or ephemeral	20	0.09
			Scattered trees	10	0.04
26190/14	TQ1124979792	30/07/2004	Tall herbs	30	0.47
			Running water (rivers and streams)	30	0.47
			Scrub	30	0.47
			Scattered trees	10	0.16
26416/01	TQ1151180063	30/07/2004	Amenity grassland	90	1.19
			Bare artificial habitat	10	0.13
26424/01	TQ1119180342	28/07/2004	Amenity grassland	85	1.43
			Bare artificial habitat	10	0.17
			Roughland (intimate mix of 9, 14 and 6)	5	0.08
26452/01	TQ1069780402	21/10/2004	Scattered trees	35	0.41
			Amenity grassland	30	0.35
			Scrub	20	0.23
			Running water (rivers and streams)	10	0.12
			Bare artificial habitat	5	0.06

Parcel Id.	Grid Ref.	Date	Habitat Type	Area (%)	Area (ha)
26453/01	TQ1073479664	21/10/2004	Non-native broadleaved woodland	50	0.48
			Planted shrubbery	20	0.19
			Native broadleaved woodland	20	0.19
			Scrub	10	0.10
26507/01	TQ1162680619	12/12/2004	Running water (rivers and streams)	79	1.40
			Scrub	12	0.21
			Scattered trees	6	0.11
			Bare artificial habitat	2	0.04
			Bare soil and rock	1	0.02
26844/01	TQ1127379990	30/07/2004	Amenity grassland	50	2.29
			Bare artificial habitat	40	1.83
			Neutral grassland (semi-improved)	4	0.18
			Native hedge	3	0.14
			Scattered trees	3	0.14
26974/04	TQ1199580846	10/08/2004	Standing water (includes canals)	50	0.55
			Bare artificial habitat	25	0.27
			Scrub	15	0.16
			Ruderal or ephemeral	5	0.05
			Scattered trees	5	0.05
26974/05	TQ1163180000	12/12/2004	Standing water (includes canals)	80	1.13
			Scrub	8	0.11
			Neutral grassland (semi-improved)	6	0.08
			Scattered trees	4	0.06
			Bare soil and rock	2	0.03
26975/01	TQ1115479663	27/07/2004	Scrub	60	4.63
			Native broadleaved woodland	15	1.16
			Tall herbs	10	0.77
			Ruderal or ephemeral	10	0.77
			Bare soil and rock	5	0.39
26975/02	TQ1161179998	30/07/2004	Scrub	55	0.73
			Native broadleaved woodland	25	0.33
			Tall herbs	20	0.27
26976/01	TQ1063979966	21/10/2004	Amenity grassland	50	0.78
			Scrub	20	0.31
			Neutral grassland (semi-improved)	15	0.24
			Scattered trees	8	0.13

Parcel Id.	Grid Ref.	Date	Habitat Type	Area (%)	Area (ha)
			Bare artificial habitat	7	0.11
27031/02	TQ1131979615	28/09/2005	Ruderal or ephemeral	35	3.45
			Bare artificial habitat	30	2.96
			Bare soil and rock	30	2.96
			Scrub	5	0.49
27031/08	TQ1155979779	28/09/2005	Ruderal or ephemeral	60	1.03
			Bare soil and rock	30	0.52
			Bare artificial habitat	10	0.17
27031/09	TQ1165779714	28/09/2005	Ruderal or ephemeral	45	0.99
			Bare artificial habitat	20	0.44
			Bare soil and rock	20	0.44
			Standing water (includes canals)	10	0.22
			Scrub	5	0.11
27032/01	TQ1202980855	21/07/2005	Standing water (includes canals)	80	0.82
			Amenity grassland	10	0.10
			Scrub	4	0.04
			Bare artificial habitat	2	0.02
			Neutral grassland (semi-improved)	2	0.02
			Scattered trees	2	0.02
27032/02	TQ1164580013	22/07/2005	Standing water (includes canals)	80	1.72
			Neutral grassland (herb-rich)	10	0.22
			Bare artificial habitat	5	0.11
			Scrub	4	0.09
			Scattered trees	1	0.02
27096/01	TQ1225279794	28/09/2005	Neutral grassland (semi-improved)	80	1.98
			Scrub	10	0.25
			Scattered trees	10	0.25
27656/01	TQ1215479657	17/06/2005	Bare artificial habitat	80	7.58
			Ruderal or ephemeral	8	0.76
			Scrub	3	0.28
			Neutral grassland (semi-improved)	2	0.19
			Scattered trees	2	0.19
27657/01	TQ1216879931	28/08/2005	Scrub	70	0.65
			Scattered trees	15	0.14
			Tall herbs	10	0.09
			Bare artificial habitat	5	0.05

Parcel Id.	Grid Ref.	Date	Habitat Type	Area (%)	Area (ha)
27658/01	TQ1174280232	26/09/2005	Allotments (active)	55	0.37
			Neutral grassland (semi-improved)	40	0.27
			Scrub	5	0.03
27659/01	TQ1185680296	22/07/2005	Tall herbs	40	0.12
			Ruderal or ephemeral	40	0.12
			Bare artificial habitat	10	0.03
			Scrub	10	0.03
27660/01	TQ1184880685	21/07/2005	Scattered trees	50	0.20
			Amenity grassland	42	0.17
			Planted shrubbery	8	0.03
27924/01	TQ1165079991	28/09/2005	Scrub	70	0.20
			Native broadleaved woodland	30	0.08
27925/01	TQ1189979708	28/09/2005	Bare soil and rock	50	1.12
			Bare artificial habitat	25	0.56
			Ruderal or ephemeral	23	0.52
			Scrub	2	0.04
27926/01	TQ1125879369	29/09/2005	Bare soil and rock	85	3.12
			Ruderal or ephemeral	15	0.55

6.0 Open Spaces

A list of open space information within the search area can be seen on the following pages. **The table can be cross-referenced with the Survey Parcels Map and the Open Space Map in the report Annex.**

For further details of open space typology and planning status categories please also refer to the Supporting Information section of the Annex.

Open space informaton has been recorded as part of a formal survey carried out during the GLAs rolling program of habitat surveys and occasionally by other organisations.

Note that GiGL does not currently hold open space data for all areas. Even where data is held, a lack of records in a defined geographical area does not necessarily mean that the open space features do not occur there – the area may simply not have been surveyed.

Note also that grid references refer to the centre-point of a survey parcel.

Parcel Id.	Grid Ref.	Date	Open Space Typology	Planning Status	Public Access	Facilities
26190/01	TQ1109480498	28/07/2004	nature reserve	Green Belt Other Reserve	Free	
26190/02	TQ1110780774	28/07/2004	nature reserve	Green Belt Conservation area Other Reserve	Free	
26190/03	TQ1122380464	28/07/2004	vacant land	Green Belt Other Reserve	None	
26190/04	TQ1115680217	28/07/2004	nature reserve	Green Belt Other Reserve	Free	
26190/05	TQ1082680036	30/07/2004	nature reserve	Green Belt	None	
26190/06	TQ1090779964	30/07/2004	nature reserve	SINC or equivalent MOL Other Reserve	Free	
26190/07	TQ1107779795	30/07/2004	nature reserve	SINC or equivalent Green Belt Other Reserve	Free	
26190/08	TQ1095479951	30/07/2004	nature reserve	SINC or equivalent Green Belt Other Reserve		
26190/09	TQ1124179833	30/07/2004	nature reserve	SINC or equivalent MOL Other Reserve	Free	
26190/10	TQ1143679939	30/07/2004	nature reserve	Green Belt Other Reserve	Restricted	
26190/11	TQ1107280008	28/07/2004	nature reserve	SINC or equivalent Green Belt Other Reserve	Free	
26190/12	TQ1084979643	30/07/2004	nature reserve	Green Belt Other Reserve	Free	
26190/13	TQ1155980033	30/07/2004	nature reserve	SINC or equivalent Green Belt Other Reserve	Free	
26190/14	TQ1124979792	30/07/2004	river	SINC or equivalent Green Belt Other Reserve	Restricted	

Parcel Id.	Grid Ref.	Date	Open Space Typology	Planning Status	Public Access	Facilities
26416/01	TQ1151180063	30/07/2004	playing fields	Green Belt	Restricted	
26424/01	TQ1119180342	28/07/2004	playing fields	Green Belt	Restricted	
26452/01	TQ1069780402	21/10/2004	park	No open space designation Other Reserve	Free	
26453/01	TQ1073479664	21/10/2004	road island/verge	Green Belt	None	
26507/01	TQ1162680619	12/12/2004	river	SINC or equivalent	None	
26844/01	TQ1127379990	30/07/2004	educational	Green Belt Other Reserve	Restricted	
26974/04	TQ1199580846	10/08/2004	canal	SINC or equivalent	Free	
26974/05	TQ1163180000	12/12/2004	canal	SINC or equivalent	Free	
26975/01	TQ1115479663	27/07/2004	vacant land	SINC or equivalent Green Belt	None	
26975/02	TQ1161179998	30/07/2004	vacant land	SINC or equivalent Green Belt	None	
26976/01	TQ1063979966	21/10/2004	playing fields		Restricted	
27031/02	TQ1131979615	28/09/2005	vacant land	No open space designation	None	
27031/08	TQ1155979779	28/09/2005	vacant land	No open space designation	None	
27031/09	TQ1165779714	28/09/2005	Other		None	
27032/01	TQ1202980855	21/07/2005	canal	SINC or equivalent Green corridor	Free	
27032/02	TQ1164580013	22/07/2005	canal	SINC or equivalent Green corridor	Free	
27096/01	TQ1225279794	28/09/2005	nature reserve	No open space designation	None	
27656/01	TQ1215479657	17/06/2005	railway embankment	Green corridor	None	
27657/01	TQ1216879931	28/08/2005	nature reserve	No open space designation	None	

Parcel Id.	Grid Ref.	Date	Open Space Typology	Planning Status	Public Access	Facilities
27658/01	TQ1174280232	26/09/2005	Allotment	Green corridor Other Reserve	Restricted	
27659/01	TQ1185680296	22/07/2005	vacant land	No open space designation	None	
27660/01	TQ1184880685	21/07/2005	landscaping around premises	No open space designation	None	
27924/01	TQ1165079991	28/09/2005	nature reserve		None	
27925/01	TQ1189979708	28/09/2005	Other		None	
27926/01	TQ1125879369	29/09/2005	vacant land		None	

7.0 Contacts

7.1 Borough contacts

Further details of sites and species within the search area may be gathered from the following borough contacts:

London Borough of Ealing

Ian Kitson
Parks, Countryside Service and Events Team
3rd Floor, South West
Perceval House
14-16 Uxbridge Road
Ealing
W5 2HL

Tel: 020 8825 9205
Email: kitsoni@ealing.gov.uk

London Borough of Hillingdon

Stuart Hunt
Green Spaces Team (4W/08)
Civic Centre
Uxbridge
Middlesex
UB8 1UW

Tel: 01895 250916
Email: shunt@hillingdon.gov.uk

7.2 Further Contacts

The following contacts work closely with GiGL and are the best source for further advice or interpretation of the data provided by us. They are widely recognised in Greater London as the experts in their fields, and have provided the following information as the preferred method of contact.

Areas of expertise	**General advice**
Name	**Steve Whitbread**
Organisation	**London Wildlife Trust**
Email	swhitbread@wildlondon.org.uk
Website	www.wildlondon.org.uk

Areas of expertise	**LWT reserve information**
Name	**Kate Coss**
Organisation	**London Wildlife Trust**
Email	kcoss@wildlondon.org.uk
Website	www.wildlondon.org.uk

Areas of expertise	**Water vole data interpretation**
Name	**Louise Wells**
Organisation	**London Wildlife Trust**
Email	lwells@wildlondon.org.uk
Website	www.wildlondon.org.uk

Areas of expertise	**London BAP species and habitats**
Name	**Nick White**
Organisation	**London Biodiversity Partnership**
Email	nwhite@lbp.org.uk
Website	www.lbp.org.uk

Areas of expertise	SINCs, open space and habitat survey data advice
Name	John Archer
Organisation	GLA - Greater London Authority
Email	john.archer@london.gov.uk
Website	www.london.gov.uk

Areas of expertise	Statutory site advice
Name	Conservation Officer
Organisation	Natural England
Email	london@naturalengland.org.uk
Website	www.naturalengland.org.uk

Areas of expertise	Bats
Organisation	London Bat Group
Email	enquiries@londonbats.org.uk
Website	www.londonbats.org.uk

Areas of expertise	Black redstarts, birds, brown and green roofs
Name	Dusty Gedge
Organisation	Livingroofs.org
Email	dustygedge@yahoo.co.uk
Website	www.livingroofs.org

Areas of expertise	Vascular plants
Name	Rodney Burton
Organisation	London Natural History Society
Email	rodney.burton@lineone.net
Website	www.lnhs.org.uk

Areas of expertise	**Plant galls, mollusca (freshwater and land), myriapoda and isopoda, ladybirds, bumble bees**
Name	**Ken Hill**
Organisation	**London Natural History Society**
Email	Ken@kenneth17.fsnet.co.uk
Website	www.lnhs.org.uk

Areas of expertise	**Spiders** — identification and recording. Beetles also recorded.
Name	**Edward Milner**
Organisation	**London Natural History Society**
Email	acacia@dial.pipex.com
Website	www.lnhs.org.uk

Areas of expertise	**Invertebrates**
Name	**Colin W Plant**
Organisation	**London Natural History Society**
Email	cpauk1@ntlworld.com
Website	www.lnhs.org.uk

Areas of expertise	**Lichens**
Name	**Amanda Waterfield**
Organisation	**London Natural History Society**
Email	a.waterfield@nhm.ac.uk
Website	www.lnhs.org.uk

Areas of expertise	**Fungi**
Name	**Ted Tuddenham**
Organisation	**London Natural History Society**
Email	mycorec@blueyonder.co.uk
Website	www.lnhs.org.uk

Areas of expertise	**Odonata – dragonflies and damselflies**
Name	**Neil Anderson**
Organisation	**London Natural History Society**
Email	neil@anders42.freeserve.co.uk
Website	www.lnhs.org.uk

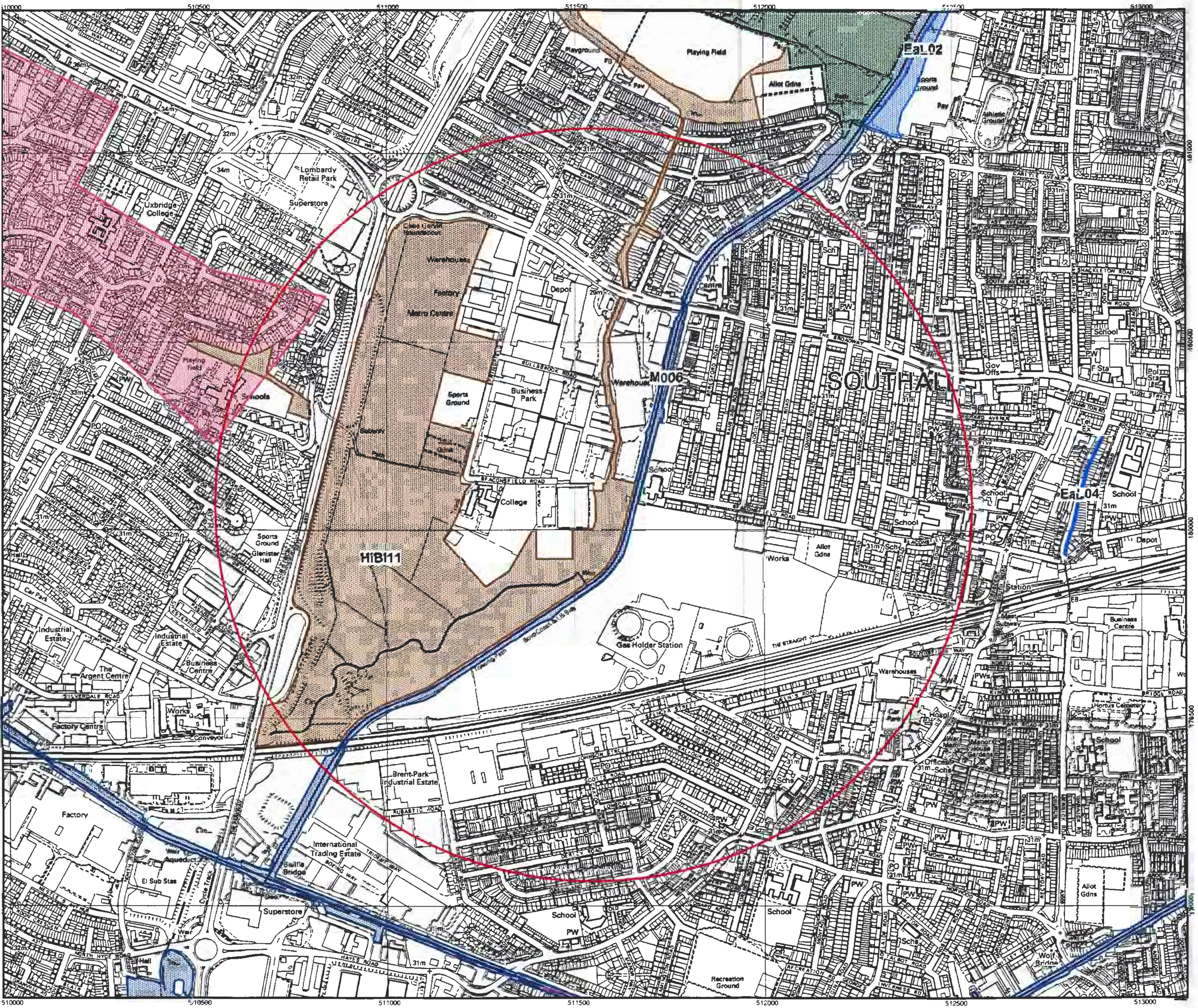
Annex A - Maps

SINCs Map

Survey Parcels Map

Open Space Map

GREATER LONDON AUTHORITY Sites of Importance for Nature Conservation



Ecological Data Search for White Young Green (07/274)

11 July 2007

Southall Gas Works

- Search Area
- Site of Metropolitan Importance
- Site of Borough Importance Grade 1
- Site of Borough Importance Grade 2
- Site of Local Importance
- Areas of Deficiency

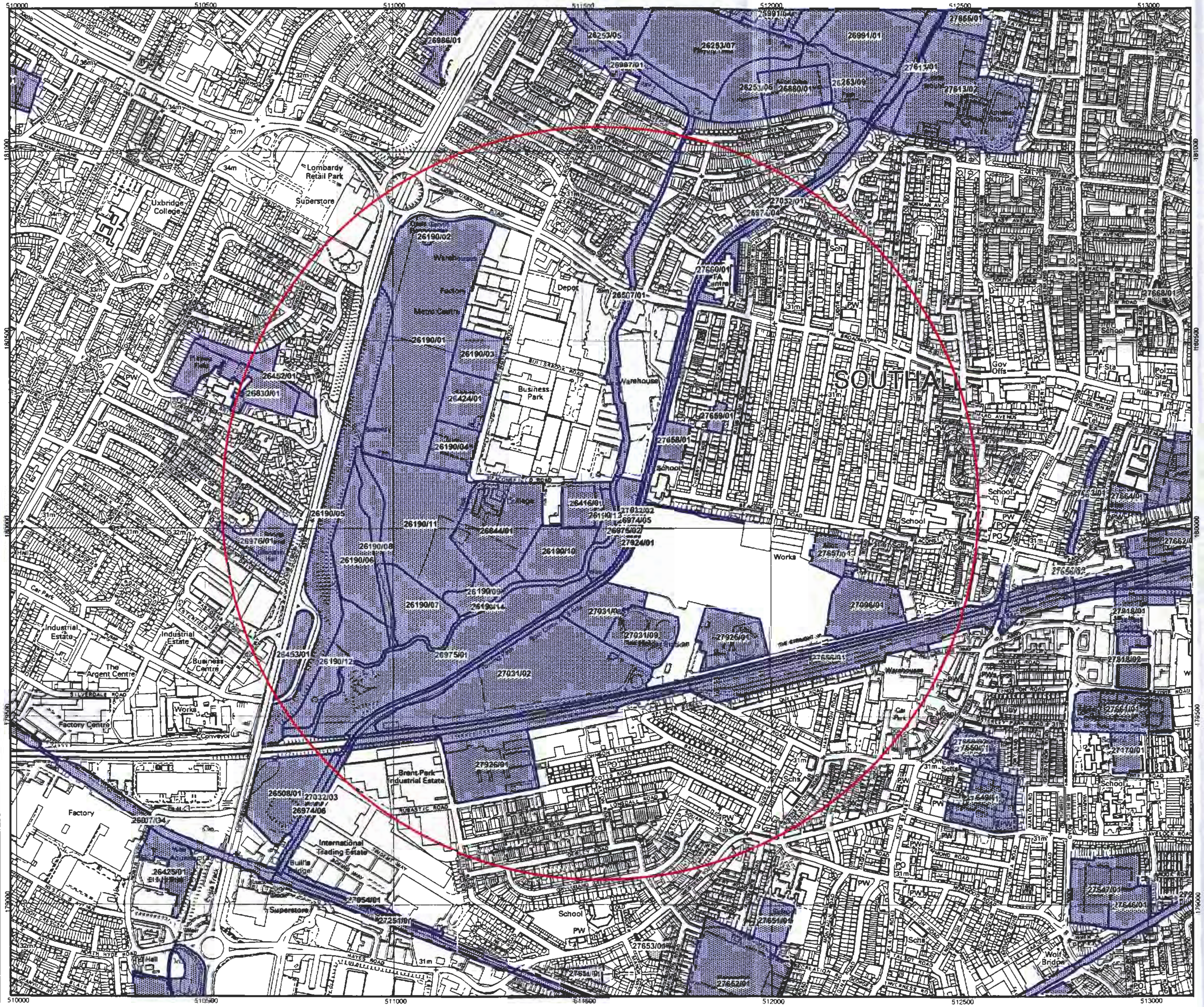
Scale 1:10000

The Sites of Importance for Nature Conservation have been identified since 1986 using procedures which have now been adopted by the Mayor of London. They are recommended for protection in planning. The boundaries and site grades reflect the most recent consideration of each site, details of which are available from the Trust and the Greater London Authority. Note that boundaries and grades may change as new information becomes available.

Produced by Greenspace Information for Greater London

GREATERLONDONAUTHORITY

Habitat Survey Parcels



Ecological Data Search for White Young Green (07/274)

11 July 2007

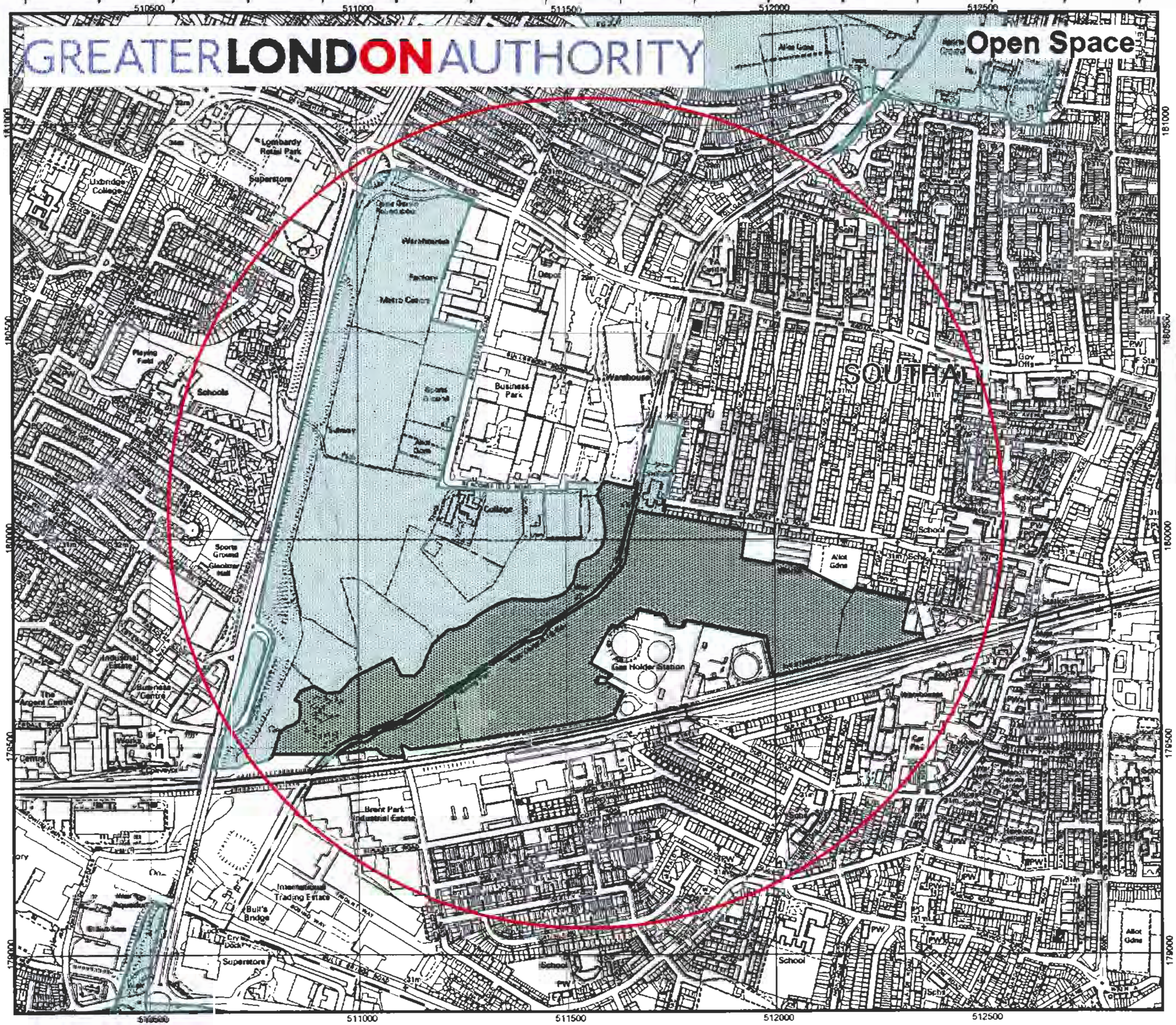
Southall Gas Works

Search Area

Survey Parcel

Scale 1:10000

Produced by Greenspace Information for Greater London



Ecological Data Search for White Young Green (07/274)

11 July 2007

Southall Gas Works

Search Area

Green belt

Metropolitan Open land

Scale 1:12500

Produced by Greenspace Information for Greater London

Annex B - Supporting Information

Statutory Site Designations

Local Nature Reserve (LNR)
Land owned, leased or managed by Local Authorities and designated under the National Parks and Access to the Countryside Act. A site of some nature conservation value managed for educational objectives — no need for SSSI status. In some cases it is managed by a non-statutory body (e.g. London Wildlife Trust). Local Authorities have the power to pass bylaws controlling (e.g.) access, special protection measures.

Site of Special Scientific Interest (SSSI)
Area notified under the Wildlife and Countryside Act, 1981, by English Nature, the Countryside Council for Wales or Scottish Heritage as being of special interest for nature conservation. Consultation and some form of agreement with the national statutory conservation agency is mandatory before any listed, potentially damaging development, change in land use, etc. can be carried out. SSSI notification forms the statutory bedrock for site protection, although experience has shown that even SSSIs are not sacrosanct.

Biological SSSIs form a national network of wildlife sites in which each site is a distinct discrete link. Sites are selected in such a way that the protection of each site, and hence the network, aims to conserve the minimum area of wildlife habitat necessary to maintain the natural diversity and distribution of Britain's native flora and fauna and the communities they comprise. Each site, therefore, is of national significance for its nature conservation value. The vast majority of SSSIs, and indeed most areas of semi-natural habitat, cannot be created within human time scales and are therefore considered irreplaceable.

Geological SSSIs—more correctly termed Earth Science SSSIs—are the best sites chosen for their research value, the criterion being that they are of national or international importance. Earth Science conservation is concerned with the maintenance of our geological and geomorphological heritage.

National Nature Reserve (NNR)
Statutory reserve established for the nation under the Wildlife and Countryside Act, 1981. NNRs may be owned by a relevant national body (e.g. English Nature in England) or by established agreement; a few are owned and managed by non-statutory bodies. NNRs cover a selection of the most important sites for nature conservation in the UK.

Special Area of Conservation (SAC) and Special Protection Area (SPA)
SACs and SPAs are areas designated under European law and are the most important sites for wildlife in the UK. SACs are designated under the European Habitats Directive (Council Directive 92/43/EEC) and SPAs under the European Birds Directive (Council Directive 79/409/EEC). Both the Habitats and Birds Directive provide for the creation of a network of protected wildlife areas across the EU, to be known as "Natura 2000". The designations aim to conserve important or threatened species and habitats and provide them with increased protection and management.

Ramsar sites
Ramsar sites are wetlands of international importance designated under the Ramsar Convention. The initial emphasis was on selecting sites of importance to waterbirds within the UK, and consequently many Ramsar sites are also Special Protection Areas (SPAs) classified under the Birds Directive. Non-bird features are now increasingly taken into account, both in the selection of new sites and when reviewing existing sites.

SINC Designations

Sites of Importance for Nature Conservation

1 The different kinds of sites and areas

1.1 There are three kinds of site, which are chosen on the basis of their importance to a particular defined geographic area. This use of search areas is an attempt, not only to protect the best sites in London, but also to provide each part of London with a nearby site, so that people are able to have access to enjoy nature.

Sites of Metropolitan Importance

1.2 Sites of Metropolitan Importance for Nature Conservation are those sites which contain the best examples of London's habitats, sites which contain particularly rare species, rare assemblages of species or important populations of species, or sites which are of particular significance within otherwise heavily built-up areas of London.

1.3 They are of the highest priority for protection. The identification and protection of Metropolitan Sites is necessary, not only to support a significant proportion of London's wildlife, but also to provide opportunities for people to have contact with the natural environment.

1.3.1 The best examples of London's habitats include the main variants of each major habitat type, for example hornbeam woodland, wet heathland, or chalk downland. Habitats typical of urban areas are also included, e.g. various types of abandoned land colonised by nature ('wasteland' or 'unofficial countryside'). Those habitats which are particularly rare in London may have all or most of their examples selected as Metropolitan Sites.

1.3.2 Sites of Metropolitan Importance include not only the best examples of each habitat type, but also areas which are outstanding because of their assemblage of habitats, for example the Crane corridor, which contains the River Crane, reservoirs, pasture, woodland and heathland.

1.3.3 Rare species include those that are nationally scarce or rare (including Red Data Book species) and species which are rare in London.

1.3.4 A small number of sites are selected which are of particular significance within heavily built up areas of London. Although these are of lesser intrinsic quality than those sites selected as the best examples of habitats on a London-wide basis they are outstanding oases and provide the opportunity for enjoyment of nature in extensive built environments. Examples include St James's Park, Nunhead Cemetery, Camley Street Natural Park and Sydenham Hill Woods. In some cases (e.g. inner London parks) this is the primary reason for their selection. For sites of higher intrinsic interest it may only be a contributory factor. Only those sites that provide a significant contribution to the ecology of an area are identified.

1.4 The list of sites was updated regularly by the London Ecology Committee. This list, and details of the site boundaries, can be obtained from the Greater London Authority.

1.5 Should one of these sites be lost or damaged, something would be lost which exists in a very few other places in London. Management of these sites should as a first priority seek to maintain and enhance their interest, but use by the public for education and passive recreation should be encouraged unless these are inconsistent with nature conservation.

Sites of Borough Importance

1.6 These are sites which are important on a borough perspective in the same way as the Metropolitan sites are important to the whole of London. Although sites of similar quality may be found elsewhere in London, damage to these sites would mean a significant loss to the borough. As with Metropolitan sites, while protection is important, management of Borough sites should usually allow and encourage their enjoyment by people and their use for education.

1.7 Since 1988 Borough sites have been divided, on the basis of their quality, into two grades, but it must be stressed that they are all important on a borough-wide view.

1.8 In defining Sites of Borough Importance, the search is not confined rigidly to borough boundaries; these are used for convenience of defining areas substantially smaller than the whole of Greater London, and the needs of neighbouring boroughs should be taken into account. In the same way as for Sites of Metropolitan Importance, parts of some boroughs are more heavily built-up and some borough sites are chosen there as oases providing the opportunity for enjoyment of nature in extensive built environments.

1.9 The borough is an appropriate search area in relation to Planning Policy Guidance on nature conservation (1994) which, in paragraphs 15 and 25, states that local plans should identify, and include policies for, areas of local nature conservation importance.

1.10 Since essentially a comparison within a given borough is made when choosing Sites of Borough Importance, there is considerable variation in quality between those for different boroughs; for example, those designated in Barnet will frequently be of higher intrinsic quality than those in Hammersmith and Fulham, a borough comparatively deficient in wildlife habitat. Only those sites that provide a significant contribution to the ecology of an area are identified.

Sites of Local Importance

1.11 A Site of Local Importance is one which is, or may be, of particular value to people nearby (such as residents or schools). These sites may already be used for nature study or be run by management committees mainly composed of local people. Where a Site of Metropolitan or Borough Importance may be so enjoyed it acts as a Local site, but further sites are given this designation in recognition of their role. This local importance means that these sites are also deserving protection in planning.

1.12 Local sites are particularly important in areas otherwise deficient in nearby wildlife sites. To aid the choice of these further local sites, Areas of Deficiency (see below) are identified. Further Local sites are chosen as the best available to alleviate this deficiency; such sites need not lie in the Area of Deficiency, but should be as near to it as possible. Where no such sites are available, opportunities should be taken to provide them by habitat enhancement or creation, by negotiating access and management agreements, or by direct acquisition. Only those sites that provide a significant contribution to the ecology of an area are identified.

Areas of Deficiency

Areas of Deficiency are defined as built-up areas more than one kilometre actual walking distance from an accessible Metropolitan or Borough site. These aid the choice of Sites of Local Importance (see above).

Statutory Species Protections

Statutory Protections

Relevant statutory protections plus brief definitions

Source: - Betts C. J. (1998) *Checklist of Protected British Species 2nd Ed,* Christopher Betts Environmental Biology, Worcester, U.K.

Full Title	***Explanation***
Appendix I of Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats)	The Berne Convention is designed to protect important populations of listed species and their habitats. This appendix lists flora which are required to be specially protected against deliberate picking, collecting, cutting, uprooting, possession, sale, etc.
Appendix II of Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats)	The appendix lists strictly protected fauna. The Berne Convention places particular emphasis on migratory species and their breeding and resting sites (see also Bonn below). Listed fauna are required to be strictly protected against deliberate killing, capture, damage/destruction of breeding and nesting sites, disturbance, taking of eggs, trading (including parts and derivatives), etc. Various exceptions can be invoked to avoid, for example, inappropriate situations arising over species which, although listed, are common and widespread.
Appendix III of Berne Convention (Convention on the conservation of European Wildlife and Natural Habitats)	Listed in its appendix are all animals not on Appendix II whose populations are required lobe protected from exploitation (indiscriminate mass killing, trading any means of causing local disappearance or serious disturbance to a species) and managed to keep them out of danger, all other reptiles and amphibians and many other mammals.
Appendix I of Bonn Convention on the Conservation of Migratory Species of Wild Animals	Species on Appendix I are considered to be in danger of extinction and require stringent efforts to ensure protection from virtually any threat. 'Migratory' is a broad term and includes dispersal, recruitment, etc.
Appendix II of Bonn Convention on the conservation of Migratory Species of Wild Animals	Appendix II species are generally of conservation concern and/or deemed to be able to benefit from international co-operation. Signatories are encouraged to draw up agreements (several have been or are being concluded) to restore/maintain species conservation status through management and other appropriate measures.
European Communities Council Directive on the Conservation of Wild Birds	The Directive relates to the conservation of all species or birds naturally occurring in the wild in the European territory of the Member States (but not Greenland), as well as their nests and habitats. A list of taxa (species and sub-species) requiring special conservation measures, such as designation and maintenance of Special Protection Areas, is cited in Annexe to this directive and these species which are included in this Checklist. Birds generally are protected from deliberate killing, taking from the wild, egg collecting, nest destruction and keeping in captivity but allowances are made for game birds. Pest species can be derogated by Member States (carrion crow, collared dove, feral and wood pigeons, rook, jackdaw, great and lesser black-backed gulls, herring gull, jay, magpie, house sparrow and starling in Britain).
Annex II of the European Communities Council Directive on the Conservation of Natural Habitats and Wild Fauna and Flora	Animal and plant species of community interest whose conservation requires the designation of Special Areas of Conservation SACs
Annex IV of the European Communities Council Directive on the Conservation of Natural Habitats and Wild Fauna and Flora	Animal and plant species of community interest in need of strict protection. All life stages are protected against (as appropriate) deliberate capture, killing, disturbance, destruction of eggs, breeding sites or resting places, picking, collecting, cutting, uprooting or destruction in the wild as well as (except for specimens taken before enforcement of the regulations) keeping, transport, sale/exchange.

Full Title	*Explanation*
Annex V of the European Communities Council Directive on the Conservation of Natural Habitats and Wild Fauna and Flora	Animal and plant species of community interest whose taking part in the wild and exploitation may be subject to management measures.
Protection of the Badgers Act 1992	Badgers are extensively protected by this Act, covering virtually any deliberate interference with the animals themselves or their setts.
Schedule I Part I of Wildlife and Countryside Act 1981 (and later amendments)	This Schedule lists birds protected by special penalties at all times. International killing, injuring, taking, possessing, disturbing and selling (including parts and derivatives, eggs, nests, etc. as applicable) as well as damaging, destroying or disturbing nests in current use or dependent young, etc. are prohibited.
Schedule I Part 2 of Wildlife and Countryside Act (including amendments)	Birds are protected by special penalties (as above) during close season.
Schedule 5 of Wildlife Act and Countryside Act 1981 (and later amendments)	Protected animals (other than birds). Deliberate killing, injuring, taking, possessing, disturbing and selling (including parts and derivatives) as well as damaging, destroying or obstructing any structure or places of refuge, etc. are prohibited. NB. Protection of some species is limited to certain Sections of the Act which are indicated in the lists as follows: S9(1) Protection limited to intentional killing, injury or taking. S9(2) Protection limited to protecting and controlling S9(4a) Protection limited to damaging, destroying, or obstructing access to, any place used by the animal for shelter or protection. S9(4b) Protection limited to disturbing the animal while it is occupying any structure or place which it uses for shelter or protection. S9(5) Protection limited to selling, offering for sale, possessing or transporting for purpose of sale, or advertising for sale, any live or dead animal, or any part of or anything derived from such animal.
Schedule 6 of Wildlife and Countryside Act 1981 (and later amendments)	Animals which may not be killed or taken by certain methods (traps and nets, poisons, automatic weapons, electrical devices, smokes/gases and various others). Even humane trapping for research requires a licence Note that bows, explosives, self-locking snares and live bird or mammal decoys are generally prohibited for use against wild animals, irrespective of this Schedule.
Schedule 8 of Wildlife and Countryside Act 1981 (and later amendments)	Protected plants and fungi. Intentional picking, uprooting, destroying, trading (including parts and derivatives), etc. are prohibited. It should be noted that under the Wildlife and Countryside Act, all wild plants in Britain are protected from international uprooting by an unauthorised person (but landowners, land occupiers, persons authorised by either of these, or persons authorised in writing by the Local Authority for the area are exempt). NB. Protection for some species may be limited to certain Sections of the Act and where this is the case it is indicated in the lists as follows: SI3(2) Protection limited to selling, offering for sale, possessing or transporting for purpose of sale, or advertising for sale, any live or dead plant, or any part of, or anything derived from, such plant.

Notable Species

Full Title	*Explanation*
Birds of Conservation Concern (BoCC)	*The Population status of birds in the UK - Birds of Conservation Concern: 2002-2007* is an assessment of the population status of the UK's bird species. It is a list agreed by a group of the UK's statutory and leading non-governmental bird conservation organisations in 2002, chaired by the Royal Society for the Protection of Birds (RSPB). The group reviewed the status of the 247 species which occur regularly in the UK, Channel Islands and the Isle of Man and divided into three lists: Red, Amber and Green. The **Red** List comprises 40 species whose populations or range are rapidly declining, and those of global conservation concern. Several common, but rapidly declining farmland birds are included on the Red List. The **Amber** List comprises the 121 species whose populations are in moderate decline, rare breeders, internationally important, restricted to a small number of sites, or those of an unfavourable conservation status in Europe. All other species occurring in the UK, Channel Islands and Isle of Man are on the **Green** List.
Biodiversity Lists	The UK Biodiversity Steering Group listed a total of 1250 species—the **Long List**—which qualify for inclusion in the **national Biodiversity Action Plan** in one or more of the following categories: • threatened endemic and other globally threatened species • species where the UK has more than 25% of the world or appropriate biogeographical population • species where numbers or range have declined by more than 25% in the last 25 years • in some instances where the species is found in fewer than 15 ten-kilometre squares in the UK • species which are listed in the EU Birds or Habitats Directives, the Bern, Bonn or CITES Conventions, or under the Wildlife and Countryside Act 1981 and the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 From the Long List, about 400 species were identified as being either globally threatened or rapidly declining in the UK (by more than 50% in the last 25 years). These comprise the **Short List**, for which Action Plans have been prepared, and the **Middle List** for which Action Plans are currently being prepared.

London Biodiversity Action Plan Species

Rationale for selecting priority species for action

1. Background

The *Greater London Authority Act 1999* requires the elected Mayor to produce a Spatial Development Strategy for London, called the London Plan. The first London Plan was published in February 2004. The Act (clause 334(5)) requires the London Plan to deal with matters of strategic importance only. The required content of the plan is set out in a government guidance note (Circular 1/2000).

The London Plan includes an important policy (3D.12) Biodiversity and nature conservation, which links to policies and proposals on approaches to strategic planning in the Mayor's Biodiversity Strategy[1]. Policy 3D.12 contains the following statement;

> *"The Mayor will and boroughs should resist development that would have a significant adverse impact on the population or conservation status of protected species or priority species identified in the London Biodiversity Action Plan and borough BAPs. Appropriate policies for their protection and enhancement and to achieve the targets set out in BAPs, should be included in UDPs."*

This policy is employed by the Mayor of London when considering those larger planning applications referred to him for direction under the *Town and Country Planning (Mayor of London) Order 2000*. Also the London Unitary Development Plans and, increasingly with time, the new Local Development Frameworks of the London Boroughs have to be in general conformity with the London Plan. It is through these local policies that most protection of priority species will occur. The planning protection for priority species should be equivalent to that applying to statutory protected species, although of course development planning can only provide protection from planning-related activities.

The London Biodiversity Partnership published its original Audit of habitats and species in 2000. This lists all habitats of interest in London, as these relate to the UK BAP. The Audit also lists some 300 species of conservation interest occurring in London. All of these could not practically be considered as priorities for conservation action in the London BAP. Importantly, the LBP has adopted a practical approach to species conservation, whereby action for species should be considered and incorporated within the action proposed for their relevant habitats whenever possible. Species Action Plans have been produced only for prioritised species that are not so conveniently habitat-specific.

Ecological survey has re-discovered and recorded many new species resident in Greater London since the Audit was first published. A review of our Species of Conservation Concern has been undertaken to consider these new findings and to identify BAP Priority Species to which the London Plan Policy 3D.12 would apply.

2. The evaluation process

2.1 Species of Conservation Concern in London

Not all of the criteria used for selecting species for the London Species Audit are of primary relevance to a list of species of conservation concern. For reasons explained in the Audit, a suite

[1] *Connecting with London's nature, The Mayor's Biodiversity Strategy*, GLA July 2000

of species was selected to include: species that are relatively ubiquitous and therefore characteristic of London (ie. suitable as "flagships"); that are "culturally valued"; easy to monitor; and/or that are good indicators of their supportive habitats. None of these criteria is directly relevant to species' conservation status.

Criteria for the selection of UK BAP[2] Species of Conservation Concern are as follows;

- Threatened endemic and other globally threatened species;
- Species where the UK has more than 25% of the world or appropriate biogeographical population;
- Species where the UK numbers or range have declined by more than 25% in the last 25 years;
- In some instances where the species is found in fewer than 15 ten km squares in the UK;
- Species listed for protection in the EU Birds or Habitats Directives, the Bern, Bonn or CITES Conventions, or under the *Wildlife and Countryside Act 1981*.

Data is deficient for rates of decline of many species groups locally. Adaptation of the UK SCC criteria to the Greater London regional context has involved the following;

- All UK SCC; nationally threatened (ie. Red Data listed); Nationally Scarce (Na, Nb, N); and (for birds) RSPB Red/Amber List species, with native or long-established naturalised populations occurring in Greater London;
- Species with native or long-established naturalised populations, which are rare[3] in Greater London and are known to be in national or regional decline (as ascertained from national distribution atlases);
- Some further species that are known to have declined significantly in Greater London in recent years.

The list of Species of Conservation Concern in Greater London is presented as four taxonomically grouped spreadsheets, titled Plants, Fungi, Vertebrates and Invertebrates. The list is not comprehensive in respect of the above criteria for some invertebrates and lower plants, for which presence in London and threat categories are less certain. The list should be viewed as the regional equivalent of the original UK BAP 'long list'. From the list of Species of Conservation Concern in Greater London, our Priority BAP Species have been identified (see next).

2.2 Priority Species in London

Criteria for selection of UK BAP Priority Species are as follows;

- Species that are globally threatened;
- Species that are rapidly declining in the UK, ie. by more than 50% in the last 25 years.

In accordance with national guidance, London BAP Priority Species must include;

- All UK BAP Priority Species with native or long-established naturalised populations in Greater London.

Further species have been selected using the following criteria;

- Species for which Species Action Plans are currently being implemented in the London BAP;
- Nationally threatened (Red Data listed) species with native or long-established naturalised populations in Greater London;
- UK SCC and declining Nationally Scarce species with significant[4] native or long-established naturalised populations within Greater London, (ie. for which a regional responsibility for conservation may be clearly demonstrated).

[2] *The UK BAP*; www.ukbap.org.uk
[3] occurring in <5% (=20) of Greater London tetrads or equivalent

- Species with native or long-established naturalised populations that are known to have undergone a recent significant decline in Greater London, or for which Greater London holds the majority of the known UK population.

[4] for example: the only population within its 10km grid square; a population at the edge of a declining species' UK range; a constituent of an isolated UK population; an exceptionally strong core area population

Habitat Surveys

1 Survey information

1.1 In order to choose sites for protection it is necessary to have good survey information on the habitats and species of all candidate areas.

The London Wildlife Habitat Survey

1.2 Information on wildlife habitats can be collected in a standardised, comprehensive survey. We are fortunate in London in having such a survey, first carried out by the London Wildlife Trust for the Greater London Council in 1984/85, and updated and extended in various surveys since, including re-examination of sites to be described in the handbook series or in relation to proposed developments or management. In a number of London boroughs a systematic survey has been carried out using the London Ecology Unit's specification since 1985. The specification was updated in 2000, when the GLA was established, to collect additional data required for open space planning. The format of the survey is similar to those usually described as 'Phase I' or 'Field by Field', but is enhanced by the extensive use of standardised written notes. The Authority holds this survey information.

1.3 The initial survey documented areas with semi-natural habitats (more natural than well-gardened allotments or heavily mown urban playing fields) and was also confined to large areas (above 0.5 ha for inner boroughs and 1 ha for outer boroughs). Much subsequent survey work has documented open spaces regardless of their natural quality and has used a much lower area threshold, to provide a more comprehensive coverage.

1.4 The wildlife habitat survey helps to ensure that candidate sites are not overlooked and that the same essential minimum of information is available for each. There is usually little other information available on the quality of the wildlife habitats, but any information provided is taken into account.

Information on species

1.5 Information on species, which has been obtained in a consistent and standardised manner as part of the systematic survey of habitats may be used by the Authority in reaching decisions on site quality. Other information on species, relating to individual sites, is frequently available but has rarely been collected in a systematic way so as to allow straightforward comparisons with other sites.

1.6 Information on species is often available from local naturalists, who are able to observe sites throughout seasons and years to provide an accurate and quite comprehensive listing of these and who may publish accounts of particular species or sites. Valuable though this information is, it often proves difficult to use it to compare candidate sites, as the recording effort put into each site may differ greatly and so may the completeness of the list. The length of the species list and the detection of rare species therefore depends upon the searching effort. For these reasons, such information on species is used only together with knowledge of how the information was obtained and of the way in which the ecology of individual species affects their apparent status.

1.7 The policy of the Authority is to take considerable care in interpreting site-based species data to ensure that fully professional standards are maintained.

Habitat Types

A list of habitats for open space survey in London

Code	Name	Definition
01/02 /03	Woodland	Stands of trees forming at least 75% cover, including coppice and trees of shrub size, but excluding fen carr (19). Includes stands of willow except *Salix cinerea, caprea* and *viminalis*, but excludes hawthorn, hazel (except hazel coppice with standards), elder, juniper and the three willow species listed above, which are always scrub (06) regardless of height. Where the species composition does not fulfil any of 01, 02 or 03 below, code as a mixture. Always record % shrub layer under the qualifiers.
01	Native broadleaved woodland	Woodland (see above) with native broadleaved species (i.e. excluding sycamore and sweet chestnut) comprising at least 75% of the canopy.
02	Non-native broadleaved woodland	Woodland (see above) with non-native broadleaved species (including sycamore and sweet chestnut) comprising 75% of the canopy.
03	Coniferous woodland	Woodland (see above) with coniferous species (including yew) comprising 75% of the canopy.
37	Scattered trees	Trees forming less than 75% canopy cover over another habitat (excluding coppice with standards, which is coded as woodland). Record percentage tree cover here, and the rest of the area under the appropriate habitat.
05	Recently felled woodland	Does not include coppice, which is coded as woodland.
06	Scrub	Dominated (at least 75% cover) by shrubs (usually less than 5 metres tall), excluding fen carr (19), heathland (15), young woodland, coppice, hedges (25, 34) and planted shrubberies (38). Includes stands of hawthorn, hazel (except coppice with standards), elder and *Salix cinerea, caprea* and *viminalis* regardless of height.
38	Planted shrubbery	Dominated (at least 75% cover) by shrubs, usually non-native species, the majority of which have clearly been planted. Excludes hedges (25, 34).
25	Native hedge	Line of shrubs, with or without treeline, one or two mature shrubs wide (wider belts should be coded as scrub or woodland), with native species comprising at least 75% of the shrubs.
34	Non-native hedge	As above but with non-native species comprising at least 75% of the shrubs. If neither 25 nor 34 apply, code as a mixture.
31	Orchard	Planted fruit or nut trees forming at least 50% canopy cover.
36	Vegetated walls, tombstones. etc	Includes ruins, fences and other artificial structures with an appreciable amount of vegetation (including mosses and lichens) but excluding artificial water margins, which should be coded as wet marginal vegetation (18) if vegetated.
26	Bare soil and rock	Includes active quarries, fresh road workings, spoil or tipping and earth banks of water habitats, where these are minimally vegetated. Excludes

Code	Name	Definition
		arable land (28).
27	Bare artificial habitat	Includes tarmac, concrete, railway ballast, gravel paths, buildings and artificial margins to aquatic habitats, where these are minimally vegetated.
08	Acid grassland	Un- or semi-improved grassland on acidic soils, with less than 25% cover of heather or dwarf gorse. Excludes reedswamp (17). Usually with one or more of *Deschampsia flexuosa, Molinia caerulea, Nardus stricta, Juncus squarrosus, Galium saxatile, Potentilla erecta* or *Rumex acetosella* in abundance.
09	Neutral grassland (semi-improved)	Mesotrophic grassland usually with one or more of *Arrhenatherum elatius, Deschampsia cespitosa, Alopecurus pratensis, Cynosurus cristatus, Dactylis glomerata, Festuca arundinacea* or *F.pratensis.* Contains more than just *Lolium perenne, Trifolium repens, Rumex acetosa, Taraxacum, Bellis perennis* and *Ranunculus* species (see 07 and 11), but lacks the characteristic forbs of 35. Excludes reedswamp (17).
35	Neutral grassland (herb-rich)	Mesotrophic grassland with more forbs typical of old grassland than 09. Likely to contain one or more of *Primula veris, Lychnis flos-cuculi, Achillea ptarmica, Silaum silaus, Succisa pratensis, Stachys officinalis, Serratula tinctoria, Ophioglussum, Gensita tinctoria, Sanguisorba officinalis* or *Caltha palustris,* or an abundance of *Carex ovalis, Pimpinella saxifraga, Conopodium majus, Cardamine pratensis, Knautia* or *Filipendula ulmaria.*
10	Basic grassland	Un- or semi-improved grassland containing calcicoles. Usually with some of *Brachypodium pinnatum, Bromopsis erecta, Heliotrichon pratense, Thymus polytrichus, Sanguisorba minor, Centaurea scabiosa* or *Origanum vulgare* in some abundance.
11	Improved or re-seeded agricultural grassland	Species-poor mesotrophic grassland containing little but *Lolium perenne, Trifolium repens, Agrostis* species, *Bellis perennis, Taraxacum* and *Ranunculus* species. Distinguished from 07 by its agricultural use and hence usually less frequent mowing.
07	Amenity grassland	Usually frequently mown, species-poor mesotrophic grassland characteristic of parks and sports pitches, containing similar species to 11. Scattered trees and shrubberies in parks should be coded separately.
12	Ruderal or ephemeral	Communities composed of pioneer species such as occur in early succession of heavily modified substrates. Typical species include *Senecio squalidus, S.vulgaris, Sinapis arvensis, Poa annua, Hirschfeldia incana* and species of *Polygonum, Persicaria, Melilotus, Atriplex, Chenopodium, Medicago, Vulpia, Picris, Lactuca, Diplotaxis, Conyza* and *Reseda.*
13	Bracken	Stands where bracken is dominant. Also used with other habitat codes to indicate scattered bracken.
14	Tall herbs	Stands of tall non-grass herbaceous species, often rhizomatous perennials, such as *Fallopia japonica, Conium maculatum, Chamerion angustifolium, Anthriscus sylvestris, Urtica dioica, Epilobium hirsutum, Solidago canadensis* and species of *Aster* and *Heracleum.* Excludes herbaceous fen vegetation 32).

Code	Name	Definition
33	Roughland	An intimate mix of semi-improved neutral grassland (09), tall herbs (14) and scrub (06). If these occur in large enough patches they should be coded separately. Usually the next successional stage after 12.
15	Heathland	Dwarf-shrub cover greater than 25% of species such as heathers and *Ulex minor*, with less than 50% cover of *Sphagnum*. May include a large amount of acid grassland (06) in a close mosaic, but code as a mixture if grassland areas are large.
39	Allotments (active)	Communal allotment gardens which are under cultivation. Code disused plots under other habitats as appropriate.
28	Arable	Cropland, horticultural land (excluding allotments), freshly ploughed land and livestock paddocks stocked so heavily as to have little vegetation.
16	Bog	Dominated by *Sphagnum* mosses (greater than 50% cover) with water table at or just below the surface.
17	Reedswamp	Stands of *Phragmites australis* with at least 75% cover of reeds. Includes dry and tidal stands.
40	Typha, etc swamp	Stands of *Glyceria maxima, Typha* species or *Phalaris arundinacea* where these species form at least 75% cover.
18	Wet marginal vegetation	Emergent vegetation with a permanently high water table in strips less than five metres wide on the margins of water bodies. Contains species such as *Iris pseudacorus, Apium nodiflorum, Acorus calamus* and species of *Rorippa, Alisma* and *Juncus*. May include *Phragmites, Typha* and *Glyceria maxima*, but where these form single-species stands code as 17 or 40 respectively. Usually too small to map but must always be coded if present.
19	Fen carr	Woodland or scrub over herbaceous vegetation with the water table above ground for most of the year.
20	Standing water (includes canals)	Lakes, reservoirs, pools, wet gravel pits, ponds, canals, docks and brackish lagoons beyond the limit of swamp or wet marginal vegetation. Always code vegetated margins separately and note trophic status and whether saline or tidal.
21	Ditches (water filled)	Distinguished from 20 and 22 by their (often agricultural) drainage role. Always code vegetated margins separately and note trophic status and whether saline or tidal.
22	Running water	Rivers and streams. Always code vegetated margins separately and note trophic status and whether saline or tidal.
23	Intertidal mud, sand, shingle, etc	Intertidal areas without significant vegetation of higher plants. Try to record the extent at low tide.
24	Saltmarsh	Intertidal areas appreciably vegetated with higher plants, excluding reedswamp (17).
30	Habitat information not available	Areas which cannot be observed due to restricted access, etc.
29	Other	To be avoided if possible. Must be specified if used.

Code	Name	Definition
32	Species-rich herbaceous fen	Stands of herbaceous vegetation where the water table is above ground for most of the year, with less than 75% dominance of *Phragmites, Typha, Glyceria* and *Phalaris arundinacea*. Distinguished by width from 18. So rare in London that it is not on the survey form; write in under "Other" if required.

Open Space Designations

Green Belt – The London Plan Policy 3D.8

The Mayor will and boroughs should maintain the protection of London's Green Belt and proposals for alterations to Green Belt boundaries should be considered through the UDP process in accordance with government guidance in PPG2. There is a general presumption against inappropriate development in the Green Belt, and such development should not be approved except in very special circumstances.

3.247 The inclusion of land within the Green Belt performs a valuable role in preventing urban sprawl and promoting an urban renaissance. The Green Belt also protects the openness of the land in order to prevent towns merging, safeguards the countryside and preserves historic settlements. The use of Green Belt land should provide Londoners with access to the countryside, opportunities for outdoor recreation, protection and enhancement of attractive landscapes, the improvement of damaged and derelict land, protection and promotion of biodiversity and retention of agricultural land. The Green Belt is a permanent feature and its boundary should only be altered in exceptional circumstances. The quality of land within the Green Belt is not reason in itself for excluding land from the Green Belt or allowing development. Where Green Belt land is of poor quality, steps should be taken to improve it. This may include undertaking a review of a wide area and identifying actions to promote improvements.

Metropolitan Open Land – The London Plan Policy 3D.9

The Mayor will and boroughs should maintain the protection of Metropolitan Open Land (MOL) from inappropriate development. Any alterations to the boundary of MOL should be undertaken by boroughs through the UDP process, in consultation with the Mayor and adjoining authorities. Land designated as MOL should satisfy one or more of the following criteria:

• land that contributes to the physical structure of London by being clearly distinguishable from the built-up area
• land that includes open air facilities, especially for leisure, recreation, sport, arts and cultural activities and tourism which serve the whole or significant parts of London
• land that contains features or landscapes of historic, recreational, nature conservation or habitat interest, of value at a metropolitan or national level
• land that forms part of a Green Chain and meets one of the above criteria.

Policies should include a presumption against inappropriate development of MOL and give the same level of protection as the Green Belt. Essential facilities for appropriate uses will only be acceptable where they do not have an adverse impact on the openness of MOL.

3.248 The Metropolitan Open Land (MOL) designation is unique to London, and protects strategically important open spaces within the built environment. Although MOL may vary in size and primary function
in different parts of London, it should be of strategic significance, for example by serving a wide catchment area or drawing visitors from several boroughs. MOL is the same as the Green Belt in terms of protection from development and serves a similar purpose. It performs three valuable functions:

• protecting open space to provide a clear break in the urban fabric and contributing to the green character of London
• protecting open space to serve the needs of Londoners outside their local area
• protecting open space that contains a feature or landscape of national or regional significance.

3.249 MOL will be protected as a permanent feature, and afforded the same level of protection as the Green Belt. Appropriate development should minimise any adverse impact on the open character of MOL through sensitive design and siting and be limited to small scale structures to support outdoor open space uses. The boundary of MOL should only be altered in exceptional circumstances and should be undertaken through the UDP process in consultation with the Mayor. Development that involves the loss of MOL in return for the creation of new open space elsewhere will not be considered appropriate.

3.250 Green Chains are important to London's open space network, recreation and biodiversity. They consist of footpaths and the open spaces that they link, which are accessible to the public. Because of their Londonwide significance, the open spaces and the links within a Green Chain should be designated as MOL.

Open Space Categories

i. Parks and Gardens

Park refers to traditional public open spaces laid out formally for leisure and recreation. They usually include a mixture of lakes, ponds, lidos, woodland, flower beds, shrubs, ornamental trees, play spaces, formal and informal pitches, bowling greens, tennis courts, golf pitch & put, footpaths, bandstands, toilets, cafes and car parks - but not necessarily all of these. Parts of some parks might be managed as so-called natural areas. Examples of parks include the Royal Parks, municipal parks such as Battersea and Victoria, and wilder places such as Hampstead Heath which, although having distinctly informal qualities, are maintained predominantly for the same purpose, and include the usual swings and roundabouts and playing pitches. Many parks are enclosed by walls or railings, although some parks that began as common land may not be enclosed.

Formal garden refers to spaces with well defined boundaries that display high standards of horticulture with intricate and detailed landscaping. It includes the London squares common to central London, which are typically square areas of grass with some shrub borders, bounded by railings, and surrounded by buildings. Examples include Belgrave Square and Soho Square.

ii. Natural and Semi Natural

Common refers to publicly accessible open space that has few if any 'facilities'. It will typically be mainly open rough grassland (not mown playing field or recreation ground type grass) and/or woodland, and may have a limited provision of facilities. In typology terms, commons are much less formal than parks or parkland. Examples include Wimbledon Common, Wanstead Flats, and parts of Epping Forest.

Private woodland refers to woodland which is not accessible for recreational use, nor managed for nature conservation. Record this under "other" until the survey form is revised to accommodate it.

Nature reserve is a category reserved for an open space that is managed primarily for nature conservation. Do not tick this box just because the site has a nature conservation designation. Many parks, etc. have such designations. An SSSI is likely to have park, common or agriculture as its type. Designated Local Nature Reserves, however, are recorded here. Also do not tick this box where you find small areas set aside for nature within parks, commons and other open spaces.

iii. Green Corridors

River should only be used for rivers and streams that do not form part of another land use, such as park, common or nature reserve.

Canal implies an artificial waterway which is navigable. Include docks in this category.

Railway cutting and **railway embankment** are self-explanatory.

Disused railway trackbed is usually obvious, with some traces of its former use. Where disused trackbeds are specifically managed for nature conservation, such as Parkland Walk, record as nature reserve.

Road island/verge is self-explanatory. Record as nature reserve if specifically managed for nature conservation.

Walking / cycling route is a designated footpath / cycleway through informal open space often along former railways or canals but record these examples as Disused railway trackbed or Canal.

iv. Outdoor Sports Facilities

Recreation ground is an area of mown grass used primarily for informal, unorganised ball games and similar activities (including dog walking). Not to be confused with playing fields, below.

Playing field is a site comprising playing pitches, usually for football, but also for rugby and hockey and, in the summer, for cricket. Playing pitches may not always be laid out in the summer, so look out for notice boards or changing rooms and pavilions for evidence. Include sites here even if they appear disused. Include school playing fields. Almost always, playing fields consist only of pitches; but they will sometimes have other bits of open land around the edges. Do not include sites that partly contain playing pitches but are more properly categorised as parks or commons. Pitches are often to be found in parks and commons, but the type here is concerned with sites that are exclusively or predominantly reserved for organised team sports.

Golf course: do not include golf courses that are part of parks, commons etc. This type does not include golf driving ranges, pitch & putt or crazy golf.

Other recreational is to be used for sites that are used exclusively or predominantly for other organised sports such as bowls, tennis and golf driving ranges (but not golf courses, see below).

v. Amenity

Village green is usually an expanse of grass in the centre of old villages, often used in the summer for cricket.

Hospital includes the grounds of any clinic or health centre.

Educational refers to school or college grounds and field study centres where school education is the primary function. Nature sites which cater for schools and for the general public should be recorded under nature reserves. School playing fields should be recorded under playing fields.

Back garden land is self-explanatory. While most surveys exclude private gardens, backlands are often surveyed for planning casework.

Landscaping around premises includes communal amenity space around housing estates and community centres, and also landscaping around industrial premises.

Reservoir includes covered reservoirs unless these form part of a park.

vi. Children and Teenagers

Play space is a site set aside mainly for children. It will contain the usual paraphernalia of swings, slides and roundabouts. Do not record play spaces here if they form part of parks, commons and other open spaces.

Adventure playground is a defined play area for children in a supervised environment. Boundaries and entrances are secure.

Youth area is a defined area for teenagers including skateboard parks, outdoor basketball hoops and other more informal areas such as 'hanging out' areas and teenage shelters.

vii Allotments, Community Gardens and City Farms

Allotments should be obvious. Include them even if they appear or are disused.

Community garden includes an area that is generally managed and maintained by the local population as a garden and/or for food growing and normally restricted in their access. For examples Pheonix Garden in Holborn.

City farm includes areas that are generally managed and maintained as a small farm by the local population, containing livestock and planting and normally restricted in their access. For example Freightliners Farm in Islington.

viii. Cemeteries and Churchyards

Churchyard/cemetery includes burial grounds, graveyards, crematorium grounds and memorial gardens, and gardens or grounds of non-Christian places of worship. Some former or burial grounds that have become full have been converted to informal leisure or recreation spaces; where the gravestones have been removed, these should be recorded as parks.

ix. Other Urban Fringe

Equestrian centre includes any land used for intensive horse keeping and riding, but not extensive horse grazing, which should be recorded as agriculture.

Agriculture includes arable and grazing land, including horse grazing, and market gardening (such as vegetables, often grown under cloches, etc.).

Nursery/horticulture does not include commercial retail nurseries (although these might legitimately form a part of a park or common, etc.). Horticulture includes areas of permanent glasshouses.

x. Civic Spaces

Civic/market square includes tarmac areas or paved open spaces, which may or may not include planting. However, they do not necessarily have seats and may just be a plaza area, with some planting (usually trees) and public art. Often provide a setting for civic buildings and opportunities for open air markets, demonstrations and civic events. Examples include the area in front of the jubilee line station at Canary Wharf, and the plaza in front of Westminster Cathedral.

Other hard surfaced areas include other areas designed for pedestrians. These typically are used as 'sitting out' areas, where workers can enjoy the sun and eat their sandwiches, and as such usually have seats or benches. For example, Emma Cons Gardens opposite the Old Vic Theatre. This category excludes pedestrianised streets, car parks, servicing areas to buildings, and housing amenity space such as communal courtyards.

xi. Other

Sewage/water works includes extensive sludge drying areas, filter beds, etc.

Disused quarry/gravel pit may be water-filled, but is not necessarily so.

Vacant land is land with no formal land use. This includes many "urban commons" which are used by people for informal recreation and which may be very valuable for nature conservation. If sites have formalised access and management for nature conservation, record as commons or nature reserves as appropriate.

Land reclamation is land recently decontaminated or reclaimed from disuse, which has not yet been redeveloped.
Others could be anything that does not fit any of the above categories, such as airfields or forestry (not wooded commons or woodland nature reserves).

SKETCHES

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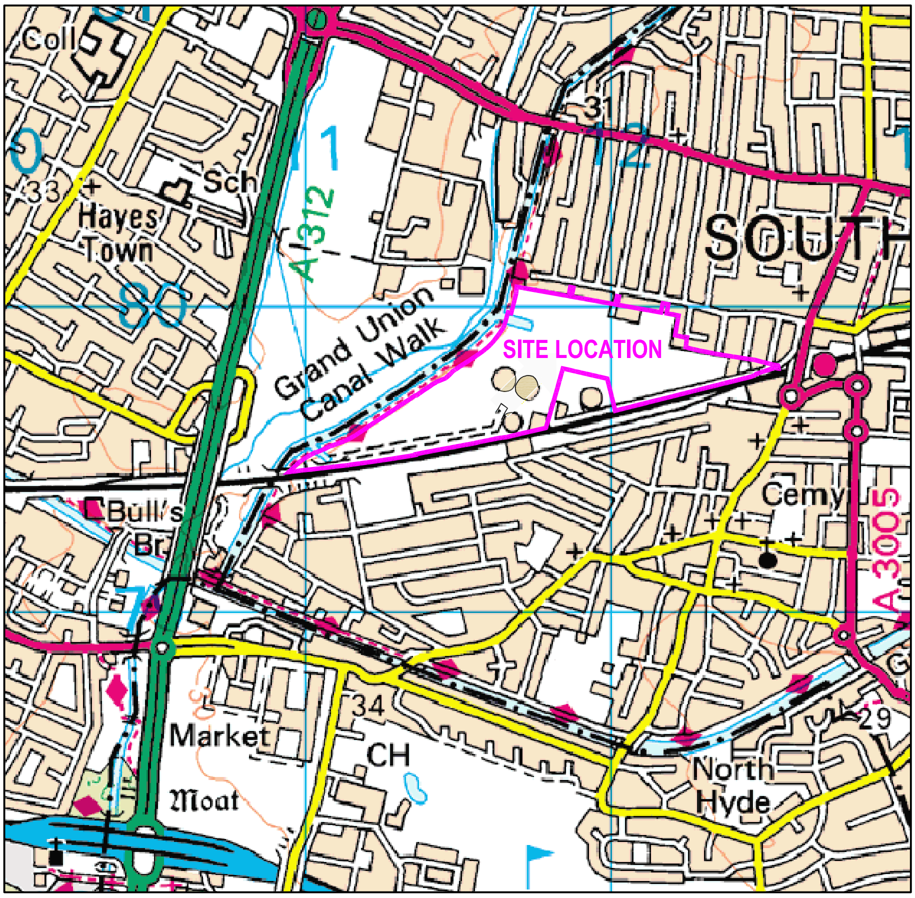

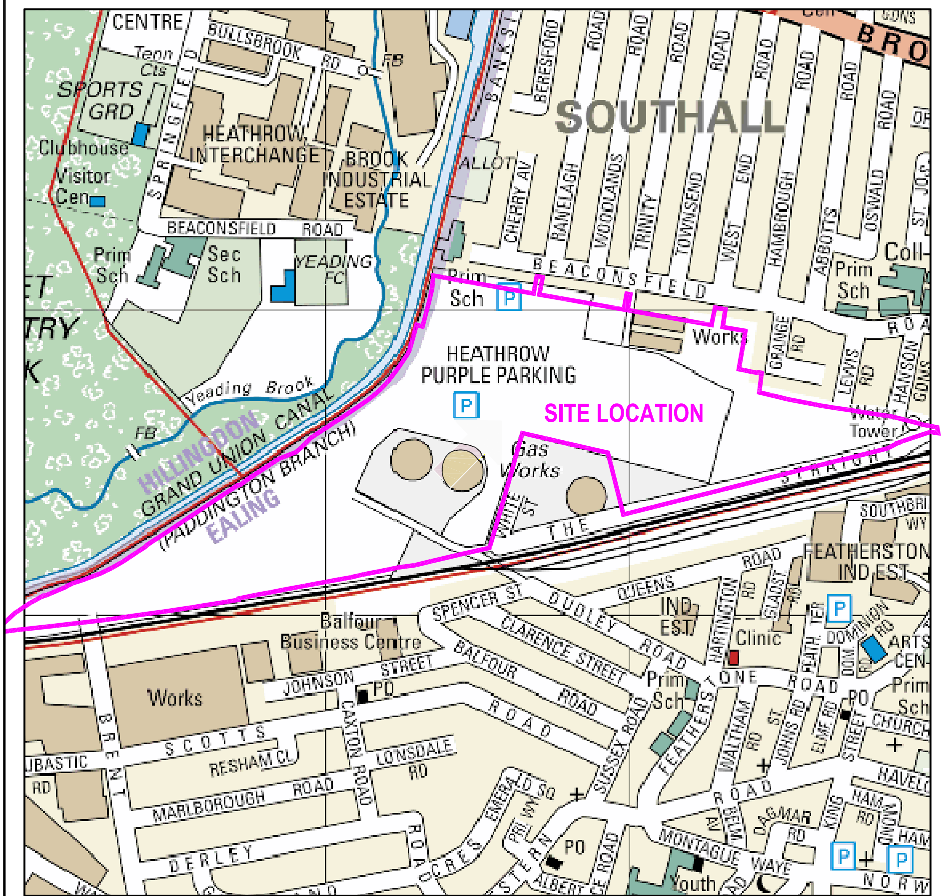

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Environmental Consultancy

Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project: SOUTHALL GASWORKS

Drawing Title: SITE LOCATION PLANS

Client: NATIONAL GRID PROPERTY LTD.

Scale at A4	Drawn By	Date	Checked By	Date	Approved By	Date
AS SHOWN	P. J. T.	JUL. 2007	V. A.	JUL. 2007	G. C.	JUL. 2007

Office	Type	Project No.	Drawing No.	Revision
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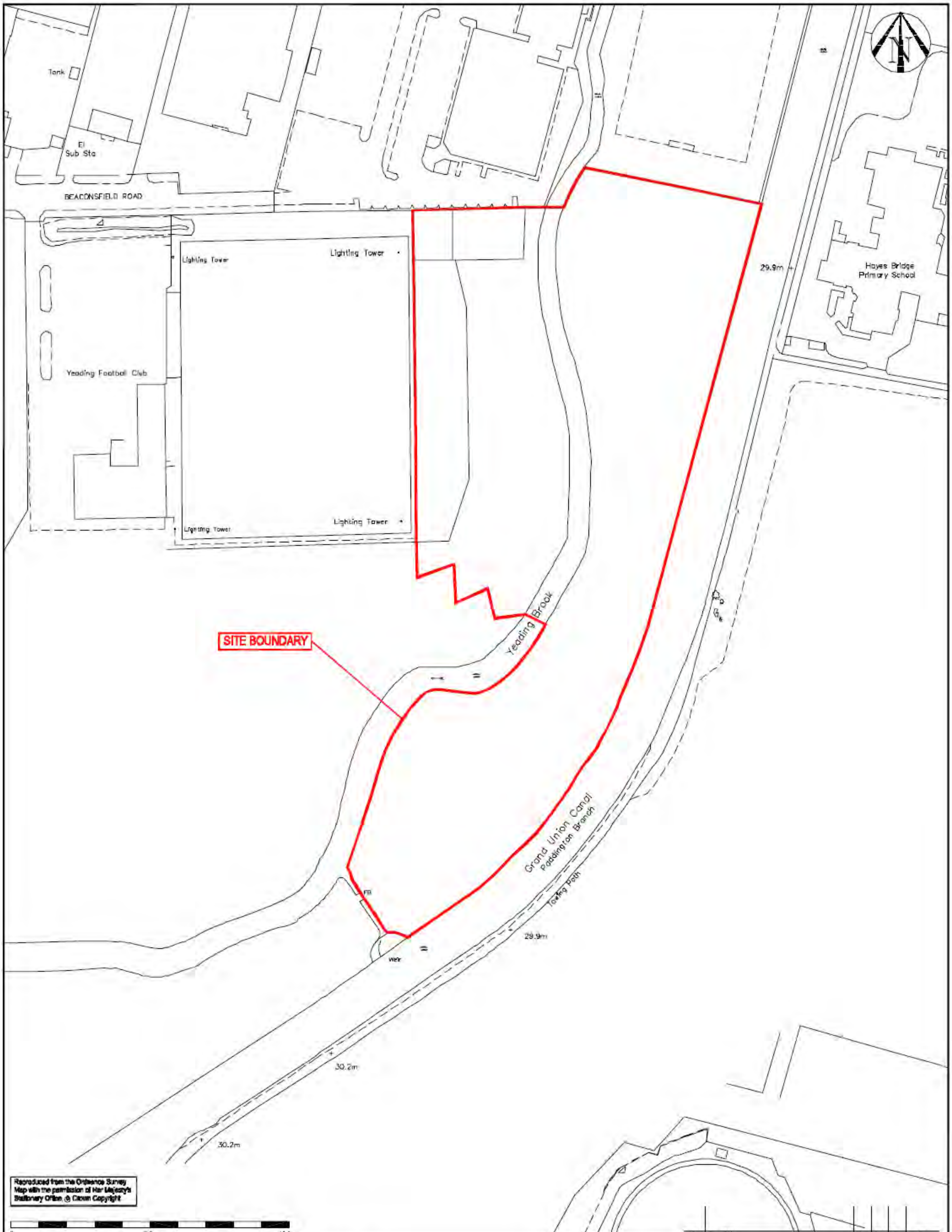

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Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project: SOUTHALL GASWORKS - SOUTHALL

Client: National Grid Property Ltd

Drawing Title: SITE LAYOUT

Scale @ A3	Drawn By	Date	Checked By	Date	Approved By	Date
1:1250	N.J.C.	NOV.2003	E.T.	NOV.2003	M.C.	NOV.2003

Office	Type	Project No.	Drawing No.	Revision
40	ENV	E0357	SK.02	

Rev	Description	By	Chk	App	Date

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Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project: X

SOUTHALL GASWORKS

Client:

NATIONAL GRID PROPERTY LTD

Drawing Title:

PHASE 1 HABITAT SURVEY

Client Drawing No.

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1 : 2000	P. J. T.	JUL. 2007	V. A.	JUL. 2007	G. C.	JUL. 2007

Office	Type	Project No.	Drawing No.	Revision
40	ENV	E000357-7	ECO.01	

White Young Green

Bat Survey Report

Southall Gasworks

thinking beyond construction

BAT SURVEY REPORT

OF

SOUTHALL GAS WORKS

FOR

NATIONAL GRID PROPERTY LTD.

Reference: E00357 Southall Gasworks BAT R01 dh			
Issue		Prepared by:	Reviewed by:
V1	**July 07**		pp
		DAN HONE **Ecologist**	**ADRIAN HUTCHINGS** **Principal Ecologist**
File Ref : H:\Data\Projects\E00001 - E01000\E00357 Southall Gasworks\4004\E00357\Ecology from 2007\Report\E00357 Southall Gasworks BAT R01 dh.doc			

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CONTENTS

EXECUTIVE SUMMARY

Site Location	Located to the west of Southall station (National Grid Reference TQ115800; see SK.01),
Previous surveys	Phase 1 surveys were undertaken by WYGE on the adjacent link road access sites of Pump Lane and Springfield in Aug '02 and July '03 respectively. The reports identified the need for further surveys for bats, water voles and invertebrates. These surveys were undertaken by WYGE in Oct '04.
WYGE Survey	White Young Green Environmental (WYGE) was commissioned by National Grid Property Ltd to undertake a bat activity survey of the adjacent Grand Union Canal to asses the use of the canal by bats with special focus upon the proposed Pump Lane and Springfield link road access points to the Southall Gasworks site.
Results	The survey found that common pipistrelle (*Pipistrellus pipistrellus*) bats are using the Canal as a foraging commuting route predominantly where prey (insects) populations are greatest, over the water and marginal vegetation which runs sporadically along each side of the canal. No bats were recorded emerging from any trees along the tow path adjacent to the site boundary. Therefore, no roosts have been confirmed on or immediately adjacent to site
Conclusion	Bats are using the canal as a foraging commuting route
Recommendations	As bats are using the canal adjacent to the site, lighting of the proposed development should be kept to their current levels along the bank side. Consideration should be given to reducing the impact of lighting by one or a combination of: reducing intensity to the minimum legally required; directing lighting away from the canal side vegetation; using low pressure sodium lamps and; reducing the period of lighting, particularly in the summer months. Additionally bat boxes should be introduced along the site boundary to provide further roosting opportunities.

0.0 INTRODUCTION

White Young Green Environmental (WYGE) was commissioned by National Grid Property Ltd to undertake a bat activity survey of the adjacent Grand Union Canal to asses the use of the canal by bats with special focus upon the proposed Pump lane and Springfield link road access points to the Southall Gasworks site.

0.1 Site Description

Located approximately west of Southall station (National Grid Reference TQ115800; see SK.01), the site comprises of a gas works and a long-term car park. Habitat is predominantly hardstanding with some areas of grassland and tall ruderal. There is a large amount of Japanese knotweed and giant hogweed scattered across the site.

The site is bounded to the south by the rail line to the north and east by Beaconsfield Road and a residential area. To the west is the Grand Union Canal. The opposite side of which is an area of trees and scrub contained by the Yeading Brook and Minet Country Park. Proposed access roads would intersect the Country Park at Springfield and Pump Lane.

0.2 Report Conditions

For a detailed review of the extent and limitations of this report, attention is drawn to the report conditions in Appendix A and WYGE tender document, ‘E000157 Southall ECO P01 GAC’, May 2007.

0.3 Background

WYGE have undertaken preliminary survey work for the Southall site and surrounds in addition to reviewing historical survey work of the study area in order to provide an Ecological Impact Statement for the proposed development and associated access roads at Southall Gasworks. This preliminary survey work and desk study identified the site and immediate vicinity as having the potential to support water voles, reptiles, invertebrates and bats. These surveys were undertaken by WYGE in Oct ’04. As such it is necessary to update these reports with follow up surveys. This report forms the basis for the follow up survey.

1.0 BAT ECOLOGY

Nomenclature (including vernacular names) for bats follows that of Jones and Walsh (2001).

There are seventeen species of native bat in the UK, all of which are insectivorous, although one species (greater mouse-eared bat *Myotis myotis*) is considered extinct. Of the extant species, fourteen belong to the Vespertilionidae (true bats) and two rare species belong to the Rhinolophidae (horseshoe bats). One species, soprano pipistrelle (*Pipistrellus pygmaeus*) has only recently been separated from the similar common pipistrelle (*Pipistrellus pipistrellus*), based on its echolocation frequency. There are no non-native species that have been introduced although occasionally, vagrant species from the continent are recorded.

A breeding roost will usually be well concealed within a man made structure or tree and requires enough space for free movement. Summer roosts can sometimes be detected by the presence of small mouse-like droppings outside the access point. Summer breeding extends from early June – late August.

A hibernation roost is often found in smaller crevices and may or may not be visible from the exterior. Hibernating bats are normally found in smaller numbers than that of breeding roosts, generally from October – April, depending on climatic conditions.

Many types of bat use tree roosts at different times of the year, including pipistrelle, some *Myotis* species and noctules (*Nyctalus noctula*), the latter usually found in larger trees.

2.0 BAT LEGISLATION

All seventeen British bat species are listed in Schedule 5 of the Wildlife and Countryside Act, 1981 (as amended) and under Annex IV of the Habitats Directive, 1992 as a European protected species. Furthermore, the Countryside and Rights of Way Act, 2000 (Schedule 12, paragraph 5) has amended Section 9 of the 1981 Act. They are therefore fully protected under Section 9 of the 1981 Act and under Regulation 39 of the Conservation (Natural Habitats etc) Regulations, 1994, which transposes the Habitats Directive into UK law.

This makes it an offence to:

- intentionally kill, injure or take any bat;
- intentionally or recklessly damage, destroy or obstruct the access to the place of shelter or protection or disturb the animal while it is occupying it;
- damage or destroy a bats breeding site or resting place.

.

This legislation applies to all life stages.

Consequently, attention should be given to dealing with the modification or development of an area if aspects of it are deemed important to bats such as flight corridors and foraging areas.

Furthermore, in terms of national conservation policy, 6 of the 17 British species of bat (common pipistrelle, greater mouse-eared and the four listed Annexe II species) are covered by Biodiversity Action Plans (BAPs), which highlight the importance of certain habitats to species, details of the threats they face and propose measures to aid in the reduction of population declines.

Based on the above legislation, if roosting bats are confirmed to be present within the mature trees on site, roosting bats should be considered a constraint to development.

3.0 METHODOLOGY

The survey followed methodology as outlined in the Bat Conservation Trust Bat Surveys Good Practice Guidelines (2007).

The surveys were undertaken, under Survey Licence number 20062394, by accredited agents Daniel Hone and Victoria Alexander on 26th 27th 28th June 2007.

3.1 Dusk Activity

The evening emergence survey was carried out on the 26th and 27th June 2007. Observations and recordings were undertaken by walking transects and stopping at key points. Particular attention was paid to the area of the proposed access roads. Any calls from bats where recorded for further analysis and species identification onto digital minidisk directly from the detector.

The surveys started 30 minutes before sunset and lasted for 1.5 hours after sunset.

3.2 Dawn Activity

At sunrise (27th and 28th June 2007), a procedure similar to that of the dusk survey was undertaken, in order to identify any bats returning from foraging when it may be possible to observe bats ‘swarming’ outside their roost just before dawn (Mitchell-Jones, 2004).

The surveys started 1.5 hours before sunrise and continued through to approximately 15 minutes after sunrise.

3.3 Species identification

Use of bat detectors enables general bat activity and foraging behaviour to be established. In order to identify species, a time-expansion Pettersson D240x and a ‘Batbox Duet’ bat detector were used, with the former linked to a portable minidisc to record bat echolocation calls for subsequent species identification, using Batsound analysis software.

Characteristic echolocation patterns may be used to distinguish individual bats to species level, although Myotis bats are hardest to separate, being very similar across species. All sound analysis was made by a qualified bat specialist.

Before dawn and after dusk, light becomes insufficient to see the bat in flight, and consequently it is hard to count actual numbers. Therefore at such low levels of light, an estimate of activity may be generated by counting the number of bat passes (sequence of ultrasonic ‘clicks’ emitted by an individual bat as it flies past).

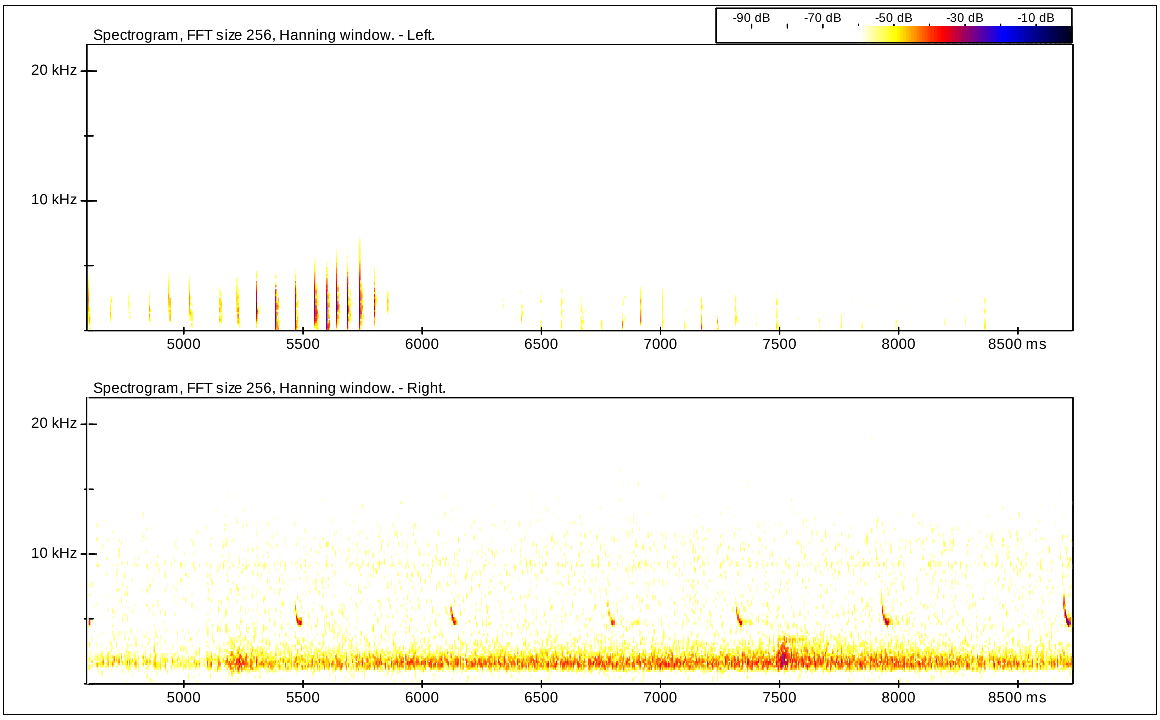
4.0 RESULTS

The weather conditions during both the external emergence survey periods were suitable for surveying bats as indicated in Table 5.0

The survey found that common pipistrelle (*Pipistrellus pipistrellus*) bats are using the Canal as a foraging commuting route predominantly where prey (insects) populations are greatest, over the water and marginal vegetation which runs sporadically along each side of the canal.

No bats were recorded emerging from any trees along the tow path adjacent to the site boundary. Therefore, no roosts have been confirmed on or immediately adjacent to site

The sonogram from one of the recordings from a common pipistrelle recorded on site is below.



Results of the bat activity survey are outlined in Table 5.0 below

Table 5.0 - Results of bats detected during the dusk and dawn surveys (June 7th-10th 2007)

Date	Sunset/ Sunrise Times and Weather	Bat Sampling Location	Bat Species Recorded	Type and Time of Activity
26/06/07	21.22pm 14.7°C 60% cloud cover bright clear dry.	transect 1	*Pipistrellus pipistrellus*	A bat was observed commuting/foraging along the canal north. Time 22.07.
26/06/07	21.22pm 14.7°C 60% cloud cover bright clear dry.	transect 1	*Pipistrellus pipistrellus*	Bats were recoded and observed commuting/foraging along the canal north approx 12 individuals. Time 22.21 onwards till end of survey.
27/06/07	2.50am 12.0°C 60% cloud cover cold dry.	transect 1	*Pipistrellus pipistrellus*	Two bats recorded commuting south along the canal. Time 3.30 and 3.34.
28/6/07	21.20pm 14.0°C Calm 40% Cloud cover recently rained	Transect 2	*Pipistrellus pipistrellus*	A bat was observed commuting/foraging along the canal north. Time 22.10 and 22.25.
29/6/07	3.00am 10.7°C Calm Clear sky 0% cloud cover	Transect 2	*Pipistrellus pipistrellus*	A bat was observed commuting/foraging along the canal south. Time 4.08 am.

5.0 DISCUSSION

The majority of the bat activity was concentrated along the canal over the water.

The canal corridor and its associated marginal vegetation provide valuable habitats for invertebrates and consequentially a valuable food resource and commuting route for bats.

Aquatic vegetation and open water provide excellent habitat for many insect species and as such are important for bats. The current light levels along the canal seem not to affect the bats, however bats tend to avoid well lit areas and as such lighting of the future development should be kept at their current levels.

6.0 RECOMMENDATIONS

As bats are using the canal adjacent to the site lighting of the proposed development should be kept to their current levels along the bank side. Consideration should be given to reducing the impact of lighting by one or a combination of the following:

- reducing intensity to the minimum legally required;
- directing lighting away from the canal side vegetation;
- using low pressure sodium lamps and;
- reducing the period of lighting, particularly in the summer months.

Additionally bat boxes should be introduced along the site boundary to provide further roosting opportunities.

Documents Consulted

- Biodiversity: The UK Action Plan. H.M.S.O., (1994), London.
- British Standards Institution (BSI) (1991) *Guide for Trees in Relation to Construction*. BS5837.
- Department of the Deputy Prime Minister (August 2005). *Planning Policy Statement 9: Biodiversity and Geological Conservation (PPS 9)*. H.M.S.O., London
- Mitchell-Jones, A.J. (2004) *Bat Mitigation Guidelines,* English Nature, Peterborough
- Mitchell-Jones, A.J & McLeish, A.P. (2004) *Bat Workers Manual 3rd Edition*, Joint Nature Conservation Committee (JNCC), Peterborough
- Bat Conservation Trust (2007) *Bat Surveys – Good Practice Guidelines*. Bat Conservation Trust, London.

APPENDICES

APPENDIX A

REPORT CONDITIONS

WHITE YOUNG GREEN ENVIRONMENTAL LTD

C1 - REPORT CONDITIONS

Southall Gas Works (Bat Survey)

This report is produced solely for the benefit of National Grid Property Ltd and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYGE. In time improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of WYGE using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to WYGE by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

Whilst skill and care have been used, no investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather related conditions.

Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the representativeness of data used by the model and the assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions.

The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of the workmanship and compliance with the specifications on site during construction. WYGE accept no liability for issues with performance arising from such factors.

SKETCHES

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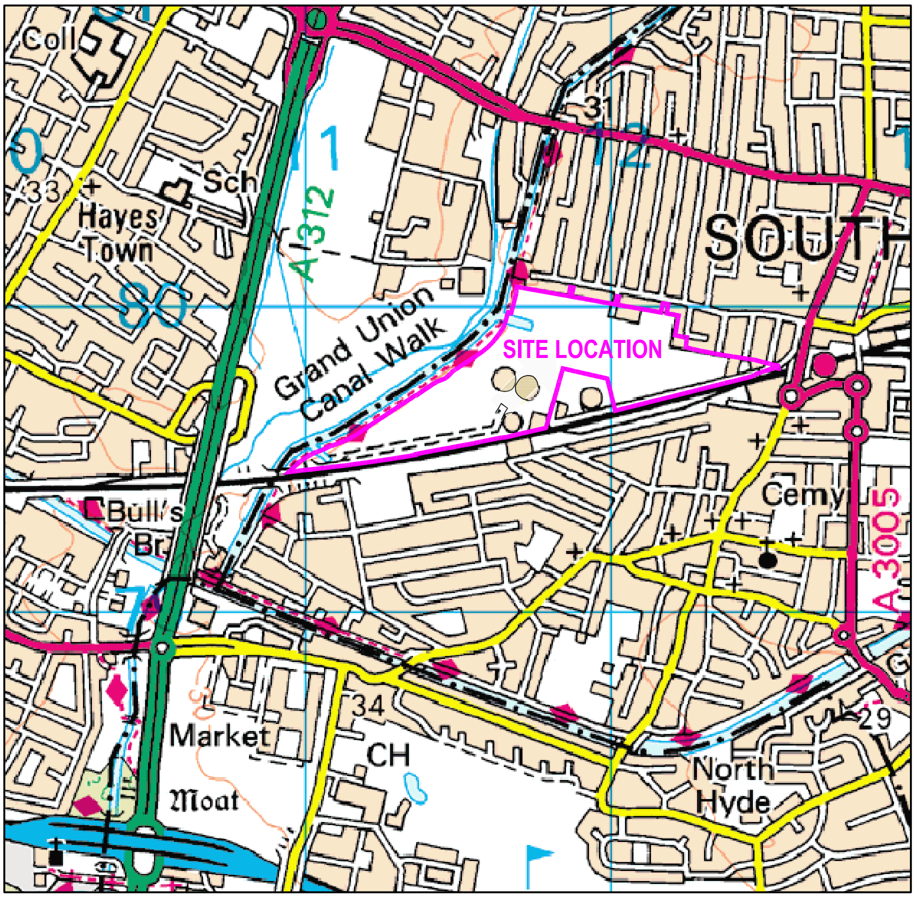

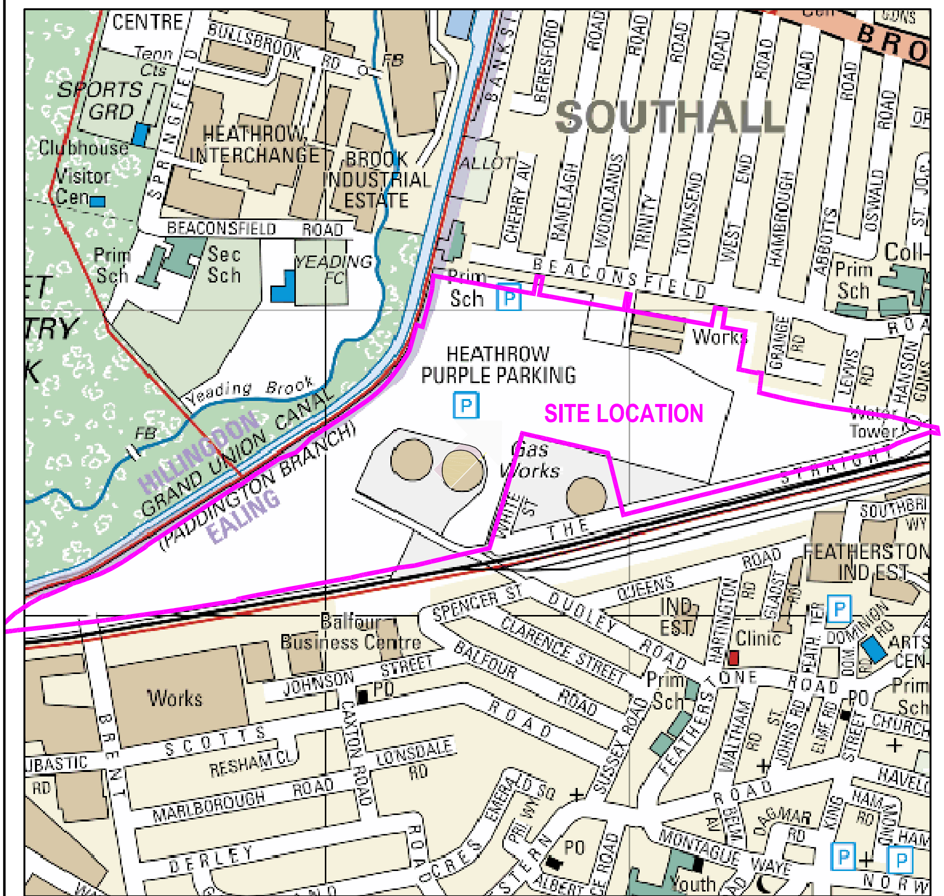

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Environmental Consultancy

Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project: SOUTHALL GASWORKS

Client: NATIONAL GRID PROPERTY LTD.

Drawing Title: SITE LOCATION PLANS

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AS SHOWN	P. J. T.	JUL. 2007	V. A.	JUL. 2007	G. C.	JUL. 2007

Office	Type	Project No.	Drawing No.	Revision
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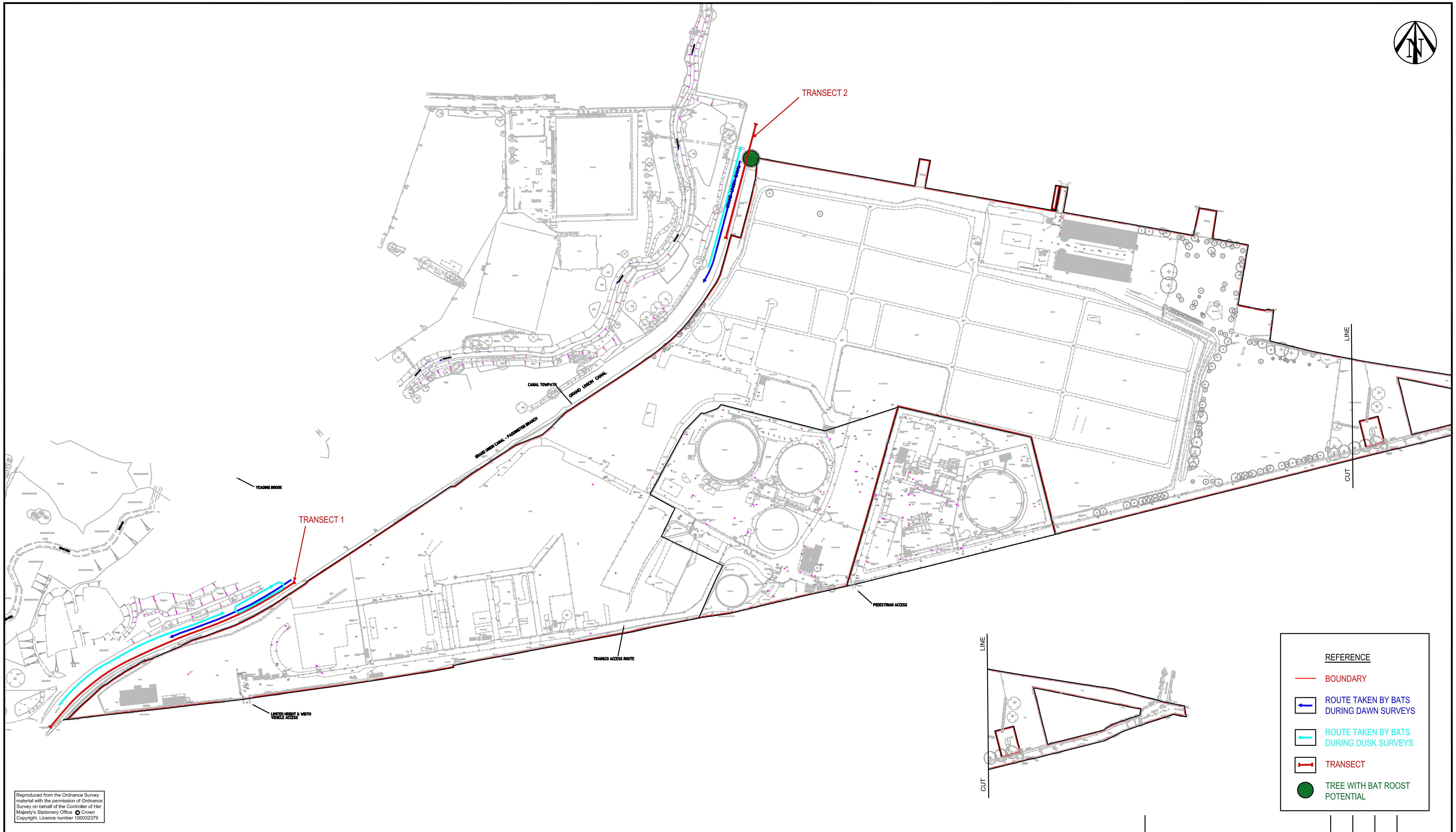

Rev	Description	By	Chk	App	Date

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Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:

SOUTHALL GASWORKS

Client:

NATIONAL GRID PROPERTY LTD

Drawing Title:

BAT SURVEY

Client Drawing No.

Scale at A1	Drawn By	Date	Checked By	Date	Approved By	Date
1 : 2000	P. J. T.	JUL. 2007	V. A.	JUL. 2007	G. C.	JUL. 2007

Office	Type	Project No.	Drawing No.	Revision
40	ENV	E000357-7	BAT.01	

Water Vole Survey Report

Southall Gasworks

thinking beyond construction

WATER VOLE SURVEY REPORT

OF

SOUTHALL GAS WORKS

FOR

NATIONAL GRID PROPERTY LTD.

Reference: E00357 Southall Gasworks WVL R01			
Issue		Prepared by:	Reviewed & Verified by:
v1	**JUL 07**		
		DANIEL HONE **Ecologist**	**ADRIAN HUTCHINGS** **Principal Ecologist**
File Ref: H:\Data\Projects\E00001 - E01000\E00357 Southall Gasworks\4004\E00357\Ecology from 2007\Report\E00357 Southall Gasworks WVL R01.doc			
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CONTENTS

0.0 EXECUTIVE SUMMARY

Site Location	Located to the west of Southall station (National Grid Reference TQ115800; see SK.01),
Previous Surveys	Phase 1 surveys were undertaken by WYGE on the adjacent link road access sites of Pump Lane and Springfield in Aug ’02 and July ’03 respectively. The reports identified the need for further surveys for bats, water voles and invertebrates. These surveys were undertaken by WYGE in Oct ’04.
WYGE Survey	White Young Green Environmental (WYGE) was commissioned by National Grid Property Ltd. to undertake a water vole survey of the Yeading Brook and Grand Union Canal within the adjacent Minet Country Park in order to identify any potential ecological constraints to the development of access roads to the Southall gas works site across the Country Park. The survey was undertaken by WYGE ecologists Daniel Hone and Victoria Alexander on 26th June 2007
Results	No signs of water vole were found.
Conclusions	The following key points were identified; • No signs of water vole were found. • The habitats along the brook were not optimal for supporting water vole populations. • At the time of the survey water voles were absent along the Yeading Brook within the Minet Country Park.

1.0 Introduction

White Young Green Environmental (WYGE) was commissioned by National Grid Property Ltd. to undertake a water vole survey of the Yeading Brook within the adjacent Minet Country Park in order to identify any potential ecological constraints to the development of access roads to the Southall gas works site across the country park.

The survey was undertaken by WYGE ecologists Daniel Hone and Victoria Alexander on 26th June 2007.

1.1 Site Description

Located to the west of Southall station (National Grid Reference TQ115800; see SK.01), the site comprises of a gas works and a long-term car park. Habitat is predominantly hardstanding with some areas of grassland and tall ruderal. There is a large amount of Japanese knotweed and giant hogweed scattered across the site.

The site is bounded to the south by the rail line to the north and east by Beaconsfield Road and a residential area. To the west is the Grand Union Canal. The opposite side of which is an area of trees and scrub contained by the Yeading Brook and Minet Country Park. Proposed access roads would intersect the Country Park at Springfield and Pump Lane.

1.2 Report Conditions

For a detailed review of the extent and limitations of this report, attention is drawn to the report conditions in Appendix A and WYGE tender document, ‘E000157 Southall ECO P01 GAC’, May 2007.

2.0 WATER VOLE ECOLOGY

The water vole (*Arvicola terrestris*) is the largest of the British voles weighing between 200 – 350g. It has a rounded body, blunt muzzle and short round ears almost entirely hidden amongst its thick fur.

Water voles, which are active day or night, live on slow flowing rivers or streams that have steep natural sides and tall, luxuriant bankside vegetation. Bankside vegetation is an important component of the habitat as the water vole is herbivorous, mainly feeding on the aerial stems of waterside plants. The animals burrow into the sides of the bank to make a nest, which they fill with grass and other waterside vegetation.

Water voles produce up to five litters from April to September with females giving birth to an average of six young after a gestation period of 20-23 days. The young leave their mother after about 22 days, when she has her next litter.

There are several distinct signs of water vole activity:

- the presence of their faeces, which are often deposited within a discrete latrine near the nest, at range boundaries and where they leave or enter the water
- feeding stations, which are preferred areas where food is brought to be eaten
- lawns, where grass is gnawed in an area close to the nest especially during nursing times for the female when time away from the nest has to be kept to a minimum
- remains of grass / reed stems, the ends of which are cut in a characteristic 'wedge' shape
- characteristic footprints
- burrows
- runs
- the sound of the water vole entering the water. When disturbed on the bank, it will dive into the water with a loud "plop". The "plop" is often the first indication that water voles are present within an area, and
- sighting of a water vole.

It is usual that, apart from seeing a water vole, presence is established from a combination of the above signs, rather than being defined by any one sign.

WATER VOLE LEGISLATION

The water vole receives limited legal protection through its inclusion on Schedule 5 of the Wildlife & Countryside Act 1981 (as amended) Section 9(4). Legislation protects the water voles places of shelter and protection but does not protect the voles themselves. Legal protection makes it an offence to intentionally:

- Damage or destroy or obstruct access to any structure or place which water voles use for shelter and protection.

- Disturb water voles whilst they are using such a place.

The water vole is also one of twelve Priority Species of British terrestrial mammals identified in the UK Biodiversity Steering Group Report (1996) as needing conservation action. As such the UK Water Vole Steering Group was established and resulted in the production of the UK Water Vole Species Action Plan (1997).

3.0 METHODOLOGY

The entire length of Yeading Brook within Minet Country Park was walked by 2 ecologists and preferred habitat areas were surveyed for signs of water vole activity. Signs looked for included water vole faeces, latrines, feeding stations, burrows, footprints and runs. This was done from the banks and by walking along the stream bed.

4.0 RESULTS

Yeading Brook (See pictures below)

Habitats along the brook where suboptimal for water voles e.g. over hanging trees and bare bank sides lacking in aquatic marginal vegetation which would account for the absence of signs of water vole activity. The brook should be considered to have a **low** potential to support a water vole population.

5.0 EVALUATION AND CONCLUSIONS

The following key points were identified;

- No signs of water vole were found.
- The habitats along the brook and canal were not optimal for supporting water vole populations.
- At the time of the survey water voles were absent along the Yeading Brook within the Minet Country Park.

Documents Consulted

- Biodiversity: The UK Action Plan. H.M.S.O., (1994), London.
- Consultation responses
- Department of the Environment (October 1994). *Planning Policy Guidance: Nature Conservation (PPG 9)*. H.M.S.O., London.
- Strachan, R. (1998) *Water Vole Conservation Handbook*. Wildlife Conservation Research Unit, Oxford
- English Nature Water vole mitigation techniques No. 415 – EN Research Reports (2001)

APPENDICES

APPENDIX A

Report Conditions

WHITE YOUNG GREEN ENVIRONMENTAL LTD

C1 - REPORT CONDITIONS

Southall Gasworks (Water Vole Survey)

This report is produced solely for the benefit of the National Grid Property Ltd and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYGE. In time improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of WYGE using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times..

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to WYGE by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

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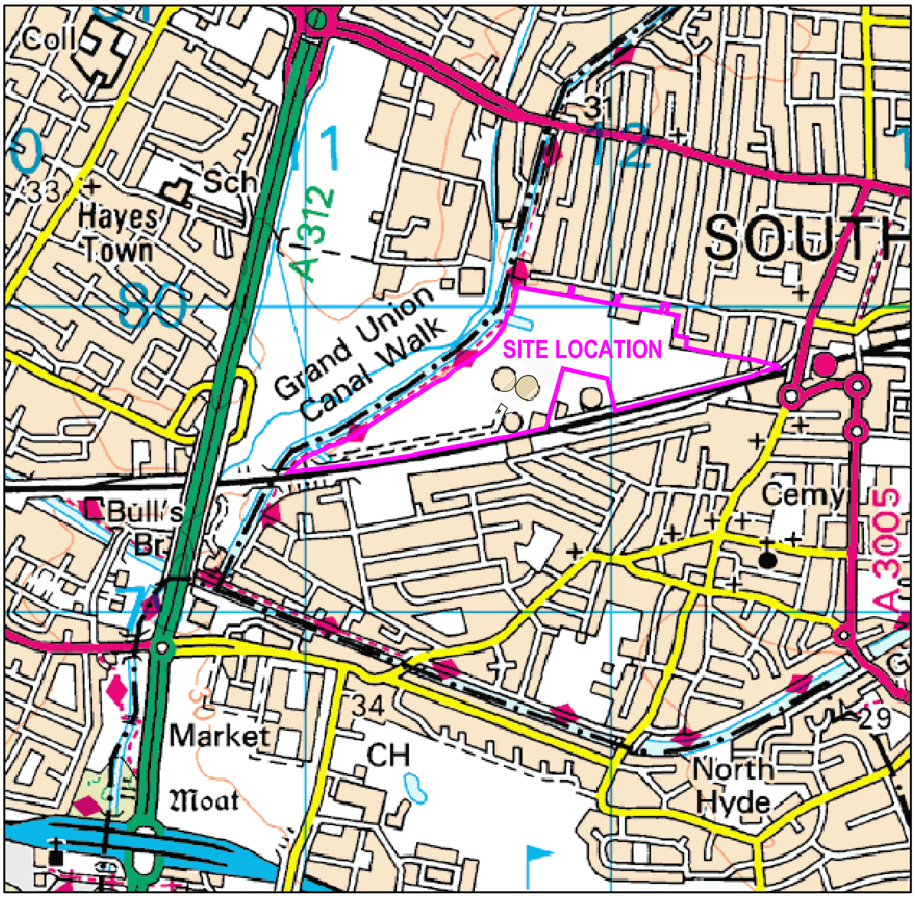
Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the representativeness of data used by the model and the assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions.

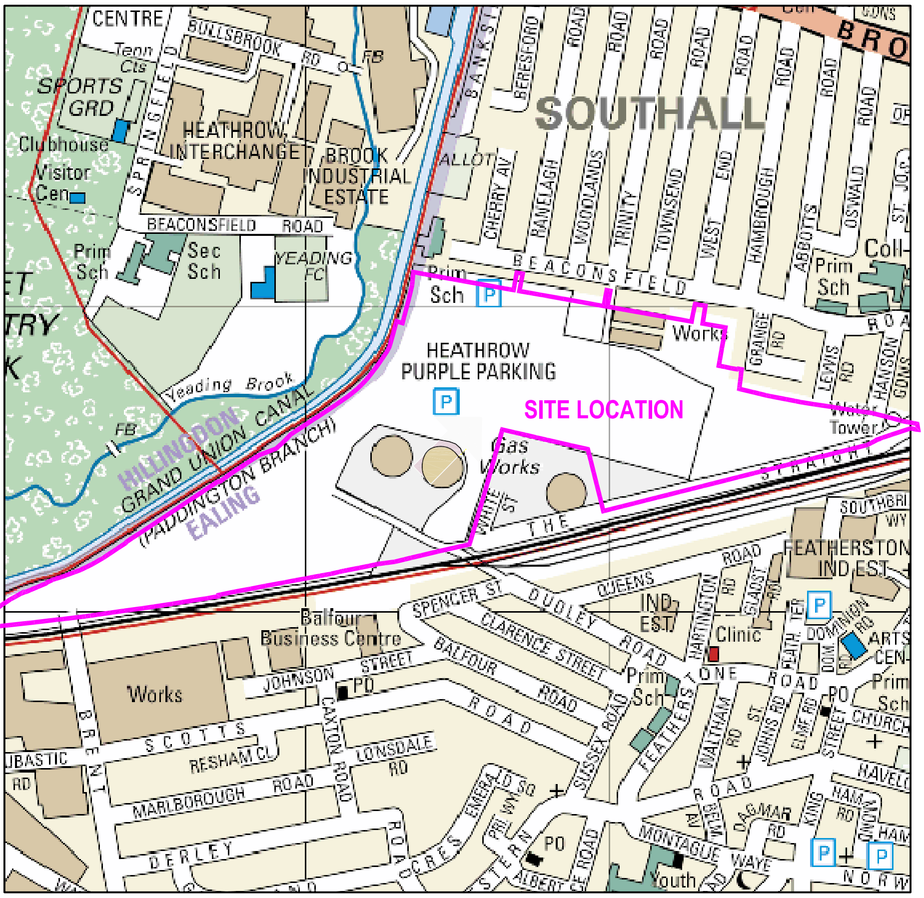
The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYGE accept no liability for issues with performance arising from such factors

SKETCHES

SCALE = 1:1000





SCALE = 1:500

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Environmental Consultancy

Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:
SOUTHALL GASWORKS

Client:
NATIONAL GRID PROPERTY LTD.

Drawing Title:
SITE LOCATION PLANS

Scale at A4	Drawn By	Date	Checked By	Date	Approved By	Date
AS SHOWN	P. J. T.	JUL. 2007	V. A.	JUL. 2007	G. C.	JUL. 2007

Office	Type	Project No.	Drawing No.	Revision
40	ENV	E000357-7	SK. 01	

Reptile Survey Report

Southall Gasworks

thinking beyond construction

REPTILE SURVEY REPORT

SOUTHALL GASWORKS

FOR

NATIONAL GRID PROPERTY LTD.

Reference: E00357 Southall Gasworks REP R01 VEA			
Issue		Prepared by:	Reviewed & Verified by:
v1	**JUL 07**		
		VICTORIA ALEXANDER **Ecologist**	**ADRIAN HUTCHINGS** **Principal Ecologist**

File Ref: H:\Data\Projects\E00001 - E01000\E00357 Southall Gasworks\4004\E00357\Ecology from 2007\Report\E00357 Southall Gasworks REP R01 VEA.doc

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CONTENTS

0.0 EXECUTIVE SUMMARY

Site Location	The site is located west of Southall station, on the northern bank of the railway line and is centred on National Grid Reference TQ115800.
WYGE Survey	Reptile presence/absence survey to assess the current reptile population on Southall Gasworks.
Results	During the six survey visits, no reptiles were observed on site or underneath any of the artificial refugia placed on site.
Conclusions	The site is unsuitable for reptiles, however, the lack of observations does not imply that reptiles are absent from the site, but that if they do occur, that they are likely to occur in a very small population.
Recommendations	As no reptiles were observed, it is not considered necessary to undertake mitigation measures. However, if any reptiles are observed during works, an ecologist should be consulted immediately for advice.

1.0 INTRODUCTION

White Young Green Environmental (WYGE) was commissioned by National Grid Property Ltd. to undertake a reptile presence/absence survey at Southall Gasworks in order to ascertain whether it supports a population of reptiles.

1.1 Site Description

Located approximately west of Southall station (National Grid Reference TQ115800; see SK.01), the site comprises of a gas works and a long-term car park. Habitat is dominantly hardstanding with some areas of grassland and tall ruderal. There is a large amount of Japanese knotweed and giant hogweed scattered across the site.

The site is bounded to the south by the rail line to the north and east by Beaconsfield Road and a residential area. To the west is the Grand Union Canal. The opposite side of which is an area of trees and scrub contained by the Yeading Brook and Minet Country Park.

Further location and site layout details are given on sketches SK 01 and SK 02.

1.2 Report Conditions

For a detailed review of the extent and limitations of this report, attention is drawn to the report conditions in Appendix A plus those detailed in the original accepted services offer letter.

2.0 REPTILE ECOLOGY

Nomenclature (including vernacular names) for reptiles follows that in Arnold and Ovenden (2002).

Six native species of reptile occur in Britain. One snake (smooth snake *Coronella austriaca*) and one lizard (sand lizard *Lacerta agilis*) are considered rare; the others being relatively widespread, although there is a distinct southern bias in reptile distribution within Britain.

Reptiles are thermophilic (i.e. heat-loving) as they are poikilothermic (i.e. their body temperature fluctuates with the external air temperature). Consequently, they are most diverse in southern England and in habitats that warm up quickly. All British reptile species hibernate from late autumn to early spring, emerging when temperatures are sufficiently warm. During the early part of the day and especially after periods of wet weather, reptiles will spend much of their time basking.

Reptiles will occupy a variety of habitats, although they occur most frequently in grassland, moor, heathland and sparsely vegetated areas. An important component of the habitat are refugia (e.g. log-piles, builder's rubble and / or discarded carpets) where adults can hide but which are also close to an area where they can expose themselves to the sun (bask). Therefore, south to south-west facing slopes with open, sparse vegetation provide ideal conditions.

In contrast, the grass snake *Natrix natrix* is associated with wetland habitats as it tends to feed on adult amphibians.

The common lizard *Lacerta vivipara* is found throughout the British Isles, and can be found in a variety of habitats including grassland, hedgerows, woodland edges, and road and railway embankments but also has a liking for wet heaths. They require both open areas for basking and refuge areas for cover. The onset of hibernation is dependent upon seasonal temperature trends, but typically occurs in October, and is usually spent deep in refugia. Animals normally emerge from their hibernation in late March / April although in mild conditions this can be as early as mid-February. Immediately following hibernation they will spend long periods basking and foraging for insects. Mating starts in April and May; between 4 and 10 fully formed young are born under cover, in late July or August.

Both brownfield and greenfield sites regularly support populations of the common lizard, grass snake and slow worm *Anguis fragilis* as well as, on occasion, adder *Vipera berus* , depending on location and habitats present.

3.0 REPTILE LEGISLATION

All British reptiles receive protection under the Wildlife and Countryside Act 1981 (as amended). The four more common species of reptile; the common lizard, the grass snake, the slow worm and the adder receive protection from Section 9(1) and all of Section 9(5) of the Wildlife and Countryside Act, 1981 (as amended), which makes it an offence to intentionally kill or injure an animal.

It is therefore a criminal offence to undertake major works on site that may result in the death or injury of a native reptile species where these species are known to be present.

In addition to the above, the two rare species of British reptile, the smooth snake and the sand lizard are listed in Schedule 5 of the Wildlife and Countryside Act, 1981 (as amended) and under Annexe IV of the Conservation of Natural Habitats and of Wild Fauna and Flora Directive, 1992 ('the Habitats Directive') as a European protected species. Furthermore, the Countryside and Rights of Way Act, 2000 (Schedule 12, paragraph 5) has amended Section 9(4) of the 1981 Act to include the term 'reckless'. It is therefore fully protected under Section 9 of the 1981 Act and under Regulation 39 of the Conservation (Natural Habitats etc) Regulations, 1994 that transposes the Habitats Directive into UK law.

Consequently, it is an offence to intentionally kill, injure or take a smooth snake/sand lizard as well as intentionally or recklessly damage, destruct or obstruct the access to the place of shelter or disturb the animal while it is occupying it.

4.0 METHODOLOGY

The method used was that prescribed by Gent and Gibson (2003) for carrying out a presence / absence survey for reptiles. This requires undertaking 5 – 6 survey visits between early March and early October.

The survey periods for the relevant reptile species have been summarised in table 4.1 below.

Table 4.1 - Survey Periods for Common Reptile Species and Temperature Ranges

Species	Survey period	Optimal Temperatures
Common lizard	Early March – early August (adults) August and September (juveniles)	$9^{\circ} – 18^{\circ O}$C
Slow worm	Early March – early August	No data
Grass snake	April – early October	$12^{\circ} – 20^{\circ O}$C
Adder	Early March – late September	8 – 16 ^{o}C

The survey was based on the following methods:

- *Direct Observation* – Whilst carrying out a walkover survey, locations of basking animals were noted and mapped indicatively. This method is especially important for grass snakes and adders as they generally bask close to their winter hibernacula.

- *Refugia Searches* – Any suitable naturally occurring refugia was carefully searched especially log-piles, rubble and discarded palettes or old carpets. In-situ refugia on site were only mapped if reptiles were found using them during the survey period.

- *Tinning* – Artificial refugia were placed in suitable reptile habitat within rough grassland and at the edges of scrub vegetation.

Froglife (1999) recommend a tinning density of approximately 10 tins per hectare. In this case a total of 30 tins were placed (54 tins of 1m x 0.5m and 22 tins of 0.5 x 0.5m) across the area of grassland to the eastern end of the site identified in the previous Phase 1 habitat survey as having reptile potential.

The tinning squares made from black roofing felt were placed across the area on the 27th June 2007. Tinning squares were laid in areas considered to have the highest potential to support reptile species, to act as artificial refugia, thereby encouraging reptiles to hide under them.

The tins were laid within areas of tall ruderal grassland, with the majority of the tins being placed around the periphery of the site and across the centre where the grass was tallest and thickest. Each tin was numbered individually so that results could be analysed and areas important for reptiles could be highlighted.

The site was visited on 7 separate occasions; the first day used direct observation only while artificial refugia were placed across the site. The remaining 6 visits comprised a presence/absence survey with 30 tins and direct observation of reptiles. Weather conditions for each of the survey dates are given below in Table1.2.

Table 1.2 - Survey Dates

Visit Number	Date	Time	Weather Conditions (Temperature)
1	27th June 2007	Mats initially placed	Scattered cloud, slight breeze (17°C)
2	6th July 2007	10:00-11:00 am	scattered cloud, slight breeze (16.8°C)
3	9th July 2007	10:00-11:00 am	Scattered cloud, windy (15°C)
4	10th July 2007	10:00-11:00 am	Scattered cloud, slight breeze (18°C)
5	11th July 2007	10:00-11:00 am	Scattered cloud, windy (17°C)
6	12th July 2007	10:00-11:00 am	Clear with light breeze (18°C)
7	13th July 2007	10:00-11:00 am	Very Light drizzle (19.5-20°C)

5.0 RESULTS

The grassland and tall ruderal habitats present across the site are of varying vertical levels and suitable basking areas consisting of areas of open grassland and bare ground are found between these areas. Additionally, a variety of refugia opportunities are present across site in the form of debris and spoil piles.

Despite the suitability of the site, no reptiles or species of note were observed on site or underneath any of the refugia placed on site.

6.0 CONCLUSION AND RECOMMENDATIONS

Habitats on site are suitable for native reptile species in particular the common lizard and the slow worm. However, the lack of observations does not imply that reptiles are absent from the site, but that if they do occur, that they are likely to occur in a very small population.

As no reptiles were observed on site, it is not considered necessary to undertake mitigation measures. However, if any reptile species are observed on site during works, an ecologist should be called immediately for advice.

Documents Consulted

- Arnold & Ovenden (2002) A Field Guide to the Reptiles and Amphibians of Britain and Europe. HarperCollins, London.
- Office of the Deputy Prime Minister (August 2005). Planning Policy Statement 9: Biodiversity and Geological Conservation (PPS 9). H.M.S.O., London.
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- Herpetofauna Groups of Britain and Ireland (1998) Evaluating local mitigation/translocation programmes: Maintaining Best Practice and lawful standards. HGBI advisory notes to for Amphibian and Reptile Groups (ARGs). HGBI, c/o Froglife, Halesworth. Unpubl.
- Joint Nature Conservation Committee (1998) Herpetofauna Worker Manual, JNCC, Peterborough.
- Wildlife and Countryside Act 1981. H.M.S.O., London.

APPENDICES

APPENDIX A

Report Conditions

WHITE YOUNG GREEN ENVIRONMENTAL LTD

C1 - REPORT CONDITIONS

Southall Gasworks (Reptile Presence/Absence Survey)

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SKETCHES

White
Young
Green

Entomological Study

West Southall, Southall, London

thinking beyond construction

ENTOMOLOGICAL SURVEY REPORT

OF

WEST SOUTHALL, LONDON

FOR

NATIONAL GRID PROPERTY LTD

Reference: E00357 Southall INV R01 LAW				
Issue		**Prepared by:**	**Reviewed by:**	**Verified by:**
V2	**Mar 08**			
		LAURA WESTWICK Assistant Ecologist	**DR PAUL JOYCE** Senior Ecologist	**DR GREG CARSON** Associate Ecologist
File Ref: H:\Data\Projects\E00001 - E01000\E00357 Southall Gasworks\4004\E00357\Ecology from 2007\Inverts\E00357 Southall INV R01 LAW.doc				

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CONTENTS

EXECUTIVE SUMMARY

Site location	Land between the Yeading Brook and the Grand Union Canal, Southall, London, measuring 2ha (NGR: TQ114798).
Previous surveys	In 2007 WYGE undertook Phase 1 habitat and, protected species (including bat) surveys. A previous invertebrate survey was undertaken in 2004.
WYGE survey	A follow-up to the 2004 invertebrate survey and assessment of land between Yeading Brook and the Grand Union Canal was commissioned to assess the presence of notable invertebrtates and potential impact on the proposed development.
Results	Thirty-five invertebrate species were recorded, mostly common and widespread, although there were three noteworthy species.
Conclusions	The site is ranked as having medium invertebrate potential, assessed using measures of habitat and plant diversity.
Recommendations	Further survey visits in 2008 are suggested at a more optimal time of year.

1.0 INTRODUCTION

White Young Green Environmental (WYGE) was commissioned by National Grid Property Ltd to carry out an invertebrate survey in October 2007 at West Southall, a former gasworks in west London.

1.1 Site description

The potential redevelopment area covers 36ha and is located 300m to the west of Southall town centre and train station, centred on the National Grid Reference TQ114798. A large vehicle storage compound, (hard standing), occupies most of the site and areas of ephemeral habitat composed of opportunistic species in addition to more dense scrub re focused on the periphery. To the north-west lies the Minet Country Park and two water courses, the Grand Union Canal (Paddington Branch: Grade 1 site of Borough Importance) and the Yeading Brook. The Grand Union Canal forms the eastern boundary and the northern edge is bounded by Yeading FC stadium, Beaconsfield road and the Brook Industrial Estate.

This study focuses on land along the Yeading Brook and the Grand Union Canal, being the proposed site of bridge crossings related to the proposed redevelopment.

1.2 Background

WYGE undertook Phase 1 Habitat and protected species surveys at West Southall and its surrounds to inform an Ecological Impact Assessment for the proposed development and associated access roads. Invertebrates had been surveyed previously in 2004. The current survey provides an update, outlining the findings of the entomological study undertaken in October 2007.

1.3 Report conditions

For a detailed review of the extent and limitations of this report, attention is drawn to the report conditions in Appendix A.

2.0 INVERTEBRATE ECOLOGY AND LEGISLATION

There is little statutory protection afforded to invertebrates, and consequently no legal obligation to ensure the protection of these animals. However, invertebrates and their associated 'brownfield' habitat, are increasingly recosgnised as important components of biodiversity, and it is recommended that best practice measures are adopted with provision of mitigation to minimise or compensate for any loss of important invertebrate habitat.

Some invertebrate species are covered by Species Action Plans (SAPs) at a local and/or national level, that highlight status and conservation requirements, emphasising their important contribution to biodiversity.

In most cases, invertebrates listed under the Wildlife and Countryside Act 1981 (as amended) are not afforded full protection, and are only afforded a section prohibiting the sale of such species. There are a few exceptions, notably the marsh fritillary butterfly *Eurodryas aurinia* and the large copper butterfly *Lycaena dispar* both of which have full protection but are not encountered within the study area due to their specific habitat requirements.

3.0 METHODS

3.1 Site visits

The survey was undertaken on 15th October 2007 by entomologist Richard Jones.

3.2 Location and collection of specimens

Invertebrates were located and collected by general methods using sweep netting, beating into a tray, and cutting/prying open vegetation with a knife. Flowers, leaf surfaces, rocks, bare ground, logs and tree trunks were examined by visual searching. Voucher specimens of all but the most common and characteristic species were kept.

3.3 Taxonomic coverage

The survey concentrated on the following major groups:

Coleoptera (beetles)
Diptera (flies)
Hemiptera (bugs, froghoppers etc)
Hymenoptera (bees, wasps and ants); and
Lepidoptera (butterflies and moths).

Examples of other groups were noted and collected if deemed of value.

4.0 SURVEY RESULTS

4.1 Overview

Thirty-five invertebrate species were recorded. These were all very common and widespread and might be expected to occur on virtually any green open space in southern England. There were three exceptions, listed below.

4.2 Noteworthy Species

Criteria for Assigning Rarity

Criteria for allocation of accepted ‘nationally rare’ (red data book) and ‘nationally scarce’ (notable) statuses are varied and complex (Shirt, 1987; Hyman & Parsons, 1992 etc) but where applicable to this report are briefly listed below.

Table 4.1 - Classification of status

Classification	Code	Description
Endangered	(RDB-1)	The rarest taxa. Taxa in danger of extinction in Great Britain; species with very few recorded localities or living in especially vulnerable habitats.
Vulnerable	(RDB-2)	Very rare species. Taxa likely to move into the RDB1 category; species declining in their range.
Rare	(RDB-3)	Rare species. Taxa with small populations and which are at risk; species estimated to occur in 15 or fewer of the 10-km squares in the national Ordnance Survey grid since 1970.
Insufficiently known	(RDB-K)	Species thought to be very rare in Britain, recorded from less than 15 of the 10-km squares of the national Ordnance Survey grid since 1970, and which warrant RDB classification of some sort, but for which there is a recognized lack of accurate information.
Nationally scarce	(notable A)	Very local species, thought to occur in 16 to 30 of the 10-km squares of the national Ordnance Survey grid since 1970.

Classification	Code	Description
Nationally scarce	(notable B)	Very local species, thought to occur in 31 to 100 of the 10-km squares of the national Ordnance Survey grid since 1970.
Nationally scarce	(Sub divided into A/B)	Status is sometimes not subdivided into categories A and B, (notable, occurring in 16 to 100 10-km squares).
Very local	subjective	Status is a much more subjective, but nevertheless useful, measure of scarcity and is based on personal experience, published and unpublished records. It is applied to species that are very limited in distribution or confined to very limited specialist habitats.

The following is a list of some of the more interesting and noteworthy species taken in the area.

Nationally scarce species

Hippodamia (formerly *Adonia*) *variegata* Goeze, the Adonis ladybird, Coleoptera: Coccinellidae. Status: nationally scarce (notable B, Hyman & Parsons, 1992). Until about 10 years ago, this ladybird was always regarded as having a coastal distribution, occurring in warm sheltered locations such as chalk downs, dunes, undercliffs and other disturbed areas (Majerus et al., 1997). However, it is now known to be fairly widespread in the London area and Thames Estuary (Jones, 2006), where it is associated with sparsely vegetated post-industrial brownfield sites.

Very local species

Pilophorus perplexus (Douglas & Scott), Hemiptera: Miridae. Status: very local. Although widespread in southern England, this bug is more or less limited to an area south of the line from the Wash to the Severn. It feeds on aphids on trees, often oaks.

Ormyrus nitidulus (Fabricius), Hymenoptera: Ormyridae. Status: very local. This scarce insect is a parasitoid of gall wasps of the genera *Andricus, Cynips* and *Biorhiza* on oak trees and *Diplolepis* on wild roses. Despite the wide abundance of its host species it is only rarely found in Britain. This may be because the group is poorly studied by entomologists.

5.0 EVALUATION

The invertebrate biodiversity of the site is low. This is partly because the site is relatively small, but also because of the time of year as few insects are still active in late October, even if the weather is warm. Itis likely that a greater number of species would be recorded during spring and summer visits.

There are several habitats available to insects within the survey area. Much of the site is woodland with native trees including birch, oak, blackthorn, hawthorn and ash. Although most of the trees are relatively young, there is some evidence of fungal decay and dead timber, an important habitat for many specialist invertebrates. There are also areas of rough grassland, herbs and patches of bare ground. These are important for many invertebrates, in particular flower visitors and those that thrive in warm, well-drained places. Running freshwater is easily polluted in urban areas and although the banks of the Yeading Brook are heavily overgrown with bramble and other invasive scrub, the water was clear and a mixture of open water and aquatic plants suggests that the brook is clean.

The main purpose of the survey was to compare the site in its current state with that of a previous visit in 2004 and to provide a visual reassessment of the invertebrate potential.

The above was carried out using an assessment tool developed for studying brownfield sites in the Thames Gateway area (Roberts *et al.*, 2006). The completed assessment form is included as Appendix B. Potential invertebrate diversity was ranked as ‘medium’ and was superficially similar to its condition in 2004. As indicated above, further visits in spring and summer would certainly reveal many other invertebrates, albeit likely to comprise the more common and widespread species. However,, the habitat types suggest that some unusual insects may also be found.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The site has not changed greatly since 2004, except that the scrub is now thicker and less penetrable. The report following the 2004 visit (Jones, 2004) listed a similar low number of unusual species (the visit was also made in October of that year) and made a few comments on the likely importance of the available habitats to insects present.

The survey area is relatively small (although there are several potentially interesting habitat types) and is ranked as having **medium** invertebrate potential when assessed using measures of habitat and plant diversity.

As in the 2004 survey, it is suggested that field visits in spring (May/June) and summer (July/August/September) would enhance the understanding of the invertebrate assemblages present. In the absence of such further surveys, it is recommended that mitigation for invertebrates (such as brown roofs) is included as part of the development programme.

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APPENDICES

APPENDIX A - Report Conditions

WHITE YOUNG GREEN ENVIRONMENTAL LTD

REPORT CONDITIONS

West Southall - Entomological Survey Report

This report is produced solely for the benefit of National Grid Property Ltd and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This document is prepared for the uses stated in the report and should not be used in a different context without reference to WYGE. In time, improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of WYGE using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to WYGE by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

Whilst skill and care have been used, no investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather related conditions.

Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the how representative the data used by the model is, and assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicated in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions.

The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYGE accept no liability for issues with performance arising from such factors.

APPENDIX B – Habitat Assessment Results

Habitat Assessment Form

☐ **Site visit** ☐ **Desktop study** ☐ **Confidential**

Site name	**Yeading Brook**	**Site code**	**Ad hoc visit**
Surveyor	**Richard Jones**	**Date**	**15.x.2007**
Site location	**Between Grand Union Canal (Paddington Branch) and Yeading Brook, Soughall**		
Owner/Manager/ follow-up details	**Access granted through environmental company White Young Green**		
Site description *(if no name given)*	**Wooded embankment**	Grid ref.	**TQ114798**
Estimated area	2 hectares	Approx. time derelict	10 years

Survey access to site

√ All ☐ None Risk: Flowing water

☐ Part Comments:

Viewed from

√ On site ☐ Site boundary

☐ Other (please specify)

Current activity

☐ Bulldozing/clearance ☐ Fly tipping ☐ Foot traffic

☐ BMX bikes/motorcycles/cars ☐ Small scale domestic tipping √ None

☐ Other/comments

Substrates

√ Clay/loam ☐ Stones ☐ Rubble

☐ Concrete/tarmac √ Sand

☐ Other (please specify)

Wet areas

√ Permanent water √ River ☐ Marsh

☐ Seasonally wet areas √ Canal ☐ Stream

☐ Saline ☐ Other

Vegetation

Plant diversity (estimated)	**Flower diversity**	**Flower abundance**
☐ High	☐ High	☐ High
√ Medium	√ Medium	√ Medium
☐ Low	☐ Low	☐ Low

Vegetation present

☐☐	Reeds	√ ☐	Oxeye daisy	√ ☐	Yellow Asteraceae
√ ☐	Mayweeds	√ ☐	Mallows	√ ☐	Yellow/white umbels
☐☐	Weld or Mignonette	☐☐	Toadflaxes	☐☐	Wild Carrot
√ ☐	Labiates	☐☐	St. John's Worts	√ ☐	White Bryony
√ ☐	Legumes	☐☐	Annual mercury	☐☐	Fleabanes
√ ☐	Ragwort	☐☐	Stonecrops	√ ☐	Wormwood
√ ☐	Thistles	☐☐	Gorse	☐☐	Drought-stressed bramble
√ ☐	Yellow crucifers		Other/comments		

Site name	Yeading Brook	Site code	None	Date	15.x.2007

Negative vegetation

√ □	Sycamore	√ □	Bracken	√ □	Nettles
□□	Buddleja	√ □	Japanese knotweed		

Vegetation types (%)

√□	Bare ground	√□	Tall herb	√ √	Scrub
□□	Sparse vegetation	□□	Creeping herb	√ √	Tree
□□	Lichen/bryophyte 'heath'	Other/comments			

Potential invertebrate species diversity

□ High √ Medium □ Low

Comments:

Mostly scrub and tree mix, birch, oak, blackthorn, hawthorn, ash and sycamore. Some open areas with bare ground. Yeading book banks rather steep and densely vegetated, but water looks clean and there is some aquatic vegetation. Canal bank with (in some areas) more open flowery areas. Most of the site is impenetrable scrub.

Future visits would be worth while.

Unusual plants:
Dittander, Lepidium latifolium, which is apparently well known in this area along the banks of the Grand Union Canal.

□ Photographs taken *(Please mark approximate position on site map or overlay)*
□ Documents attached No. of pages

White Young Green

Southall Gas Works
Southall, London

Arboricultural Survey Report

for National Grid Property

September 2007

thinking beyond construction

White Young Green

Southall Gas Works
Southall, London

Arboricultural Survey Report

for National Grid Property

September 2007

Reference:– **Southall Gas Works, Southall, London – Arboricultural Survey Report**

Issue		**Prepared by**	**Checked by**	**Verified by**
V1	July 2007			
V2	Sept. 2007			
V3	-			
V4	**-**	**Guy Morrison**	**Paul Burgess**	**Peter Harrison**
V5	-	**Principal Arboriculturalist**	**Associate**	**Associate Director**

File Ref: N:Projects/E013004/Reports

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NATIONAL GRID PROPERTIES

SOUTHALL GAS WORKS, SOUTHALL, LONDON

ARBORICULTURAL SURVEY REPORT

SEPTEMBER 2007

CONTENTS

0.0 SUMMARY

White Young Green Environmental was commissioned to carry out a tree survey on a site of proposed mixed development at the Southall Gas Works and adjacent land to the west.

The site was visited during June 2007 and the trees assessed in accordance with BSS5837:2005 '*Trees in relation to construction – Recommendations'*.

The main site is the former site of a gas works, now used for airport parking, as well as an adjacent area of overgrown cricket pitch. Additional land surveyed in relation to proposed access roads included a canal, country park, school playing fields and a football club.

The survey assessed two hundred and fourteen individual trees and sixty five groups of trees and shrubs. The overall tree density is irregular, with most of the trees concentrated close to the boundaries on the main site and within the country park to the west of the canal.

Only two individual trees of high quality and value were identified, both in the Minet Country Park. These are over-mature pedunculate oak trees with extensive cavities and other features of ecological value.

Eighty one trees were assigned to a moderate quality and value category. These included the row of middle-age London plane and accompanying sycamore and silver maple that form a distinctive landscape feature parallel to the railway line on the southern boundary of the gas works site. The other main group of moderate value trees were middle-age oaks and a lesser number of ash and sycamore within the country park area and a short row of middle-age grey poplars adjacent to the football ground.

Ninety one trees of low quality and value were identified. Some of these are smaller or younger trees which do not yet have a significant amenity or ecological value. These also included the large number of mature hybrid black poplars on the northern boundary of the main site which had been topped and a large number of crack willow trees lining the stream which are easily replaced and have a limited lifespan at maturity.

Forty trees require felling because of their condition, irrespective of the development proposal. These include dead trees, regrowth on the stumps of felled trees, trees with significant decay that put them at risk of structural failure and fire-damaged trees.

Of the groups of trees and shrubs, one group in the country park was identified as being of high quality and value category because of a number of mature and over-mature oak and ash trees. Thirteen groups were identified as being of moderate quality and value category. These included large areas of semi-natural scrub such as that in the centre and eastern part of the country park and mixed planting of amenity value on the south-western boundary. Forty five groups of tree and shrubs were assigned to the low quality and value category. These included small groups of such as the narrow strips to the east of the canal towpath and areas of recent amenity tree planting. Six groups of trees required felling because of its condition irrespective of the development proposal. These included small groups of defective trees and shrubs and groups that interfered with the growth and development of higher quality trees.

The site contains a number of higher quality trees (high and moderate quality and value) and these represent a constraint on development. Within the main site these trees are concentrated on and close to the southern boundary and represent a small proportion of the overall area of this large site. The higher quality trees to the west of the canal are more dispersed and it is likely that there would be some impact associated with the loss of some of these trees as a result of access road construction.

1.0 SCOPE AND BRIEF

This arboricultural report was commissioned by National Grid Properties. It relates to the Southall Gas Works site, London, which is proposed for mixed development. The report and survey also cover parts of the Grand Union Canal (Paddington Branch), Minet Country Park and The Warren Yeading Football Club which lie to the west and are proposed for potential access works.

The report was prepared by Guy Morrison Dip.Arb.(RFS) M.Arbor.A MICF, Principal Arboriculturalist at White Young Green Environmental.

The scope of the report was to prepare a tree survey report for the site in accordance with BSS5837:2005 '*Trees in relation to construction – Recommendations*' (BSi, 2005). This would determine the size, condition and value of trees, shrubs and hedgerows on and immediately adjacent to the site and provide recommendations for remedial work and root protective distances to ensure the future health and stability of retained trees.

A tree survey was previously carried out on the main gas works site (ACS Consulting, 2005), but there was a need to repeat the survey because of a revision to the BS5837 survey methodology, unrecorded felling of trees on sites and a need to survey additional areas of proposed access works.

A preliminary masterplan for the site was available at the time of the survey, but this was not taken into account when assessing the trees and their intrinsic value.

2.0 SITE DESCRIPTION

The site is in Southall in the London Boroughs of Ealing and Hillingdon. The main gas works site is bound to the south by a railway line, to the west by the Paddington Branch of the Grand Union Canal and to the north by Beaconsfield Road and small cul-de-sac streets associated with this. The Minet Country Park site lies to the west of the canal and is also bound to the south by the railway line. It is bound to the west by the A312 The Parkway and to the north by the Guru Nanak School, Beaconsfield Road. The Warren Yeading Football Club ground is situated on Beaconsfield Road to the east of the school.

The gas works site contains a number of demolished gas storage towers and one operational tower and associated infrastructure in the central southern part of the site, which was omitted from the survey because development is not proposed here. The central and western portion of the site is mainly used for airport parking and all the trees here are concentrated around the periphery, with a short row of mature and middle-age Lombardy poplar on the western boundary and a band of mature pollarded hybrid black poplar and younger sycamore on the northern boundary. In addition to this there is a single middle-age common lime tree adjacent to the site office and dense buddleia and hawthorn-dominated scrub associated with demolished gas towers and the railway line.

The eastern portion of the gas works site contains an overgrown former cricket pitch which is bound on its south by a long row of late middle-age London plane trees with a small number of sycamore and silver maple. There are also a mature ash and horse chestnut tree and a number of young sycamore and silver birch at the eastern end of the site

To the north-west of the former cricket pitch is a small area overgrown with dense Japanese knotweed. The area is bound on its northern and eastern boundary by mature pollarded hybrid black poplar and golden hybrid black poplar.

To the west of the gas works site is the canal. Patches of linear scrub line the boundary between the towpath and gas works site and include middle-age hawthorn and goat and grey willow and young ash, English elm and pedunculate oak. At the southern end adjacent to the railway is a larger patch of goat and grey willow scrub with a high density of young pedunculate oak.

The Minet Country Park is bisected by a stream and a flood channel. The area to the east of the stream has a high density of trees and scrub. At the southern end adjacent to the railway line are a number of middle-age pedunculate oaks and late middle-age crack willow trees. The willows and smaller number of oaks also line the banks of the stream along its length. At the northern end of this area is a number of late middle-age sycamore and ash trees. The fertile moist soils at the southern and northern end have dense stands of goat willow, hawthorn and elder scrub, alternating with open areas with dense bramble and herbaceous vegetation including nettle, hemlock, Japanese knotweed, Himalayan balsam and giant hogweed. It is understood that the centre of this area has historically been used for dumping and the scrub here is dominated by buddleia, silver birch, hawthorn and oak.

Between the stream and flood channel at the southern end of the site is a dense area of hawthorn, bullace and elder scrub, with scattered middle-age pedunculate oak trees and middle-age crack willow lining the stream. Within the centre of this area is a group of late middle-age pedunculate oak and a small number of scattered mature oaks, which are also found associated with two overgrown hedgerows beyond the area of survey.

Trees and shrubs on the area between the flood channel and western boundary of the site has predominantly been planted and includes a diverse mix of young and middle-age alders, wild cherry, field maple, false acacia, Scots pine, hazel and hawthorn.

The grounds of the Guru Nanak School have a very low tree density, with a single middle-age hornbeam tree within the area of survey.

The Warren Yeading Football Club grounds include a short row of late middle-age grey poplars and recent planting of standard Italian alder, which are mainly dead. There are also patches of blackthorn scrub and adjoining scattered hawthorn scrub and riparian crack willow trees.

The surrounding area has a relatively low tree density as it is dominated by high density terraced and semi-detached housing and light industry. As such, the trees on the site as a whole represent an important arboricultural resource and the country park and canal form an important piece of green infrastructure within the city. Although the site is large, and includes some overgrown areas, many of the trees are visible from adjacent housing, roads, the railway, and the canal. As such they have potential for significant amenity value.

3.0 STATUTORY TREE PROTECTION

Tree Preservation Orders (TPOs) and Conservation Areas place various restrictions on the felling, pruning or damaging of trees, subject to various exemptions (DETR, 2000).

Enquiries were made to the local planning authorities (LPAs) on the presence of TPOs and Conservation Areas within and adjacent to the site. They confirmed (September 2007) that there were no TPOs on the site, but that railway land to the south of the site is covered by Ealing Borough Council TPO no. 749. There is also a Conservation Area associated with the canal and covering the towpath, banks and associated land. Consent should be sought from the LPA before felling or pruning any trees covered by the TPO and six weeks notice should be served on the LPA before felling or pruning any trees within the Conservation Area. It has not been possible to determine the exact boundaries of the Conservation Area and it is recommended that a precautionary approach is adopted and the LPA consulted on works to all trees close to the canal.

Tree felling on non-residential land is also controlled under the Forestry Act 1967 (as amended), which requires that a Felling License is obtained from the Forestry Commission before felling more than $2m^2$ of timber per three month period, subject to various exemptions and variations (FC, 2005).

There is an exemption for all the above statutory controls for tree felling and pruning and hedgerow removal for works strictly necessary to implement development that has received planning permission from the LPA. It is recommended that no tree felling is carried out until planning permission has been gained and that trees to be felled are shown on a Tree Protection Plan (see 6.6), which is submitted to the LPA.

4.0 METHODOLOGY

The site was visited over four days during June 2007 to carry out an assessment in accordance with BS5837:2005.

A topographical survey was supplied identifying the position of the trees and this formed the basis of the Tree Constraints Plan (Appendix F).

The following information was collected for each tree: species, age class (see Table 1), height, stem diameter at 1.5m above ground level, crown spread in the four cardinal directions and height of the crown above the ground (excluding basal sprouts and epicormic branches).

Table 1. Age class categories

Age class	*Proportion of life expectancy*
Young	< 1/3
Middle-age	1/3 – 2/3
Mature	>2/3
Over-mature	>2/3 and crown retracting as a result of age

Where multi-stemmed trees and shrubs were identified, the stem diameter was measured close to ground level, immediately above the root buttress flare. Where clusters of stems joining below ground level prevented the measure of a single basal stem diameter, a visual estimate was made of the effective basal stem diameter.

An assessment was made of the trees' physiological and structural condition, noting any disorders or biomechanical features which present an obvious hazard to present or future users of the site or affect the trees' life expectancy. Trees were assessed visually from ground level. No climbed inspection, removal of ivy or detailed investigation of decay was made.

Tree condition can change significantly over a relatively short period of time, and therefore the results and recommendations of this survey can only be held to be valid for a period of 12 months following the survey date.

Preliminary management works are proposed in order to either remove/reduce hazards or promote good future growth of the tree. All works carried out should comply with BS3998:1989 *British Standard Recommendations for Tree Work*.

The trees' overall quality and value for retention was assessed in accordance with BS5837:2005 Table 1 (Appendix B). This was dependent on the trees' physiological and structural condition, safe useful life expectancy and arboricultural, landscape, cultural, ecological value and amenity value (as a function of size, prominence, attractiveness and screening).

The Root Protection (RPA) radius and area for each tree was also calculated in accordance with BS5837:2005. The RPA is an area of ground that provides sufficient soil rooting volume to ensure the survival of the tree.

5.0 SURVEY RESULTS / EVALUATION

The survey results are shown in the survey schedule (Appendix A) and partially summarised on the Tree Constraints Plan (Appendix F).

The survey assessed two hundred and fourteen individual trees and sixty five groups of trees. The overall tree density is irregular, with most of the trees concentrated close to the boundaries of the main site and across the country park area.

Only two individual trees of high quality and value (category A) were identified, both in the country park. These are over-mature veteran pedunculate oak trees (no.s 113 and 116) with extensive cavities and other features ecological value.

Eighty one trees were assigned to a moderate quality and value category (category B). These included the row of late middle-age London plane and accompanying sycamore and silver maple that form a distinctive landscape feature parallel to the railway line on the southern boundary of the gas works site. These trees have value both through their present amenity value and their potential for screening any future development. Their value can be expected to increase to high value if they are retained to maturity. The other main group of moderate value trees were middle-age oaks and a lesser number of ash and sycamore within the country park area. Some of these already have amenity value, particularly those viewable from the canal, but this and their ecological value will increase as they mature. The other group of moderate value trees is the short row of late middle-age grey poplars adjacent to the football ground. This row has some amenity value that will increase as the trees mature.

Ninety one trees of low quality and value (category C) were identified. Some of these are smaller or younger trees, such as young oak trees which do not yet have a significant amenity or ecological value. Some trees are assigned to this category because of defects that do not require the felling of the trees, but which will prevent the trees attaining significant amenity value. An example of this is the large number of topped mature hybrid black poplars on the northern boundary of the main site. Other trees of low value are the large number of crack willow trees lining the stream and on damper ground in the east of the country park. These fast-growing trees are easily replaced and they have a limited lifespan at maturity because of their propensity to collapse.

Forty trees require felling because of their condition, irrespective of the development proposal (category R). These include dead trees, regrowth on the stumps of felled trees, trees with significant decay that put them at risk of structural failure and fire-damaged trees. It should be noted that the recommendation to fell assumes that some development will take place in the vicinity. Dead and defective trees in areas of the country park with not public access could otherwise be left to decay and collapse naturally as a wildlife habitat.

Of the groups of trees and shrubs, one was identified as being of high quality and value category (category A) (G48). This group within the country park at the edge of the area of survey was identified as being of high value because of a number of mature and over-mature oak and ash trees on the line of an overgrown hedgerow. The topographical survey should be repeated to identify the position of individual trees here if development is proposed in the vicinity.

Of the groups of trees and shrubs, thirteen were identified as being of moderate quality and value category (category B). These included large areas of semi-natural scrub such as that in the centre and eastern part of the country park. It should be noted that although the whole area has some amenity and ecological value, individual trees and shrubs within it are of little value and there would be little impact associated with the loss of a small proportion of the area resulting from the construction of an access road. Groups of moderate value also included areas of recent amenity tree planting in the south-western corner beside The Parkway. Although this planting is relatively young and therefore easily replaced, it has amenity and screening value in its current location.

Forty five groups of tree and shrubs were assigned to the low quality and value category (category C). These included small groups of scrub of small and young trees of limited amenity and ecological value, such as the narrow strips to the east of the canal towpath.

Six groups of trees required felling because of its condition irrespective of the development proposal. These included small groups of defective trees and shrubs and groups that interfered with the growth and development of better trees, such as the natural regeneration of sycamore and hawthorn below the row of London plane.

The site contains a number of higher quality trees (high and moderate quality and value) and these represent a constraint on development. Within the main site these trees are concentrated on and close to the southern boundary and represent a small proportion of the overall area of this large site. The higher quality trees to the west of the canal are more dispersed and it is likely that there would be some impact associated with the loss of some of these trees as a result of access road construction.

6.0 RECOMMENDATIONS

6.1 Preliminary works schedule

It is recommended that all works contained within the preliminary works schedule (Appendix A) are carried out, particularly where hazardous defects are identified. Before doing this it is recommended that the presence of statutory controls on tree felling and pruning is resolved with the Local Planning Authority.

6.2 Tree quality and value categories

It is recommended that the design of the site takes account of the results of the survey, giving particular attention to the retention of high (A category) and moderate (B category) trees wherever possible. Where possible, low value (C category) trees should be retained, but their presence should not represent a significant constraint on the design. Trees requiring removal irrespective of the development proposal should obviously not represent a constraint.

6.3 Cumulative impacts

It should be recognised that although the individual removal of low value trees and small groups of low value trees does not have a deleterious impact on the local environment, there can be a significant cumulative impact where a large number of trees are removed. An example of this would be the willow and thorn scrub in the country park, which is of low individual value, but as a large area provides a habitat of local ecological value. In this situation it is recommended that the site layout provides opportunities for mitigating the impact through the landscape planting plan.

6.4 Sustainable tree retention

In order to allow for the long-term sustainable retention of trees. Two requirements need to be met. The first is that there is no adverse physical impact on the trees. This can be met by ensuring that no adverse construction takes place within the RPA given in the survey schedule and shown on the tree constraints plan. Where construction is to take place within the RPA, the impact of this on the tree can be minimised or eliminated by the use of special ground protection measures such as the use of non/minimal dig construction and the use of porous materials.

In addition to reducing the physical impact on the tree, it is also important to allow the space for trees to grow and develop without causing significant nuisances such as severe loss of light to adjacent properties that will lead to pressure for their future felling or severe pruning. Provisional maximum heights are given in Appendix C and it is recommended that this information is taken account of during the design process.

6.5 Construction phase tree protection

It is recommended that all retained trees on or immediately adjacent to the site should be protected by protective fencing during the site clearance and construction phases. This construction exclusion zone should protect the RPA and ensure that trees to be retained and their essential rooting zone is not damaged during the works.

All potentially damaging operations should be excluded from within the construction exclusion zone, including: excavation, changes to levels, temporary access, vehicle parking or movements, fires and the storage, disposal or mixing of materials and chemicals.

6.6 Tree Protection Plans

It is recommended that a tree protection plan is produced once the layout is finalised. This will show the location and design of the protective fencing and other tree protection measures, such as ground protection. It should also show trees to be retained and removed and be accompanied by a schedule and specification of remedial and facilitative arboricultural works. All works carried out should comply with BS3998:1989 *British Standard Recommendations for Tree Work*.

6.7 Topographical survey

A small number of trees (no.s 2, 16, 37, 44, 74102, 103, 104, 106, 116 and 159) were not on the original topographical survey and their position is shown approximately on the tree protection plan. It is recommended that the topographical survey is repeated to identify the individual location of these trees and a revised tree constraints plan can be issued based on this.

6.8 Re-inspection

Security fences, buildings and dense vegetation prevented access for the close inspection of a number of trees and it is indicated in the schedule where these trees were surveyed at a distance and some dimensions taken from the original 2003 topographical survey. This was sufficient to assess the crown health, overall form and amenity value of the trees, but not to make a detailed assessment of condition, for example to identify the presence of decay and other defects, or make up-to-date measurements for calculating RPAs. It is recommended that access is ensured to re-inspect all these trees close distance before detailed design starts and a revised survey schedule and tree constraints plan issued.

6.9 Invasive vegetation control

The site contains large areas dominated by invasive non-native vegetation including Japanese knotweed, giant hogweed and Himalayan balsam. Of these, spread of the former two species is controlled by the Wildlife and Countryside Act 1980 and it is desirable that all three species are controlled. It is recommended that a control and eradication strategy is put in place at the earliest opportunity and this will be significantly cheaper if done well in advance of construction.

7.0 REFERENCES

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APPENDIX A - SURVEY SCHEDULE

SURVEY SCHEDULE

Individual Trees / Shrubs

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)				Physiol-ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
							N	E	S	W								
1	Hybrid black poplar	Mature	1290	1	24	4.5	12	10	10	10	Fair	Poor	Large tree previously topped at 8-10m and now re-grown a full crown. Brackets from the fungal decay species *Rigidoprus ulmarius* at apex of triangular bark wounds 600x400mm and 400x400mm at N and NW stem base. No apparent cavity. Associated surface decay. Dieback of minor twigs in crown. Cavity with opening 300x50mm 6m N. Nesting material present and 'tar-wash' below. High potential for bat roost.	Carry out aerial inspection of potential decay in crown if retained. Carry out bat inspection before carrying out nay work.	20-40	C1	15.48	752.9
2	Pedunculate oak	Young	150*	1	6	2	1.5	1.5	1.5	1.5	Good	Good	No significant defects.	None	>40	C1	1.80	10.2
3	Pedunculate oak	Young	150	1	8	1.5	3.5	1	1	3	Good	Fair	Tag no. 1635. No significant defects.	None	>40	C1	1.80	10.2
4	Lombardy poplar	Middle age	280	1	12	0	1.5	2	2	1.5	Fair	Poor	Stem previously topped at 6.0m. Now re-growing. Strip bark wound on E stem 0.5-10m occluding.	Crown-lift 2.0m.	10-20	C2	3.36	35.5
5	Lombardy poplar	Middle age	370+260	2	16	0.5	2	1.5	2	1.5	Good	Good	No significant defects.	Crown-lift 2.0m.	20-40	C2	4.50	63.6
6	Lombardy poplar	Middle age	320	1	7	1.5	1.5	1.5	1.5	1.5	Fair	Poor	Stem previously topped at 5.0m. Now re-growing.	Consider felling tree to promote adjacent oak natural regeneration.	10-20	C2	3.84	46.3
7	Lombardy poplar	Middle age	290	1	15	1.8	1	1	1	1	Good	Fair	Bark wound where previously crown-lifted occluding.	Crown-lift 2.0m.	20-40	C2	3.48	38.1
8	Lombardy poplar	Middle age	400	1	17	0.5	1.5	1.5	1.5	1.5	Good	Fair	Bark wound where previously crown-lifted occluding.	Crown-lift 2.0m.	20-40	C2	4.80	72.4
9	Lombardy poplar	Middle age	530	1	20	0	2	2.5	2.5	2	Poor	Fair	Crown dieback in N crown. Small rot pocket on S stem at 2.5m.	Remove major deadwood (diameter>50mm and length >1.0m). Crown-lift 2.0m.	10-20	C2	6.36	127.1
10	Lombardy poplar	Middle age	300	1	7	0.5	1	1	1	1	Fair	Poor	Stem previously topped at 4.0m. Now re-growing. Bark dieback and associated decay where previously topped.	Fell tree	<10	R	NA	NA
11	Lombardy poplar	Middle age	400	1	19	0	1	1	1	1	Poor	Fair	Crown dieback in upper crown.	Remove major deadwood (diam.>50mm and length >1.0m). Crown-lift 2.0m.	10-20	C2	4.80	72.4

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)				Physiol -ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
							N	E	S	W								
12	Lombardy poplar	Mature	610	1	21	0	1.5	3	3.5	1	Poor	Fair	Crown dieback in upper crown.	Remove major deadwood (diam.>50mm and length >1.0m). Crown-lift 2.0m.	10-20	C2	7.32	168.4
13	Lombardy poplar	Middle age	320	1	16	0	1.5	1.5	1.5	1.5	Good	Fair	Ingrown wire at 1.0m. No significant defects.	Remove ingrown wire Crown-lift 2.0m.	20-40	C2	3.84	46.3
14	Lombardy poplar	Middle age	490	1	22	0	2	2	2	1	Good	Good	No significant defects.	Crown-lift 2.0m.	20-40	C2	5.88	108.6
15	Lombardy poplar	Mature	730	1	23	0	2	2	2.5	2	Good	Good	No significant defects.	Crown-lift 2.0m. Remove elder and sycamore natural regeneration at base.	20-40	C2	8.76	241.1
16	Lombardy poplar	Young	130 @base	Multi-stemmed	8	0	1	1	1	1	Good	Fair	Cluster of suckers.	Thin retain single largest stem.	>40	C2	1.30	5.3
17	Lombardy poplar	Mature	830	1	2.5	0.5	3	3.5	2.5	1.5	Good	Fair	Razor wire at 0.5m starting to ingrow. No significant defects	Remove razor wire. Crown-lift 2.0m.	20-40	C2	9.96	311.7
18	Lombardy poplar	Middle age	510	1	20	1.8	2	1.5	1.5	1.5	Fair	Very poor	Large basal cavity open S. 550mm deep when 680mm diameter. Significant risk of collapse (t/R<0.3). Bark damage on SW buttress. Root damaged N due to shallow excavation.	Fell. Inspect for bats before felling.	0	R	NA	NA
19	Lombardy poplar	Mature	710	1	22	0.5	3	3	3	2	Good	Fair	Small patch of dead bark and early associated decay between buttresses N-NE.	Crown-lift 2.0m.	20-40	C2	8.52	228.1
20	Goat willow	Mature	410 @base	Multi-stemmed	9	1	4	1	5.5	5.5	Good	Fair	Large multi-stemmed tree at base of retaining wall.	Consider coppicing tree before stems collapse.	<10	C1	4.10	52.8
21	Pedunculate oak	Young	210	1	7	1	2	2	4	4.5	Good	Good	Tag no. 1636. No significant defects.	None	>40	B1	2.52	20.0
22	Pedunculate oak	Young	310	1	11	0.5	5.5	4	1	5	Good	Good	No significant defects.	None	>40	B1	3.72	43.5
23	Common lime	Middle age	560	1	16	2	5.5	5	5	5	Good	Good	No significant defects. Growing in small raised bed 0.5m beyond stem edge. Tarmac beyond.	None. Care will be required with hand-removal of tarmac within RPA if retained.	20-40	B1	6.72	141.9
24	Sycamore	Middle age	510	1	12	1.5	5	7	2	7	Poor	Poor	Tag no. 0043. 2 small brackets of the butt decay species *Ganoderma adspersum* at E stem base. Growing close to overhead train electric lines to S. Crown density low with leaf scorching above adjacent fuel oil tank. Previously topped at 4.0m, but has re-grown full crown. Growing in small 1.0x1.0m pit surrounded by concrete slabs with retaining wall 1.0m N and boundary wall 0.5m S.	Fell tree	<10	R	NA	NA

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)				Physiol -ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
							N	E	S	W								
25	Hybrid black poplar	Mature	700*	1	10	0	2.5	2.5	2.5	2.5	Fair	Poor	Access for close inspection not possible due to recent herbicide use. Recently topped tree.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	8.40	221.7
26	Hybrid black poplar	Mature	700*	1	10	0	2.5	2.5	2.5	2.5	Fair	Poor	Access for close inspection not possible due to recent herbicide use. Recently topped tree.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	8.40	221.7
27	Hybrid black poplar	Mature	700*	1	10	0	2.5	2.5	2.5	2.5	Fair	Poor	Access for close inspection not possible due to recent herbicide use. Recently topped tree.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	8.40	221.7
28	Hybrid black poplar	Mature	700* @base	Multi-stemmed	4	0	1	1	1	1	Fair	Very poor	Coppice re-growth from felled tree.	Remove stump.	0	R	NA	NA
29	Hybrid black poplar	Mature	940 @base	1 (low branch)	9	1.5	3	2.5	2.5	3	Fair	Poor	Recently topped at 7m. Level of decay where topped could not be established due to dense growth. Small bark wound at SE stem base.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	9.40	277.6
30	Golden hybrid black poplar	Mature	680	1	7	2	2	2	2.5	2.5	Poor	Poor	Recently topped at 5m. Level of decay where topped could not be established due to dense growth. Dieback of re-growth on N side crown.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	8.16	209.2
31	Hybrid black poplar	Mature	700 @base	Multi-stemmed	3	0	1.5	1.5	1.5	1.5	Fair	Very poor	Coppice re-growth from felled tree.	Remove stump.	0	R	NA	NA
32	Hybrid black poplar	Mature	590	1	10	0	2.5	2.5	2.5	2.5	Fair	Poor	Recently topped at 8m. Level of decay where topped could not be established due to dense growth. Decay established where side branch removed at 7m, but occluding.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	7.08	157.5
33	Golden hybrid black poplar	Mature	680	1	9	2	2.5	2.5	3	2.5	Fair	Poor	Tag no. 0637. Recently topped at 7m. Level of decay where topped could not be established due to dense growth.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	8.16	209.2
34	Hybrid black poplar	Mature	800	1	10.5	0	3.5	4	3.5	4.5	Fair	Poor	Recently topped at 8m. Level of decay where topped could not be established due to dense growth.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	9.60	289.6
35	Golden hybrid black poplar	Mature	500	1	8	2	2	2.5	3	2	Fair	Very poor	Recently topped at 6m. Extensive stem cavity at 2m. Potential for stem collapse (t/R<0.3).	Fell tree	0	R	NA	NA
36	Hybrid black poplar	Mature	760	1	10	0.5	2.5	3	3.5	3	Fair	Poor	Recently topped at 8m. Level of decay where topped could not be established due to dense growth.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	9.12	261.3

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m) N	E	S	W	Physiol-ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
37	Hybrid black poplar	Mature	700* @base	Multi-stemmed	3	0	1.5	1.5	1.5	1.5	Fair	Very poor	Coppice re-growth from felled tree.	Remove stump.	0	R	NA	NA
38	Golden hybrid black poplar	Mature	570	1	7	2	2	3	4	1.5	Fair	Poor	Recently topped at 5m. Level of decay where topped could not be established due to dense growth.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	6.84	147.0
39	Golden hybrid black poplar	Mature	660	1	9	2	3.5	3	2	2.5	Fair	Poor	Recently topped at 7m. Level of decay where topped could not be established due to dense growth.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	7.92	197.1
40	Hybrid black poplar	Mature	1800 @base	Multi-stemmed	11	0	3.5	3.5	4.5	3.5	Fair	Poor	Recently topped at 9m. Level of decay where topped could not be established due to dense growth. Secondary stem previously removed at W stem base. Decay established but not yet significant.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained. Monitor stem cavity.	20-40	C2	15.00	707.0
41	Golden hybrid black poplar	Mature	670	1	10	2	2	3.5	3	2.5	Fair	Poor	Recently topped at 8m. Level of decay where topped could not be established due to dense growth. Stem cavity at 2.5m not yet significant (t/R>0.3), but requires monitoring if retained.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained. Monitor stem cavity.	10-20	C2	8.04	203.1
42	Sycamore	Middle age	300 @base	Multi-stemmed	3.5	0	1.5	1.5	1.5	1.5	Fair	Very poor	Coppice re-growth from felled tree.	Remove stump.	0	R	NA	NA
43	Golden hybrid black poplar	Mature	630	1	8.5	2	3	3	2.5	2.5	Fair	Poor	Recently topped at 4m. Level of decay where topped could not be established due to dense growth.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	7.56	179.6
44	Hybrid black poplar	Young	130	1	8	1.8	2	1.5	1.5	2	Fair	Good	Sucker growing among dense Japanese knotweed.	None	>40	C2	1.56	7.6
45	Hybrid black poplar	Mature	1000 @base	Multi-stemmed	3.5	0	2	2	2	2	Fair	Very poor	Coppice re-growth from felled tree.	Remove stump.	0	R	NA	NA
46	Hybrid black poplar	Mature	940	1	10	0.5	2.5	2.5	4	4	Fair	Poor	Tag no. 0637. Recently topped at 8m. Level of decay where topped could not be established due to dense growth. Crown dieback where topped.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	10-20	C2	11.28	399.8
47	Golden hybrid black poplar	Mature	650	1	9	1.8	3	1.5	2	2.5	Fair	Poor	Recently topped at 6m. Level of decay where topped could not be established due to dense growth. Crown dieback where topped. Slime flux from small stem wound 2.0m SW.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained.	20-40	C2	7.80	191.2

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m) N	E	S	W	Physiol -ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
48	Sycamore	Middle age	240	1	18	0	5	4	2	1.5	Fair	Fair	Heavily crown-lifted tree. Previously suppressed by adjacent felled poplar, leading to open crown.	None	>40	C2	2.88	26.1
49	Hybrid black poplar	Mature	890	1	11.5	0.5	2	2.5	2.5	2.5	Fair	Poor	Recently topped at 8m. Level of decay where topped could not be established due to dense growth.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained. Monitor stem cavity.	20-40	C2	10.68	358.4
50	Golden hybrid black poplar	Mature	670	1	7	2	2.5	2	3	2.5	Fair	Poor	Recently topped at 4.5m. Level of decay where topped could not be established due to dense growth.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained. Monitor stem cavity.	20-40	C2	8.04	203.1
51	Lombardy poplar	Mature	920	1	1	0	0.5	0.5	0.5	0.5	Fair	Very poor	Recently felled tree re-growing from stump.	Remove stump.	0	R	NA	NA
52	Lombardy poplar	Mature	750	1	1	0	0.5	0.5	0.5	0.5	Fair	Very poor	Recently felled tree re-growing from stump.	Remove stump.	0	R	NA	NA
53	Goat willow	Middle age	200* @base	Multi-stemmed	4	0	2	2	2	2	Good	Fair	Growing among dense Japanese knotweed.	None	10-20	C2	2.00	12.6
54	Goat willow	Middle age	200* @base	Multi-stemmed	4	0	2	2	2	2	Good	Fair	Growing among dense Japanese knotweed.	None	10-20	C2	2.00	12.6
55	Hybrid black poplar	Mature	730	1	10	0.5	2	2.5	2.5	2	Fair	Poor	Recently topped at 8m. Level of decay where topped could not be established due to dense growth.	Re-inspect in autumn/winter. Re-pollard on 5 year cycle if retained. Monitor stem cavity	20-40	C2	8.76	241.1
56	Hybrid black poplar	Mature	640	1	22	2	6.5	6.5	5	7.5	Fair	Very poor	Unpollarded tree. Large triangular bark wound 1000x500mm at base. No cavity but significant associated decay. Crown density low with dieback of fine twigs.	Fell tree	0	R	NA	NA
57	Hybrid black poplar	Mature	740	1	21	2	6.5	9	6	8	Fair	Good	Unpollarded tree. No significant defects. Material piled around base.	Carefully remove accumulated material around base.	20-40	B1	8.88	247.8
58	Hybrid black poplar	Middle age	210	1	12	1.5	1	6	1	1	Good	Fair	Suppressed by no. 57, leading to strong stem lean NE.	Consider felling tree to promote adjacent tree.	10-20	C1	2.52	20.0
59	Hybrid black poplar	Middle age	200+180	2	14	0.5	3.5	4	2.5	3.5	Fair	Very poor	Excavation 0.5m deep 1.5m N. This will have cut significant roots and destabilised the tree.	Fell tree	0	R	NA	NA
60	Hybrid black poplar	Middle age	380	1	15	0.5	3.5	3.5	4	4	Good	Good	No significant defects.	Crown-lift 1.5m	20-40	C1	4.56	65.3
61	Sycamore	Middle age	250	1	10	0	2.5	2.5	2.5	2.5	Fair	Fair	Off-site tree growing in adjacent garden. No apparent significant defects.	None	>40	C1	3.00	28.3

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)				Physiol -ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
							N	E	S	W								
62	Ash	Mature	770	1	20	1.5	10.5	8.5	8	8.5	Poor	Fair	Frequent thin strips of dead bark run vertically up stem to half height around entire circumference. Cause not obvious as no obvious canker or *Inonotus* infection. Giant hogweed beneath canopy.	Monitor tree's condition if retained.	10-20	C1	9.24	268.3
63	Horse chestnut	Mature	850	1	16	2.5	8.5	9.5	7	7	Fair	Fair	Tag no. 0603 Triangular bark wounds at stem base -800x250mm NE and700x250mm SW. Both with early associated decay. Air-gun wounding on N lower stem. Heavy horse chestnut leaf miner infection. Giant hogweed beneath canopy.	Monitor tree's condition if retained.	20-40	C1	10.20	326.9
64	London plane	Middle age	500	1	13	1	4.5	5	7.5	5	Good	Good	Low branch obstructing pavement. No significant defects.	Crown-lift 2.0m.	>40	B2	6.00	113.1
65	London plane	Middle age	400+250	2	13	1.8	4.5	3	7.5	3	Good	Good	No significant defects.	None	>40	B2	5.76	104.2
66	London plane	Middle age	300	4	3.5	0	1	1	1	1	Good	Good	Recently felled tree re-growing from stump.	Remove stump.	0	R	NA	NA
67	London plane	Middle age	430	1	14	2	5.5	5	7.5	5	Good	Good	No significant defects.	None	>40	B2	5.16	83.7
68	London plane	Middle age	600	1	15	2	7.5	4	7.5	4	Good	Good	Minor stem rot pocket 1.8m S and 1.5m N occluding.	None	>40	B2	7.20	162.9
69	London plane	Middle age	360	1	16	2.2	7.5	2	7	2	Good	Good	No significant defects.	None	>40	B2	4.32	58.6
70	London plane	Middle age	390	1	17	2.2	8.5	2.5	7.5	2.5	Good	Good	Established decay in main branch at 2.2m will develop to weaken branch. No significant defects.	Remove branch at 2.2m.	>40	B2	4.68	68.8
71	London plane	Middle age	530	1	18	2	8.5	3	8	3	Good	Good	Minor stem rot pocket 1.8m NW occluding. No significant defects.	None	>40	B2	6.36	127.1
72	London plane	Middle age	580	1	19	2	9.5	2.5	8	2.5	Good	Good	No significant defects.	Remove small basal shoot.	>40	B2	6.96	152.2
73	London plane	Middle age	680	1	20	2	8.5	2	9.5	2	Good	Good	No significant defects.	None	>40	B2	8.16	209.2
74	Pedunculate oak	Young	170	1	6.5	0.5	3	1.5	3	2.5	Good	Fair	Minor weak fork with included bark at 3.0m. Wire wrapped around stem.	Remove wire.	>40	C1	2.04	13.1
75	Hybrid black poplar	Middle age	500 @base	Multi-stemmed	0.5	0	0	0	0	0	Fair	Very poor	Recently felled tree re-growing from stump.	Remove stump.	0	R	NA	NA
76	Silver birch	Middle age	250	1	8	1.5	2.5	2.5	2.5	3	Good	Good	No significant defects	None	20-40	C1	3.00	28.3
77	London plane	Middle age	1020 @base	1 (low branch)	17	1	8.5	9.5	10	9.5	Good	Good	Tag no. 0617. Previously topped at 3m. Full crown re-grown. No significant defects.	None	>40	B2	10.20	326.9

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)				Physiol-ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
							N	E	S	W								
78	London plane	Middle age	680	1	18	2.2	9	3.5	7.5	8	Good	Good	No significant defects	None	>40	B2	8.16	209.2
79	Silver maple	Middle age	550	1	18	2.2	10	3.5	7	2	Good	Good	No significant defects	None	20-40	B2	6.60	136.9
80	London plane	Middle age	570 @base	1 (low branch)	18	1	8	2.5	7	2.5	Good	Good	Small rot hole at 2.0m W. No significant defects.	None	>40	B2	5.70	102.1
81	Sycamore	Middle age	470	1	18	0.5	7	2	6	3	Good	Fair	Small rot hole at 1.5m S. No significant defects.	Crown-lift 2.0m.	>40	B2	5.64	99.9
82	London plane	Middle age	680 @base	1 (low branch)	17	1.5	9	6.5	8.5	4.5	Good	Fair	Large 1.5m dead stub 1.5m W with woodpecker holes. No significant defects.	None	>40	B2	6.80	145.3
83	Silver maple	Middle age	650	1	18	0	6.5	5	8.5	4	Good	Good	No significant defects	Remove minor basal shoots.	20-40	B2	7.80	191.2
84	London plane	Middle age	450	1	17	2.5	10	3.5	8.5	2.5	Good	Good	No significant defects	None	>40	B2	5.40	91.6
85	London plane	Middle age	570	1	17	2	7.5	8.5	9	3	Good	Good	No significant defects	None	>40	B2	6.84	147.0
86	London plane	Middle age	670	1	17	2	6	3.5	8	5	Good	Good	Decayed branch stub at 2.0m S. No significant defects.	Remove branch at 2.0m S.	>40	B2	8.04	203.1
87	London plane	Middle age	380	1	16	2	6.5	2.5	7	2.5	Good	Good	No significant defects	None	>40	B2	4.56	65.3
88	London plane	Middle age	540	1	16	3	9	5	7.5	4	Good	Good	No significant defects	None	>40	B2	6.48	131.9
89	Sycamore	Middle age	410	1	15	0	6.5	2.5	8	3	Good	Good	No significant defects	Remove minor basal shoots.	>40	B2	4.92	76.1
90	Purple-leaved sycamore	Middle age	330	1	16	2	5	2	6	3.5	Good	Good	No significant defects	None	>40	B2	3.96	49.3
91	London plane	Middle age	530	1	15	2	7.5	1.5	6.5	4.5	Fair	Poor	Loss of secondary stem has created a deep 1.0x0.3m wound on the NE stem. This is not yet a structural defect, but will become so as decay establishes.	Fell tree	<10	R	NA	NA
92	Sycamore	Middle age	340	1	14	0	6	4.5	5.5	2.5	Very poor	Poor	Crown dead from half height. Strip of dead bark from base over half circumference.	Fell tree	0	R	NA	NA
93	Sycamore	Young	240	1	8	2	2	0.5	2	2	Dead	Dead	Dead tree.	Fell tree	0	R	NA	NA
94	Sycamore	Middle age	400	1	10	0	4	5	5	4.5	Good	Good	Partially occluded bark wound to 2.0m which previously occupied half circumference. Early associated decay. This is not yet a structural defect, but will become so as decay establishes.	Fell tree	<10	R	NA	NA
95	Sycamore	Middle age	330	2	12	0	3	1.5	4	3	Good	Very poor	Tag no. 0602. Weak fork with severe included bark at base.	Fell tree	0	R	NA	NA
96	London plane	Middle age	710	1	16	2.5	8	8	5	7	Good	Fair	Tag no. 0605. Previously topped at 4-5m. Full crown re-grown. No significant defects.	None	<10	R	NA	NA

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m) N	E	S	W	Physiol-ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
97	London plane	Middle age	570	1	16	3	4	5.5	6.5	5	Fair	Fair	Tag no. 0611. Crown density relatively low. Previously topped at 4-5m. Full crown re-grown.	None	>40	B2	6.84	147.0
98	London plane	Middle age	680	1	17	3	8	5.5	7.5	6	Fair	Good	Tag no. 0610. Crown density relatively low. Previously topped at 5-6m. Full crown re-grown.	None	>40	B2	8.16	209.2
99	London plane	Middle age	650	1	18	3.5	8.5	7	8.5	6	Good	Fair	Previously topped at 6-7m. Full crown re-grown. No significant defects.	None	>40	B2	7.80	191.2
100	London plane	Middle age	650	1	18	2	9.5	7	6	6	Good	Fair	Tag no. 0608. Previously topped at 6-7m. Full crown re-grown. Small rot hole 3m N. No significant defects.	None	>40	B2	7.80	191.2
101	London plane	Middle age	580	1	17	2.2	9	6	6.5	5.5	Good	Fair	Tag no. 0607. Previously topped at 5-6m. Full crown re-grown. Small rot hole on stem. No significant defects.	None	>40	B2	6.96	152.2
102	Lawson cypress	Middle age	350*	1	14*	0	3	3	3	3	Good	Good	Off-site tree growing in adjacent garden. No apparent significant defects.	None	>40	C1	4.40	60.8
103	Wild cherry	Middle age	150*	1	8*	2	2	3	3	1	Good	Good	Off-site tree growing in adjacent garden. Tree growing <0.5m from brick boundary wall and likely to damage this as it grows.	None	>40	C1	1.80	10.2
104	Sycamore	Middle age	400*	2	12*	0	3	3	3	3	Good	Good	Off-site tree growing in adjacent garden. No apparent significant defects.	None	>40	C1	4.80	72.4
105	Grey alder	Middle age	300*	1	14*	1	5	3	3	6	Good	Good	Access for close inspection not possible due to steep bank. No apparent defects.	None	20-40	C1	3.60	40.7
106	Pedunculate oak	Middle age	500*	1	14*	2	4	6	6	4	Good	Good	Giant hogweed prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	>40	B1	6.00	113.1
107	Pedunculate oak	Middle age	500*	1	14*	2	5	5	5	5	Good	Good	Giant hogweed prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	>40	B1	6.00	113.1
108	Pedunculate oak	Middle age	530	1	16	2	9	6.5	1	1	Good	Fair	Overgrown and partially suppressed by adjacent oak, leading to irregular crown. Dense ivy on stem.	None	>40	B2	6.36	127.1
109	Pedunculate oak	Middle age	470	1	16	3	8	5	5.5	3.5	Good	Good	Barbed wire ingrown in stem. No significant defects. 'S' painted on stem.	Cut barbed wire where it emerges from stem.	>40	B2	5.64	99.9
110	Pedunculate oak	Middle age	340	1	16	2	1	3	5	2.5	Good	Good	No significant defects.	None	>40	B2	4.08	52.3

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m) N	E	S	W	Physiol -ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
111	Pedunculate oak	Middle age	570	1	18	4	5	6	6	6	Good	Good	No significant defects.	None	>40	B2	6.84	147.0
112	Pedunculate oak	Over-mature	630	1	10.5	2	3.5	5	4	2	Poor	Fair	Stag-headed tree with low crown density. Hollow beneath butt due to rabbit burrowing. Dead bark on root crown and possible butt decay. Cluster of *Armillaria* fruiting bodies on exposed root. High potential for roosting bats.	Investigate the level of root and butt decay if to be retained. Determine the requirement for dead wood removal once layout confirmed.	>40	B3	7.56	179.6
113	Pedunculate oak	Over-mature	990	1	12	2	6	4	6.5	4	Poor	Poor	Veteran tree. Extensive decay and cavities though stem and large branches. Stem previously snapped at 5m Major deadwood in crown. Large triangular bark wound 1.8x0.7m at NW stem base. Many nails. Woodpecker holes and tar run on stem. High potential for roosting bats.	Reduce upper stem to 7m to reduce risk of crown collapse. Carry out aerial inspection of potential decay in crown if retained. Carry out bat inspection before carrying out any work.	>40	A3	11.88	443.4
114	Pedunculate oak	Middle age	490	1	11	1	5	2.5	2.5	2	Poor	Very poor	Extensive dead bark and associated decay on S side to full height. Risk of stem snap.	Consider felling tree to allow the development of tree no. 113.	<10	R	NA	NA
115	Pedunculate oak	Middle age	490	1	10	0.5	6	2	2	4	Good	Good	Multi-stemmed from 2.0m. No significant defects.	None	>40	B1	5.88	108.6
116	Pedunculate oak	Over-mature	1070	1	16	2	7	7	7	6	Poor	Poor	Veteran stag-headed tree. Large strip of dead bark of half circumference to half height on S side. Fire damage on S side. Cracking around branch at 5.0m NE. Loss of major branch on E crown. Large rot holes and major deadwood throughout crown. High potential for roosting bats.	Carry out aerial inspection of potential decay in crown if retained. Carry out bat inspection before carrying out nay work.	>40	A3	12.84	518.0
117	Crack willow	Middle age	200*	2	10*		5*	5*	5*	5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	10-20*	C1*	2.40	18.1
118	Crack willow	Middle age	100*	1	8*		3.5*	3.5*	3.5*	3.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	10-20*	C1*	1.20	4.5

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)				Physiol -ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
							N	E	S	W								
119	Ash	Middle age	350*	1	16*		5*	5*	5*	5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.20	55.4
120	Pedunculate oak	Middle age	450*	1	14*		7*	7*	7*	7*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	5.40	91.6
121	Pedunculate oak	Middle age	350*	2	14*		7*	7*	7*	7*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.20	55.4
122	Pedunculate oak	Middle age	350*	1	14*		7*	7*	7*	7*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.20	55.4
123	Pedunculate oak	Middle age	350*	1	14*		7*	7*	7*	7*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.20	55.4
124	Pedunculate oak	Middle age	350*	1	14*		7*	7*	7*	7*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.20	55.4
125	Pedunculate oak	Middle age	300*	1	12*		4*	4*	4*	4*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	3.60	40.7
126	Pedunculate oak	Middle age	400*	3	14*		7*	7*	7*	7*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.80	72.4
127	Pedunculate oak	Middle age	400*	1	14*		7*	7*	7*	7*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.80	72.4
128	Pedunculate oak	Middle age	400*	1	14*		7*	7*	7*	7*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.80	72.4
129	Crack willow	Middle age	400*	2	15*		7.5*	7.5*	7.5*	7.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	10-20*	C1*	4.80	72.4
130	Pedunculate oak	Middle age	350*	1	14*		3.5*	3.5*	3.5*	3.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.20	55.4
131	Crack willow	Middle age	400*	2	14*		6*	6*	6*	6*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	10-20*	C1*	4.80	72.4

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)				Physiol-ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
							N	E	S	W								
132	Crack willow	Middle age	400*	4	14*		6*	6*	6*	6*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	10-20*	C1*	4.00	50.3
133	Crack willow	Middle age	400*	1	13*		4.5*	4.5*	4.5*	4.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	10-20*	C1*	4.80	72.4
134	Crack willow	Middle age	400*	2	11*		5*	5*	5*	5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	10-20*	C1*	4.00	50.3
135	Crack willow	Middle age	300*	1	13*		3.5*	3.5*	3.5*	3.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	10-20*	C1*	3.60	40.7
136	Crack willow	Middle age	300*	1	13*		3.5*	3.5*	3.5*	3.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	10-20*	C1*	3.60	40.7
137	Crack willow	Mature	1100*	1	24*		10*	10*	10*	10*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	10-20*	C1*	13.20	547.5
138	Wild cherry	Middle age	300*	1	9*		4.5*	4.5*	4.5*	4.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	3.60	40.7
139	Tree of heaven	Middle age	200*	2	9*		3.5*	3.5*	3.5*	3.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	20-40*	C1*	2.00	12.6
140	Sycamore	Middle age	200*	11	7*		4.5*	4.5*	4.5*	4.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter. Consider felling sycamore to favour tree of heaven.	>40*	C1*	2.00	12.6
141	Pedunculate oak	Middle age	490	1	13	2	7	5.5	6.5	6	Poor	Fair	Fire damage on S stem to 2m likely to lead to bark death and decay.	Monitor fire damage.	20-40	C1	5.88	108.6
142	Pedunculate oak	Young	100	1	5	0.5	1.5	1.5	1.5	1.5	Good	Good	No significant defects.	None	>40	C1	1.20	4.5
143	Hawthorn	Middle age	200 @base	Multi-stemmed	4	0	1.5	1.5	1.5	1.5	Very poor	Poor	Crown 90% dead.	Fell tree	0	R	NA	NA
144	Hornbeam	Middle age	400*	1	7	2	4	3.5	3.5	3.5	Good	Good	Growing in grounds of school. No significant defects.	None	>40	B1	4.80	72.4
145	Crack willow	Mature	620+500	Multi-stemmed	12	0	6	6	6	6	Good	Fair	Multi-stemmed tree on stream bank.	Coppice tree within five years to reduce risk of collapse.	10-20	C1	8.20	211.3
146	Crack willow	Middle age	600 @base	Multi-stemmed	12	0	5	5	5	5	Good	Fair	No significant defects.	None	20-40	C1	6.00	113.1
147	Crack willow	Mature	750*	1	6	0	2	2	2	2	Fair	Poor	Stem previously snapped at 2m. Re-growth from stem. Dense brambles prevented close inspection.	Remove snapped top. Retain as deadwood habitat.	10-20	C1	9.00	254.5

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m) N	E	S	W	Physiol -ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
148	Pedunculate oak	Mature	1000*	1	6	0	10	7	1	1	Poor	Very poor	Decayed tree recently collapsed at 2.0m. Partially attached branch at 1.0m the only remaining live growth. Dense brambles prevented close inspection.	Remove snapped top. Retain as deadwood habitat.	10-20	B3	12.00	452.4
149	Crack willow	Middle age	350	1	12	0.5	6.5	3	6	6	Good	Fair	No significant defects.	None	10-20	C1	4.20	55.4
150	Crack willow	Middle age	430	2	12	0	9	6	4	3	Good	Fair	No significant defects.	None	10-20	C1	5.16	83.7
151	Crack willow	Middle age	240+230+200+150+130+110	6	10	0	6.5	6	5	5	Good	Fair	Cluster of stems. No significant defects.	None	10-20	C1	4.80	72.4
152	Crack willow	Middle age	800*	Multi-stemmed	10	0	5	5	5	5	Good	Fair	Multi-stemmed tree growing of stream bank. Close inspection not possible due to giant hogweed.	Coppice tree within five years to reduce risk of collapse.	10-20	C1	9.60	289.6
153	Grey poplar	Middle age	430 @base	1 (low branch)	12	1.5	2	6	6	5.5	Good	Good	No significant defects.	None	>40	B2	4.30	58.1
154	Grey poplar	Middle age	360 @base	1 (low branch)	13	1.5	2	1	5.5	6	Good	Good	Secondary stem previously removed at base. Wound occluding.	None	>40	B2	3.60	40.7
155	Golden honey locust	Young	50	1	4	0.5	0.5	0.5	0.5	1.5	Good	Good	Recently planted tree. Suckers at base.	Remove root suckers. Fell adjacent hawthorn to allow development.	>40	C1	0.60	1.1
156	Goat willow	Middle age	300*	1	4.5	0	4.5	4.5	4.5	4.5	Good	Good	No significant defects.	None	10-20	C1	3.60	40.7
157	Grey poplar	Middle age	310	1	10.5	1	2	2	4.5	5	Good	Good	No significant defects.	None	>40	B2	3.72	43.5
158	Grey poplar	Middle age	390	1	10.5	1.5	7	7	2	4	Good	Poor	Branch at 1.5m SW weakly attached with included bark.	Remove branch at 1.5m SW.	>40	B2	4.68	68.8
159	Golden honey locust	Young	90 @base	1 (low branch)	3	0.5	1.5	1.5	2	1.5	Good	Good	Recently planted tree.	Remove branch stub at 0.5m.	>40	C1	0.90	2.5
160	Grey poplar	Middle age	220	1	10	1.3	0.5	4	4	4.5	Good	Good	No significant defects.	Consider felling to allow the development of adjacent poplar.	>40	C2	2.64	21.9
161	Grey poplar	Middle age	370	1	11	1.5	4	6	2	4.5	Good	Good	No significant defects.	None	>40	B2	4.44	61.9
162	Grey poplar	Middle age	310 @base	1 (low branch)	10	0.5	1.5	5	1	5.5	Good	Good	No significant defects.	Consider felling to allow the development of adjacent poplar.	>40	C2	3.10	30.2
163	Grey poplar	Middle age	270	1	10	2	5.5	5	0.5	4	Good	Good	No significant defects.	Remove branch stubs to 1.5m.	>40	B2	3.24	33.0
164	Italian alder	Young	50	1	2.5	1.5	0	0	0	0	Dead	Dead	Recently planted standard tree. Now dead.	Remove tree	0	R	NA	NA
165	Italian alder	Young	50	1	2.5	1.5	0	0	0	0	Dead	Dead	Recently planted standard tree. Now dead.	Remove tree	0	R	NA	NA
166	Italian alder	Young	50	1	4	1.5	0	0	0	0	Dead	Dead	Recently planted standard tree. Now dead.	Remove tree	0	R	NA	NA
167	Italian alder	Young	50	1	4	1.5	0	0	0	0	Dead	Dead	Recently planted standard tree. Now dead.	Remove tree	0	R	NA	NA
168	Italian alder	Young	50	1	5	1.5	0	0	0	0	Dead	Dead	Recently planted standard tree. Now dead.	Remove tree	0	R	NA	NA

Ref. no.	Species	Age class	Stem diameter @1.5m (mm)	Stem no.	Height (m)	Crown clearance height (m)	Crown spread radius (m) N	E	S	W	Physiological condition	Structural condition	Comments	Preliminary work recommendations	Remaning contribution (yrs)	Category grade	RPA radius (m)	RPA area (m^2)
169	Pyrus calleryana	Young	70	1	6	1.5	1	1	1	1	Good	Good	Redundant stake and tie.	Remove stake and tie	>40	C2	0.84	2.2
170	Italian alder	Young	110	1	7	1.5	2.5	2.5	2.5	2.5	Fair	Fair	Redundant stake and ingrown tie damaging stem.	Remove stake and tie	>40	C2	1.32	5.5
171	Italian alder	Young	50	1	3	1.5	0	0	0	0	Dead	Dead	Recently planted standard tree. Now dead.	Remove tree	0	R	NA	NA
172	Italian alder	Young	50	1	4	1.5	0	0	0	0	Dead	Dead	Recently planted standard tree. Now dead.	Remove tree	0	R	NA	NA
173	Italian alder	Young	60	1	4	1.5	1.5	1.5	1.5	1.5	Good	Good	Redundant stake and tie.	Remove stake and tie	>40	C2	0.72	1.6
174	Italian alder	Young	50	1	3	1.5	0	0	0	0	Dead	Dead	Recently planted standard tree. Now dead.	Remove tree	0	R	NA	NA
175	Italian alder	Young	50	1	4	1.5	0	0	0	0	Dead	Dead	Recently planted standard tree. Now dead.	Remove tree	0	R	NA	NA
176	Italian alder	Young	70	1	5	1.5	1.5	1.5	1.5	1.5	Good	Good	Redundant stake and tie.	Remove stake and tie	>40	C2	0.84	2.2
177	Italian alder	Young	50	1	1.5	1.5	0	0	0	0	Dead	Dead	Recently planted standard tree. Now dead.	Remove tree	0	R	NA	NA
178	Italian alder	Young	50	1	5	1.5	1	1	1	1	Good	Good	Redundant stake and tie.	Remove stake and tie	>40	C2	0.60	1.1
179	Italian alder	Young	50	1	4	1.5	0	0	0	0	Dead	Dead	Recently planted standard tree. Now dead.	Remove tree	0	R	NA	NA
180	Silver birch	Young	50	1	3	1.5	0	0	0	0	Dead	Dead	Recently planted standard tree. Now dead.	Remove tree	0	R	NA	NA
181	Crack willow	Middle age	350*	3	12*		6*	6*	6*	6*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	10-20*	C1*	3.50	38.5
182	Sycamore	Middle age	400*	1	14*		6*	6*	6*	6*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.80	72.4
183	Sycamore	Middle age	300*	1	13*		4.5*	4.5*	4.5*	4.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	C1*	3.60	40.7
184	Sycamore	Middle age	300*	3	13*		6*	6*	6*	6*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	3.00	28.3
185	Sycamore	Middle age	400*	2	11*		5.5*	5.5*	5.5*	5.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.00	50.3
186	Pedunculate oak	Middle age	460 @base	3	10	0	2.5	2.5	4	4	Good	Poor	Twin-stemmed tree with weak main fork with severe included bark.	Fell tree	0	R	NA	NA
187	Pedunculate oak	Middle age	480	1	14	1	8	6	4	6	Good	Good	No significant defects.	None	>40	B2	5.76	104.2
188	Pedunculate oak	Middle age	370	1	14	2	7	6.5	2	5	Good	Good	No significant defects.	None	>40	B2	4.44	61.9
189	Pedunculate oak	Middle age	200	1	10	2.5	3	2	0.5	2	Good	Good	No significant defects.	None	>40	B2	2.40	18.1
190	Crack willow	Middle age	580 @base	Multi-stemmed	14	0	7	2	6	5	Good	Poor	E branch decayed and collapsed.	Coppice tree within five years to reduce risk of collapse.	10-20	C	5.80	105.7
191	Sycamore	Middle age	390	1	14	0.1	5	6	3	1	Good	Good	No significant defects.	Remove minor branch at 0.1m with bark browsing.	>40	B1	4.68	68.8

Ref. no.	Species	Age class	Stem diameter @1.5m (mm)	Stem no.	Height (m)	Crown clearance height (m)	Crown spread radius (m)				Physiological condition	Structural condition	Comments	Preliminary work recommendations	Remaning contribution (yrs)	Category grade	RPA radius (m)	RPA area (m^2)
							N	E	S	W								
192	Pedunculate oak	Middle age	290	1	11	1	6	4.5	5	5	Good	Good	No significant defects.	None	>40	B1	3.48	38.1
193	Ash	Mature	670	1	12	2.5	8	4	9	9	Good	Good	No significant defects.	None	20-40	B1	8.04	203.1
194	Ash	Middle age	570 @base	2	10	0.5	6	8	1	0	Good	Poor	Weak fork with severe included bark at base.	Fell tree	<10	R	NA	NA
195	Pedunculate oak	Middle age	400*	1	12*		7*	7*	7*	7*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.80	72.4
196	Sycamore	Middle age	300*	1	9*		3*	3*	3*	3*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	C1*	3.60	40.7
197	Sycamore	Middle age	400*	3	13*		5.5*	5.5*	5.5*	5.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.00	50.3
198	Sycamore	Middle age	350*	1	13*		3.5*	3.5*	3.5*	3.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	C1*	4.20	55.4
199	Sycamore	Middle age	500*	1	13*		4*	4*	4*	4*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	C1*	6.00	113.1
200	Pedunculate oak	Middle age	350*	1	11*		4*	4*	4*	4*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	C1*	4.20	55.4
201	Pedunculate oak	Middle age	600*	1	15*		8*	8*	8*	8*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	7.20	162.9
202	Silver birch	Middle age	200*	1	10*		3.5*	3.5*	3.5*	3.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	20-40*	C1*	2.40	18.1
203	Pedunculate oak	Middle age	400*	1	10*		6*	6*	6*	6*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.80	72.4
204	Pedunculate oak	Middle age	400*	1	12*		5.5*	5.5*	5.5*	5.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.80	72.4
205	Sycamore	Middle age	400*	Multi-stemmed	9*		4*	4*	4*	4*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	C1*	4.00	50.3
206	White willow	Mature	600*	1	14*		7*	7*	7*	7*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	20-40*	C1*	7.20	162.9

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)				Physiol -ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
							N	E	S	W								
207	Pedunculate oak	Middle age	450*	2	12*		6*	6*	6*	6*	Poor*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	C1*	4.50	63.6
208	Pedunculate oak	Mature	800*	1	15*		7.5*	7.5*	7.5*	7.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	9.60	289.6
209	Pedunculate oak	Middle age	600*	1	15*		7.5*	7.5*	7.5*	7.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	7.20	162.9
210	Pedunculate oak	Middle age	600*	1	12*		7.5*	7.5*	7.5*	7.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	7.20	162.9
211	Ash	Middle age	400*	1	12*		4.5*	4.5*	4.5*	4.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.80	72.4
212	Ash	Middle age	500*	1	16*		7*	7*	7*	7*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	6.00	113.1
213	Ash	Middle age	350*	3	16*		7*	7*	7*	7*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	3.50	38.5
214	Ash	Middle age	400*	5	16*		7.5*	7.5*	7.5*	7.5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect autumn/winter.	>40*	B1*	4.00	50.3

* - Attribute or dimension determined at distance dues to restricted access

Tree / Shrub Groups and Hedgerows

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)	Physiol -ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
G1	Hybrid black poplar†, sycamore, pedunculate oak, hawthorn	Mature/ middle-age	100-750	1/ Multi-stemmed	6-22	0+	2-8	Good	Fair/ poor	Linear group of planted pollarded mature poplars and middle-age naturally regenerated trees. Assessed at distance as located behind sheet metal fence with no access.	Reinspect when access can be gained. Re-pollard topped trees on 5 year cycle if retained.	>40	C2	Crown spread	
G2	Goat willow, hawthorn, buddleia, osier, elder	Mature/ middle-age	NA	Multi-stemmed	3-8	0+	1-4	Good	Good	Dense scrub between chain-link and sheet metal fence. Japanese knotweed present.	Eradicate Japanese knotweed.	20-40	C2	Crown spread	
G3	Goat willow†, hawthorn, Swedish whitebeam, buddleia, oak	Mature/ middle-age	100-300 @base	Multi-stemmed	5-9	0+	1-3.5	Good/ fair	Good/ fair	Tag no. 1631. Scrub between chain-link and sheet metal fence.	Cut stems growing through chain-link fence.	>40	C2	Crown spread	
G4	Hawthorn, oak, ash, sycamore, buddleia, dog rose	Middle-age/ young	100-300 @base	Multi-stemmed	4-7	0+	1-2.5	Good	Good	Scattered scrub with bramble between chain-link and sheet metal fence.	None	>40	C2	Crown spread	
G5	Ash	Young	50-250 @base	Multi-stemmed	3-6	0+	0.5-2	Good	Poor	Previously coppiced trees growing at base of retaining wall. Weak forks with included bark.	Fell trees.	<10	R	None	
G6	English elm†, pedunculate oak	Young	50-150 @base	Multi-stemmed	2-6	0+	0.5-2	Good/ poor	Fair/ poor	Previously coppiced trees growing at base of retaining wall. Elm suffering from Dutch elm disease.	Fell all elms and other trees within 0.5m of retaining wall.	20-40	C2	Crown spread	
G7	Ash, goat willow	Middle-age/ young	100-370 @base	Multi-stemmed	6-12	0+	1-4.5	Good	Fair	None	Single ash and coppice willow.	20-40	C2	Crown spread	
G8	Goat willow†, ash, silver birch, hawthorn, grey willow	Mature/ middle-age	100-500 @base	1/ Multi-stemmed	6-12	0+	2-5	Good	Good/ fair	Scrub growing between concrete wall and sheet metal fence.	None	20-40	C2	Crown spread	
G9	Goat willow†, pedunculate oak, grey willow, elder	Mature/ middle-age	100-400 @base	Multi-stemmed	6-10	0+	1-4	Good	Good/ fair	Tag no. 1740. Scrub growing between concrete wall and sheet metal fence.	None	20-40	C2	Crown spread	
G10	Hawthorn†, dog rose	Middle-age	50-150 @base	Multi-stemmed	4-6	0+	1-3	Good	Fair	Short line of linear scrub	None	20-40	C2	Crown spread	
G11	Goat willow	Middle-age	100-250 @base	Multi-stemmed	6-7	0+	1-4	Good	Fair	Short line of linear scrub	None	20-40	C2	Crown spread	
G12	goat willow†, hawthorn, grey willow	Mature/ middle-age	100 @base	Multi-stemmed	8-10	0+	1-5	Good	Good/ fair	Scrub between chain-link and sheet metal fence.	Cut stems growing through chain-link fence.	20-40	C2	Crown spread	
G13	Pedunculate oak†, grey willow*, goat willow, hawthorn, buddleia, elder	Mature/ middle-age	100-300 @base	1/ Multi-stemmed	4-9	0+	2-5	Good	Good/ fair	Tag no. 1728. Patch of scrub growing partially on rubble piles. Giant hogweed present.	Single all oaks and re-space to 2m centres. Control giant hogweed.	>40	B2	Crown spread	

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)	Physiol-ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
G14	Buddleia	Mature	NA	Multi-stemmed	3-4	0+	1-2	Fair	Good	Naturally regenerated scrub on railway land.	None	20-40	C2	Crown spread	
G15	Buddleia	Mature	NA	Multi-stemmed	3-6	0+	1-2	Fair	Good	Naturally regenerated scrub on railway land.	None	20-40	C2	Crown spread	
G16	Buddleia	Mature	NA	Multi-stemmed	4	0+	1-2	Fair	Good	Naturally regenerated scrub	None	20-40	C2	Crown spread	
G17	Buddleia†, sycamore, goat willow, silver birch	Mature	NA	Multi-stemmed	4-7	0+	1-2	Fair	Good	Naturally regenerated scrub on area surrounding former gas tower.	None	20-40	C2	Crown spread	
G18	Buddleia†, sycamore, hawthorn	Mature/ middle-age	NA	Multi-stemmed	4-7	0+	1-2	Fair	Good	Naturally regenerated scrub on area surrounding former gas tower.	None	20-40	C2	Crown spread	
G19	Buddleia†, silver birch	Mature/ young	NA	Multi-stemmed	4-7	0+	1-2	Fair	Good	Within active gas works area beyond site boundary. Naturally regenerated scrub.	None	20-40	C2	Crown spread	
G20	Silver birch†, buddleia	Mature/ young	NA	Multi-stemmed	5-7	0+	1-2	Fair	Good	Within active gas works area beyond site boundary. Naturally regenerated scrub.	None	20-40	C2	Crown spread	
G21	Pedunculate oak, silver birch	Middle-age/ young	10-25	1	5-9	0.5+	1-4	Good	Good/ poor	Within active gas works area beyond site boundary. Roots of trees at W end partially damaged by recent works.	Inspect rooting of W trees.	>40	C2	Crown spread	
G22	Pedunculate oak, silver birch, rowan	Young	100-150	1	5-7	0.5+	1-3	Good	Good	Within active gas works area beyond site boundary. No significant defects	None	>40	C2	Crown spread	
G23	Hybrid black poplar		750	1	10	1	2.5	Fair	Poor	Linear group of planted pollarded mature poplars. Assessed at distance as located behind building with no access.	Reinspect when access can be gained. Re-pollard on 5 year cycle if retained.	20-40	C2	Crown spread	
G24	Hawthorn, goat willow	Mature	300* @base	Multi-stemmed	8	0	1-3	Poor	Poor	Crown dieback and low crown density. Surrounded by recently sprayed Japanese knotweed.	Fell trees		R	None	
G25	Silver birch	Young	70-120	1	8	1	1-3	Fair	Poor	Group of 3 stems. Roots bulldozed on S side close to stems. Stem bark wounds. Surrounded by recently sprayed Japanese knotweed.	Fell trees	0	R	None	
G26	Silver birch, pedunculate oak, hybrid black poplar, elder	Middle-age/ young	50-140	1/ Multi-stemmed	5-8	0+	1-1.5	Good/ poor	Good/ poor	Small group of trees and scrub. Oak suffering crown dieback.	None	>40	C2	Crown spread	
G27	Sycamore†, wild cherry, elder	Young	NA	Multi-stemmed	0.5-1.5	0+	0.5-1.5	Fair	Fair	Coppice regrowth from previously felled trees along base of boundary wall.	Remove trees	0	R	None	
G28	Wild cherry†,, sycamore, rowan, elder	Young	<50 @base	Multi-stemmed	0.5	0+	<0.5	Fair	Fair	Dense sucker regrowth from previously felled trees.	None	>40	C2	Crown spread	

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)	Physiol -ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
G29	Sycamore†, wild cherry, elder	Young	<100 @base	Multi-stemmed	2-3	0+	0.5-1.5	Fair	Fair	Coppice regrowth from previously felled trees along base of boundary walls.	Remove trees	0	R	None	
G30	Hybrid black poplar†, sycamore	Young	50-180	1	6-10	0.5+	01/02/2005	Good	Good	Small group of suckers and naturally regenerated trees growing on cinder pile.	Remove pushed over stem.	>40	C2	Crown spread	
G31	Sycamore†, hawthorn	Young	50-150	Multi-stemmed	3-5	0+	0.5-2	Fair	Fair	Naturally regenerated trees and scrub beneath London plane row. Detract from the formal row.	Remove trees	<10	R	None	
G32	Silver birch†, sycamore, goat willow	Middle-age	100-200	1/MS	8-12	0+	2-7	Good	Good	No significant defects	Fell sycamore growing beneath plane trees	20-40	C2(/R)	Crown spread	
G33	Goat willow, sycamore, hawthorn, elder	Middle-age	150-370 @base	Multi-stemmed	8-12	0+	2-5	Good	Fair/ poor	1 no. twin-stemmed sycamore with weak fork with included bark.	Single multi-stemmed sycamore to best stem. Fell twin-stemmed sycamore adjacent to gate.	20-40	C2(/R)	Crown spread	
G34	Sycamore†, horse chestnut	Middle-age/ young	140-320	1	7-12	0.5+	2-5.5	Good	Good/ poor	1 no. twin-stemmed sycamore with weak fork with included bark. Several trees very close to security fence.	Fell twin-stemmed sycamore adjacent to gate. Fell trees <1.0m from fence if fence retained.	>40	C2(/R)	Crown spread	
G35	False acacia†, English elm, hybrid black poplar, hawthorn, rowan, apple, elder, hazel, dogwood, dog rose	Middle-age	50-290 @base	1/ Multi-stemmed	6-12	0+	1-5	Good	Good/ fair	Planted group on bank from railway to stream and flood channel. Screening value for road and railway. Young elms dying from Dutch elm disease. Giant hemlock present. Overhead power line.	Fell dead/dying elm. Control giant hogweed.	>40	B2	Crown spread	
G36	Wild cherry†, field maple†, Scots pine, pedunculate oak, hawthorn, rowan, cherry laurel, hazel, geulder rose	Young	50-150 @base	1/ Multi-stemmed	4-10	0+	1-3	Good	Good/ fair	Planted group on bank between highway bridge and flood channel. Screening value for road. Giant hemlock present.	Thin dense stand 35%. Control giant hogweed.	>40	B2	Crown spread	
G37	Wild cherry, Norway maple, pedunculate oak	Young	90-100	1	4-6	0+	1.5-2.5	Good	Good	Scattered group of 4 no. young planted trees on bank.	Crown-lift all 1.0m and single cherry to best stem.	>40	C2	Crown spread	
G38	Field maple, elder, blackthorn	Young	150 @base	Multi-stemmed	4-5	0+	1.5-2.5	Good	Good	Scattered group on with bramble Giant hemlock present.	Thin dense stand 35%. Control giant hogweed.	>40	C2	Crown spread	
G39	Common alder†, Italian alder, grey alder, silver birch, false acacia, field maple, rowan, geulder rose, elder	Middle-age/ young	50-200 @base	1/MS	3-12	0+	1-4	Good/ poor	Good/ fair	Dense linear group lining flood channel. Steep bank.	None	>40	B2	Crown spread	
G40	Hawthorn†, bullace†, elder†, crack willow, pedunculate oak	Middle-age/ mature	50-600 @base	Multi-stemmed	4-12	0+	1-7	Good/ fair	Good/ fair	Dense scrub. Willow scattered along stream. Dense growth of giant hogweed, with Himalayan balsam along stream. Coppiced to 2-4m beneath overhead lines.	Control giant hogweed. Consider coppicing coupes on a rotational basis once hogweed controlled.	>40	B2	Crown spread	

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)	Physiol-ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
G41	Pedunculate oak†, hawthorn, bullace, blackthorn, elder, apple, dog rose	Middle-age	280-780	1/ Multi-stemmed	6-16	2	2-7	Fair	Fair	Small woodland area with approximately 15 no. late mature oak. Oak adjacent to overhead lines with large triangular wound 2x0.7m at base and associated decay. Twin-stemmed tree with split stem at 3m. Ingrown barbed wire on some trees. Some potential for bats in splits and small rot holes.	Pollard wounded tree adjacent to lines to 3.5m. Reduce split stem on twin-stemmed tree by 50%. Cut all ingrown barbed wire at bark surface. Produce topographical survey of individual trees and assess individually if development proposed in vicinity. Survey for bats before carrying out work.	>40	B2	Crown spread	
G42	Pedunculate oak†, blackthorn, elder	Middle-age	300-380	1	4-12	3	2-6	Good	Fair	4 no. oak dense group. I no. tree near overhead line has extensive stem decay. Ingrown barbed wire.	Fell decayed tree. Cut all ingrown barbed wire at bark surface. Produce topographical survey of individual trees and assess individually if development proposed in vicinity. Survey for bats before carrying out work.	>40	B2/R	Crown spread	
G43	Crack willow†, hawthorn†, blackthorn*, pedunculate oak, elder	Middle-age/ mature	50-500 @base	Multi-stemmed	5-12	0+	1-5	Good	Good/ poor	Dense scrub. Collapsed willow beside stream.	Coppice collapsed willow. Consider coppicing coupes on a rotational basis once hogweed controlled.	>40	B2	Crown spread	
G44	Pedunculate oak†, English elm, ash, hawthorn, apple	Middle-age/ mature/ over-mature	50-1240	1/ Multi-stemmed	6-18	0+	1-8	Good/ fair	Good/ poor	Includes mature and over-mature oak and ash on line of overgrown hedgerow. Mature and over-mature trees with decay, cavities and high potential for bats.	Produce topographical survey of individual trees and assess individually if development proposed in vicinity. Survey for bats before carrying out work.	>40	A3	Crown spread	
G45	Pedunculate oak†, crack willow, blackthorn, hawthorn, dog rose	Middle-age	5-300	1/MS	3-10	0+	1-5	Good	Good	Overgrown hedgerow.	None	>40	B2	Crown spread	
G46	Crack willow†, hawthorn, elder	Middle-age/ mature	50-600 @base	Multi-stemmed	4-12	0+	1-7	Good	Fair	Dense scrub with willow along stream. Part-surveyed due to dense vegetation. Dense giant hogweed.	Control giant hogweed. Consider coppicing coupes on a rotational basis once hogweed controlled.	>40*	B2	Crown spread	
G47	Pedunculate oak†, sycamore, silver birch, hawthorn, goat willow, elder, dog rose	Mature/ middle-age	100-300* @base	1/ Multi-stemmed	4-9*	0+	2-5*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	>40*	B2*	Crown spread	
G48	Crack willow, goat willow, hawthorn	Middle-age		Multi-stemmed	6-8*	0+	1-4*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	20-40*	C2*	Crown spread	
G49	Crack willow†, sycamore hawthorn	Middle-age/ young	50-200 @base	Multi-stemmed	2-8	0+	1-4*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	>40*	C2	Crown spread	

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)	Physiol-ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
G50	Ash†, goat willow, hawthorn	Young/ middle-age	50-150 @base	Multi-stemmed	6	0+	1-3*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	>40*	C2	Crown spread	
G51	Goat willow	Middle-age	200* @base	Multi-stemmed	8	0+	1-4*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	10-20	C2	Crown spread	
G52	Buddleia	Mature	NA	Multi-stemmed	4	0+	1-2*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	10-20	C2	Crown spread	
G53	Silver birch†, buddleia†, hawthorn†, pedunculate oak, tree of heaven, crack willow, blackthorn	Young/ middle-age	50-150*	1/ Multi-stemmed	4-10	0+	1-3*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	>40*	B2	Crown spread	
G54	Crack willow	Middle-age/ young	100-420	Multi-stemmed	3-10	0+	1-6	Good	Fair	Scattered scrub with bramble.	Coppice cracked willow.	20-40	C2	Crown spread	
G55	Blackthorn	Mature	NA	Multi-stemmed	5	0+	NA	Good	Good	Dense scrub.	None	>40	C2	Crown spread	
G56	Blackthorn	Mature	NA	Multi-stemmed	5	0+	NA	Good	Good	Dense scrub.	None	>40	C2	Crown spread	
G57	Blackthorn	Mature	NA	Multi-stemmed	5	0+	NA	Good	Good	Dense scrub.	None	>40	C2	Crown spread	
G58	Hawthorn†, apple, elder	Middle-age	100-300 @base	Multi-stemmed	4-6	0+	1-3	Good	Good	Scattered scrub	None	>40	C2	Crown spread	
G59	Goat willow	Middle-age	50-150*	Multi-stemmed	6	0+	1-3*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	20-40*	C2	Crown spread	
G60	Goat willow†, sycamore, hawthorn, elder	Middle-age	50-150*	Multi-stemmed	4-8	0+	1-4*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	>40*	C2	Crown spread	
G61	Pedunculate oak†, silver birch†, hawthorn, elder, goat willow	Young/ middle-age	50-300	1/ Multi-stemmed	4-10	0+	1-4	Good/ fair	Good/ fair	Scrub with frequent young oak. Stand of partially sprayed Japanese knotweed	Continue Japanese knotweed control.	>40	B2	Crown spread	
G62	Hawthorn†, pedunculate oak	Young/ middle-age	50-200	1/ Multi-stemmed	6-8	0+	0.5-2	Good	Good	Dense thorn scrub with scattered young oak.	None	>40	C2	Crown spread	
G63	Hawthorn†, pedunculate oak, elder	Middle-age/ young	50-150*	Multi-stemmed	6-10	0+	1-4*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	>40*	C2	Crown spread	
G64	Silver birch†, goat willow†, blackthorn†, elder†, crack willow, hawthorn	Middle-age/ young	50-150*	Multi-stemmed	6-8	0+	1-4*	Good*	Fair*	Vegetation prevented close inspection. No apparent significant defects.	Re-inspect in autumn/winter	>40*	B2	Crown spread	

Ref. no.	Species	Age class	Stem diam-eter @1.5m (mm)	Stem no.	Height (m)	Crown clear-ance height (m)	Crown spread radius (m)	Physiol -ogical cond-tion	Struct-ural cond-ition	Comments	Preliminary work recommendations	Rema-ning contri-bution (yrs)	Categ-ory grade	RPA radius (m)	RPA area (m^2)
G65	Blackthorn	Mature	NA	Multi-stemmed	5	0+	NA	Good*	Fair*	Dense scrub.	None	>40*	C2	Crown spread	

† - Dominant species within group
* - Attribute or dimension determined at distance dues to restricted access

APPENDIX B - TREE QUALITY AND VALUE ASSESSMENT CATEGORIES

Table B1. From BS5837:2005, Table 1 – 'Cascade chart for tree quality assessment'.

<table>
<tr><td colspan="5">TREES FOR REMOVAL</td></tr>
<tr><td>Category and definition</td><td colspan="3">Criteria</td><td>Plan colour</td></tr>
<tr><td><u>Category R</u>
Those in such a condition that any existing value would be lost within 10 years and which should, in the current context, be removed for reasons of sound arboricultural management.</td><td colspan="3">• Trees that have a serious, irreversible, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other R category tree (ie: where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning)
• Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline
• Trees infected with pathogens of significance to the health and/or safety of other trees (eg: Dutch elm disease) or very low quality trees suppressing adjacent trees if better quality
• NB: Habitat reinstatement may be appropriate (eg: R category tree used as a bat roost: installation of bat box in nearby tree).</td><td>Dark red</td></tr>
<tr><td colspan="5">TREES TO BE CONSIDERED FOR RETENTION</td></tr>
<tr><td rowspan="2">Category and definition</td><td colspan="3">Criteria - Subcategories</td><td rowspan="2">Plan colour</td></tr>
<tr><td>1. Mainly arboricultural values</td><td>2. Mainly landscape values</td><td>3. Mainly cultural values, including conservation</td></tr>
<tr><td><u>Category A</u>
Those of high quality and value: in such a condition as to be able to make a substantial contribution (a minimum of 40 years is suggested).</td><td>Trees that are particularly good examples of their species, especially if rare or unusual, or essential components of groups, or of formal or semi-formal arboricultural features (eg: the dominant and/or principal trees within an avenue).</td><td>Trees, groups or woodlands which provide a definite screening or softening effect to the locality in relation to views into or out of the site, or those of particular visual importance (eg: avenues or other arboricultural features assessed as groups).</td><td>Trees, groups or woodlands of significant conservation, historical, commemorative or other value (eg: veteran trees or wood-pasture).</td><td>Light green</td></tr>
<tr><td><u>Category B</u>
Those of moderate quality and value: in such a condition as to make a significant contribution (a minimum of 20 years is suggested).</td><td>Trees that might be included in the high category, but are downgraded because of impaired condition (eg: presence of remedial defects including unsympathetic past management and minor storm damage).</td><td>Trees present in numbers, usually as groups or woodlands, such that they form distinct landscape features, thereby attracting a higher collective rating than they might as individuals but which are not, individually, essential components of formal or semi-formal arboricultural features (eg: trees of moderate quality within an avenue that include better, A category specimens), or trees situated mainly internally to the site, therefore individually having little visual impact on the wider locality.</td><td>Trees with clearly identifiable conservation or other cultural benefits.</td><td>Mid blue</td></tr>
<tr><td rowspan="2"><u>Category C</u>
Those of low quality and value: currently in adequate condition to remain until new planting could be established (a minimum of 10 years is suggested), or young trees with a stem diameter below 150mm.</td><td>Trees not qualifying in higher categories.</td><td>Trees present in groups or woodlands, but without this conferring on them significantly greater landscape value, and/or trees offering low or only temporary screening benefit.</td><td>Trees with very limited conservation or other cultural benefits.</td><td rowspan="2">Grey</td></tr>
<tr><td colspan="3">NB: Whilst C category trees will usually not be retained where they impose a significant constraint on development, young trees with a stem diameter of less than 150mm should be considered for relocation.</td></tr>
</table>

APPENDIX C – SPECIES LIST AND POTENTIAL TREE HEIGHT

*Table C1. Potential ultimate height for tree and shrub species and cultivars on the Southall Gas Works site, taken from More and White (2003). This was reduced for some species (indicated by *), where the average mature height for similar sites in the London area is less than that given by More and White.*

Species	Common name	Potential height (m)
Acer campestre	field maple	14
Acer pseudoplatanus	Norway maple	25
Acer platanoides	sycamore	30*
Acer pseudoplatanus 'Atropurpureum'	sycamore (purple under-leaf)	25
Acer saccharinum	silver maple	30
Aesculus hippocastanum	horse chestnut	30*
Ailanthus altissima	tree of heaven	30
Alnus cordata	Italian alder	30
Alnus glutinosa	common alder	25
Alnus incana	grey alder	22
Betula pendula	silver birch	25
Buddleia davidii	buddleia	6
Carpinus betulus	hornbeam	20
Chaemycyparis lawsoniana	Lawson cypress	30*
Corylus avellana	hazel	10*
Crataegus monogyna	hawthorn	15
Fraxinus excelsior	ash	30
Gleditsia triacanthos 'Sunburst'	golden honey locust	18
Malus domestica	apple (wilding)	10
Pinus sylvestris	Scots pine	25*
Platanus x hispanica	London plane	35
Populus x canadensis	hybrid black poplar	35
Populus x canadensis 'Serotina Aurea'	golden hybrid black poplar	25
Populus x canescens	grey poplar	25
Populus nigra 'Italica'	Lombardy poplar	30
Prunus avium	wild cherry	25
Prunus institia	bullace	10
Prunus laurocerasus	cherry laurel	6
Prunus spinosa	blackthorn	7
Pyrus calleryana	an ornamental pear	14
Quercus robur	pedunculate oak	25
Robinia pseudoacacia	false acacia	25
Rosa canina	dog rose	4
Salix alba	white willow	25
Salix caprea	goat willow	10
Salix cinerea	grey willow	7
Salix fragilis	crack willow	25
Salix viminalis	osier	7
Sorbus aucuparia	rowan	15
Sorbus intermedia	Swedish whitebeam	15
Tilia x europaea	common lime	35*
Ulmus procera	English elm	10*
Viburnum opulus	geulder rose	6

APPENDIX E - PHOTOGRAPHS

Fig. 1. Tree 01, a mature hybrid black poplar, viewed from the canal towpath to the south.

Fig. 2. Group G01, mature hybrid black poplar and goat willow with middle-age birch and sycamore, viewed from the south.

Fig. 3. Trees 04-19, mature Lombardy poplars, viewed from car-parking area to the south-east.

Fig. 4. Trees 04-19, mature Lombardy poplars and canal-side tree and scrub groups, viewed from the towpath to the north.

Fig. 5. Trees 29-33, pollarded mature hybrid black poplars close to the northern boundary, viewed from the south.

Fig. 6. Trees 56-60, mature hybrid black poplars, viewed from the west.

Fig. 7. Trees 64 and 65, late middle-age London planes, viewed from The Straight to the east.

Fig. 8. Tree 66 and 73, late middle-age London planes, viewed from The Straight to the west.

Fig. 9. Tree 23, late middle-age common lime, viewed from the north.

Fig. 10. Trees and scrub within Minet Country Park, viewed from across canal to the east.

APPENDIX F - TREE CONSTRAINTS PLAN

APPENDIX G - REPORT CONDITIONS

WHITE YOUNG GREEN ENVIRONMENTAL LTD

Southall Gas Works, Southall, London – Arboricultural Survey Report

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This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYGE. In time improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of WYGE using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to WYGE by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

Whilst skill and care have been used, no investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather related conditions.

Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the representativeness of data used by the model and the assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions.

The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYGE accept no liability for issues with performance arising from such factors

September 2007

White Young Green

River Corridor Survey

Yeading Brook, West Southall

thinking beyond construction

RIVER CORRIDOR SURVEY

OF

YEADING BROOK, WEST SOUTHALL

FOR

NATIONAL GRID PROPERTY

Reference: E00357-7 WestSouthall RCS				
Issue		Prepared by:	Reviewed by:	Verified by:
v1	**Feb 06**	**EMMA TOOVEY SENIOR ECOLOGIST**	**RICHARD ANDREWS PRINCIPAL ECOLOGIST**	**JOE ATTWOOD ASSOCIATE**
File Ref: H:\Data\Projects\E00001 - E01000\E00357 Southall Gasworks\4004\E00357\Ecology from 2007\E00357-7 WestSouthall RCS.doc				
White Young Green Environmental Sunley House, Bedford Park, Croydon, Surrey, CR0 2AP ***Telephone: 020 8649 6600 Facsimile: 020 8649 6629 E-Mail: enviro.london@wyg.com***				

CONTENTS

1.0 INTRODUCTION

WYGE undertook a River Corridor Survey of the Yeading Brook (Minet Park section) in December 2005 and of the downstream section of the storm drain in January 2006. Whilst it is recognised that winter is not an ideal time of year for such surveys, dominant plant species, vegetation structure and physical habitat features were identifiable, and therefore the surveys are considered adequate for assessing the habitat quality of the river corridor.

The results of the survey are presented in the sketch-maps ECO 100 and ECO 101. A description of each river's habitats in each lateral zone is provided below, followed by an evaluation of their habitat quality.

1.1 Site description

To the west of the main West Southall site lies the Minet Country Park, which is owned and managed by the London Borough of Hillingdon. There are three watercourses to the west of the main site: the Grand Union Canal, the Yeading Brook and a storm drain. The land that is situated between the Grand Union Canal and the Yeading Brook, referred to as the Minet Tip, is owned and managed by British Waterways. Although these features and land uses are primarily beyond the boundaries of the development area, they do form part of the overall development 'footprint' where the proposed access roads to the west of the site traverse these areas of interest.

1.2 Methodology

This survey is based on the Environment Agency's (2003) River Habitat Survey methodology.

1.3 Report conditions

For a detailed review of the extent and limitations of this report, attention is drawn to the report conditions in Appendix A.

2.0 THE YEADING BROOK

2.1 The aquatic zone

The channel consisted of a approximately 60cm water depth on the day of survey. Flow patterns generally consisted of smooth laminar flow with infrequent slack areas and limited faster runs where the river had been narrowed by silt and vegetation encroachment. The bed substrate was primarily silt apart from some minor exposures of gravel in the upstream section where flow was faster. The features of greatest nature conservation interest consisted of side and mid-channel vegetated silt-bars which had been colonised primarily by branched bur-reed (*Sparganum erectum*). A few poorly developed pools and riffles were evident in the upper reach, but otherwise depths were relatively uniform. Apart from the stands of bur-reed, the other dominant channel vegetation consisted of fennel-leaved pondweed (*Potamogeton pectinalis*) and algae.

Fly tipping, including dumped car tyres and burnt out cars, was frequent throughout the reach and significantly detracts from the quality of the aquatic zone.

2.2 The Marginal Zone

The banks along most of the brook are relatively steep, and it is likely that the river has been over-deepened in the past for land drainage purposes. This, combined with extensive shading by trees, particularly in the lower half of the survey reach, limits the extent of marginal growth. However, there are significant areas of silt deposition along the river margins in places, and these are being colonised and consolidated by emergent vegetation, particularly branched bur-reed as mentioned above. This is more prevalent where the river is less shaded by bank-top trees.

There is also a small, damp ditch which enters from the right bank, downstream of the footbridge, and this has a greater variety of wetland/marginal plants such as greater reedmace (*Typha latifolia*), gipsywort (*Lycopus europaeus*), and fool's watercress (*Apium nodiflorum*).

2.3 The bank zone

The banks and bank-tops of the Yeading Brook are dominated by trees including crack willow (*Salix fragilis*), pedunculate oak (*Quercus robur*) and ash (*Fraxinus excelsior*). Scrub speices include bramble (*Rubus fruiticosus* agg.) and blackthorn (*Prunus spinosa*), while tall ruderal speices include stinging nettles (*Urtica dioica*) and docks (*Rumex* spp), interspersed with false oak grass (*Arrhenatherum elatius*). This mixed community gives the banktop vegetation a 'complex' structure (Environment Agency, 2003). The left bank (canal side) is more wooded than the right.

The variety of banktop habitats provides a valuable ecological asset. in terms of shelter, nesting opportunity, food sources, and commuting/dispersal routes. This is further reinforced by its relative seclusion: the presence of dense patches of thorn scrub and nettles are presumably a deterrent to human activity along the banktop and reduce the impacts of disturbance.

The bank zone is however suffering in many places from infestation by a number of invasive, non-native plants including giant hogweed (*Heracleum mantegazzianum*), Himalayan balsam (*Impatiens glandulifera*) and Japanese knotweed (*Fallopia japonica*). All are notoriously difficult to control. They are very effective at spreading and out-competing other plants, casusing a reduction in native riverine species diversity. In addition giant hogweed presents a potential human health risk as it contains a chemical in its sap that can cause photo-sensitive chemical burns to the skin.

2.4 Fauna

As with vegetation, winter is not optimal for identifying the presence of notable animal species, as most fauna are less active than in spring or summer. Furthermore, River Corridor Survey is not designed for this purpose. However, incidental sightings of animals or their field-sign should be noted.

During the survey the only notable species that was seen was a single kingfisher (*Alcedo atthis*) flying upstream. The river here provides good perching and hunting habitat for this species, as there are numerous overhanging tree and shrub branches, and the site is relatively undisturbed.

Prior to this survey, there were unconfirmed reports of water vole (*Arvicola terrestris*) presence along the Yeading Brook. However, none of the previous WYGE surveys (Summer 2005) nor this River Corridor Survey (Winter 05/06) found conclusive evidence of water vole occupation. The shaded nature of the river and relative lack of marginal vegetation makes this reach sub-optimal for water voles. There are also records of American mink (*Mustela vison*) within Minet Country Park (Conroy 2004), which would severely limit the chances of a water vole population surviving.. There was plenty of evidence of brown rat (*Rattus norvegicus*) including droppings and footprints. It is possible that such footprints have been mistaken in the past for water vole prints. It is recognised by riparian mammal specialists that water vole footprints cannot always be reliably differentiated from those of young rats. Other field evidence such as food piles and droppings/latrines would be much more evident in the summer breeding season. It is therefore possible, but unlikely, that water voles may be present in low numbers, and therefore summer survey of proposed bridge crossing sites is recommended.

2.5 Evaluation

Various methods currently exist for evaluating the nature conservation importance of ecological features. Most of these are designed for areas of land and their associated habitats, but similar principles can be applied to rivers. The criteria for site evaluation used in this report are based on those defined in A Nature Conservation Review (Ratcliffe, 1977), as shown in Table 1.

Table 1 Ecological Evaluation of the Yeading Brook, Southall, adapted from Ratcliffe, 1977

Criterion	Remarks
Naturalness	Moderate: River appears to follow a relatively natural course but has presumably been over-resectioned/dredged in the past. Artificial bank protection exists at downstream end and treated sewage out-falls into upstream end. Non-native species and extensive litter are present and significant, further reducing the naturalness of the watercourse.
Diversity	At the plant community or animal assemblage level: Low aquatic and marginal species diversity. Low-Moderate terrestrial species diversity. Moderate physical/structural diversity
Rarity	Low: habitat is common in lowland England. Vegetation communities within the river corridor are very common in the south of England. Low potential for rare or scarce faunal species to exist.
Re-creatability	Moderate: The channel and its vegetation could be recreated within a period of a few years. Tree and scrub habitat on banks are more mature and would take longer to recreate.
Ecological linkage	Moderate-High: The river forms a continuous aquatic corridor both upstream and downstream. This section is relatively undisturbed and has well-developed riparian vegetation. Upstream and downstream the river is constrained by existing development.
Potential value	High: At present, the ecological value of the water course is limited by urban impacts such as litter and waste-water inputs, as well as invasive species. However, there is good potential for improved habitat management and for restoration of more diverse river features that could provide habitat for a wider range of species.
Age	The channel appears from historic maps to have followed its present meandering course for at least 150 years. Mature trees within the riparian corridor are probably at least 30 years old, but the surrounding

Comment [ds1]: Do we have info on the 'Living Waterways' project?

	scrub and rank vegetation may be more recent, following cessation of agricultural land use.

3.0 THE STORM DRAIN

The storm drain was constructed in the 1980s to take excess flood water from the Yeading Brook.

3.6 The aquatic zone

The channel was approximately 6m wide and water depth was approximately. 60cm water depth on the day of survey. The channel substrate consisted of a thick layer (c. 20-30cm) of black, anoxic silt throughout the entire survey section, colonised in a number of places by starworts (*Callitiche* spp.). Apart from this, the channel appeared devoid of vegetation, although there were accumulations of cut/broken watercress (*Rorippa amphibia*) stems in a number of places, although none was seen growing (possibly due to survey season). The hard-bed below the silt consists of flat concrete. There were no in-channel geomorphological features and depth and width was uniform throughout.

Litter from fly-tipping was very frequent and added to the very poor quality of the aquatic zone.

3.7 The marginal zone

The banks of this artificial channel are 1.2m high vertical concrete walls and no marginal zone exists. Occasional cover along these banks was provided by over-hanging bank-top vegetation such as bramble. There were numerous drain-pipe holes (ie minor outfalls) in the concrete banks.

3.8 The bank zone

The bank-tops of the storm drain were dominated by dense bramble scrub and scattered clumps of trees such as alder (*Alnus glutinosa*), crack willow (*Salix fragilis*), field maple (*Acer campestre*), silver birch (*Betula pendula*) and false acacia (*Robinia pseudoacacia*). Trees became more prevalent downstream near the confluence with the Yeading Brook. The variety of habitat in terms of shelter and nesting opportunity, food sources, and commuting/dispersal routes makes the bank-top zone a valuable ecological asset in the area. This is further reinforced by its relative seclusion.

The bank zone had infestations of invasive, non-native plants, notably giant hogweed and Japanese knotweed. Giant hogweed was particularly prevalent and presents a potential public health risk (see Section 2.1 above).

3.9 Notable fauna

During the survey, no notable species were seen and the channel itself provided unfavourable habitat for riverine species. However, the mosaic of dense scrub, trees and rank grassland on the bank-tops provides valuable habitat that is likely to support a range of common faunal species along this corridor. There are reports of bats and kingfishers using this corridor (Conroy, 2004).

3.10 Evaluation

Table 2.2 Ecological Evaluation of the Storm Drain. (adapted from Ratcliffe, 1977)

Criterion	Remarks
Naturalness	Very low – an entirely artificial concrete-lined channel built in the 1980s to take excess flood flows. It also suffers from fly-tipping and non-native species.
Diversity	Very low aquatic and marginal species diversity. Low-moderate terrestrial species diversity. Very low in-channel substrate and flow diversity High terrestrial structural diversity
Rarity	Low: habitat is common in urban areas. Vegetation within the river corridor are common in the south of England.
Re-creatability	Moderate: The storm drain is artifical, so habitat modifications should focus on creating riverine features eg creating a two stage channel using an artificial berm or in-channel planters. Local provenance riparian vegetation should be planted as well as allowing natural re-colonisation.
Ecological linkage	Moderate: The storm drain links aquatic habitat both upstream and downstream. This section is relatively undisturbed and has well-developed riparian vegetation structure, However, this is effectively an artificial flood relief channel to the Yeading Brook.
Potential value	High: Like many artificial channels, this has high potential for enhancement and naturalization, which could greatly improve its wildlife interest.
Age	Constructed in the 1980s.

4.0 SUMMARY AND RECOMMENDATIONS

The habitats of greatest value within Minet Country Park along the Yeading Brook are found along the bank tops and include scrub, woodland, ruderal vegetation and rank grassland. This provides a good variety of common plant species and complex structure that can support a range of common and notable fauna. These areas are relatively undisturbed, as the dense vegetation structure does not encourage intensive recreation. It is recommended that these areas are managed for their wildlife interest, according to the recent Management Plan produced by 'A Rocha Living Waterways' (Conroy 2004). The greatest existing threat to these areas is the extensive growth of invasive plant species such as giant hogweed and Japanese knotweed. These require urgent and on-going control.

Comment [ds2]: Do we have this report to check its recommendations?

The Yeading Brook is a valuable local wildlife feature with a relatively well-preserved meandering plan-form. Rivers are dynamic habitats and the processes of erosion and deposition that have created its current form should be allowed to continue. However, the in-channel habitat quality of the Yeading Brook is limited due to significant quantities of litter and, to a lesser extent, the level of shading by trees and scrub.

The storm drain is of very low habitat quality with very limited aquatic diversity. Significant works are required to improve the habitat. The emphasis should be on habitat creation and restoration, including rubbish removal

Fly-tipping and dumping of rubbish in both channels is significant problem Tipping should be controlled and litter within the channel regularly removed.

5.0 REFERENCES

Environment Agency (2003) *River habitat survey in Britain and Ireland: field survey guidance manual*.

Ratcliffe, D. (1977). A Nature Conservation Review, volume 1. Cambridge University Press.

APPENDICES

Appendix A – Report conditions

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REPORT CONDITIONS

Yeading Brook and Strom Drain, West Southall – River Corridor Survey

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Appendix B – Sketches

White Young Green

River Habitat Survey

Yeading Brook, West Southall

thinking beyond construction

RIVER HABITAT SURVEY

OF

YEADING BROOK

FOR

YEADING AND HAYES FOOTBALL CLUB

Reference: A041812 Yeading&HayesFC RCS R01 DJS.doc			
Issue		Prepared by	Reviewed and verified by:
v1	**May 08**		
		Duncan Smith **Senior Ecologist**	**Dr Greg Carson** **Associate Ecologist**
File Ref H:\Data\Projects\A041001-A042000\A041812 Yeading & Hayes FC\Ecology\Reports\River Habitat Survey\A041812 Yeading&HayesFC RHS R01 DJS.doc			
White Young Green Environmental Sunley House, Bedford Park, Croydon, Surrey, CR0 2AP ***Telephone: 020 8649 6600 Facsimile: 020 8649 6629 E-Mail: enviro.london@wyg.com***			

CONTENTS

EXECUTIVE SUMMARY

Site Location	Yeading Brook, West Southall (Grid Ref: TQ1151 1799).
Previous surveys	WYGE undertook a corridor survey of the Yeading Brook (Minet Park section) in December 2005, and presented the results as maps. The report described river habitats and assessed the habitat quality of the river corridor.
WYGE Survey	River Habitat Survey (RHS) of Yeading Brook, West Southall, undertaken on 18 April 2008 along 500m stretch, between Grid Ref: TQ1158 8012 and TQ1129 7983 using Environment Agency 2003 standard methodology.
Results	A description of the RHS survey is provided, with an explanation of the terms used.
Impact	Impact from proposed development at Yeading FC is addressed, including the, sport pitch repositioning and stand construction.
Recommendations	• Avoid removing scrub and bank side vegetation during the bird breeding season. • Consider impact of lighting on potential bat populations. • Eradicate invasive plants, especially along river bank. • Retain dead wood on bank side and adjacent habitat and undertake limited clearance of bank side scrub and tall ruderals. • Remove litter should from the brook. • Convey run-off from sports pitches and areas of hard standing into open channel, planted with common reed or similar marginal riparian vegetation.

1.0 INTRODUCTION

White Young Green Environmental (WYGE) carried out a river corridor survey of the Yeading Brook (Minet Park) section in December 2005, and provided a description of river habitats and their ecological value. The current River Habitat Survey (RHS) was undertaken by Duncan Smith (Accreditation Number LB028) on 18 April 2008, using the methodology specified by the Environment Agency (2003). Up to date environmental information about the environmental characteristics of this area is necessary to meet national planning policy (Planning Policy Statement 9, 2005). In this report, information from the RHS is used to assess the impact of development on this section of the Yeading Brook.

1.1 Site description

The RHS was carried out along a 500m stretch of the Yeading Brook, which lies immediately to the east of the Yeading and Hayse Football Club (Sketch ECO.01). At this location, the Yeading Brook is part of a local wildlife site known as the 'Yeading Brook, Minet County Park and Hitherbroom Park', and is classified by the Greater London Authority (Wildweb website), on behalf of the Mayor of London, as a Borough Grade 1 site, because of its wildlife importance in a Borough context.

The land situated between the Grand Union Canal and the Yeading Brook is known as the Minet Tip, part of which is owned by National Grid Property Ltd. In relation to a separate application, a footbridge is proposed between the Minet Tip and Yeading football ground.

1.2 Report conditions

For a detailed review of the extent and limitations of this report, attention is drawn to the report conditions in Appendix A.

2.0 METHODOLOGY

The survey uses the standard methodology described by the Environment Agency (2003). This requires consistent recording of features by competent, well trained and accredited surveyors.

RHS is a method designed to characterise and assess, in broad terms, the physical structure of freshwater streams and rivers. RHS classifies broad vegetation types (eg tall herb/rank vegetation) and basic geomorphological principles and processes.

RHS is undertaken along a 500m length of river channel. Observations are made at ten equally spaces spot-checks, separated by approximately 50m. Physical features are assessed using a 1m wide 'transect' across the channel, while all other elements (land use, vegetation structure and channel vegetation types) are assessed using a 10m wide transect. Information on valley form and land use in the river corridor provides additional context. Essential equipment for undertaking a RHS includes a 2m long ranging pole.

This Yeading Brook RHS was carried out from along the right bank. Spot Check 1 was at the upstream end of the brook (Grid Ref: TQ1158 8012). Spot Check 6, at the mid-section, was 250m from Spot Check 1. Spot Check 10, the final spot check, was at 450m along the bank from the start, while the end of the surveyed stretch was 50m beyond Spot Check 10 (Grid Ref: TQ1129 7983; See sketch ECO.1).

During a RHS, the river bank is defined as the permanent side to the river channel. For recording purposes, the bank starts at the water's edge and continues to the 'bank top' where the break of slope allows for cultivation or development to take place.

Weather conditions on 18 April 2008 were cloudy and overcaste, approximately 11°C and very windy (Beaufort scale 6, strong breeze).

3.0 RESULTS

This section provides a description of the RHS survey, using the heading shown on the survey form. The definitions described below are those in the Environment Agency's Field Survey Guidance Manual (2003). The completed survey form is provided in the appendices.

3.1 Field Survey Details

The Yeading Brook is part of a river channel, as it is a natural rivers that has been modified by human activity.

The were no adverse conditions affecting the survey ie weather and flow conditions were favourable for surveying.

The river channel was partially visible, as it was obscured by turbid water and filamentous algae for 33-95% of the surveyed stretch.

3.2 Predominant Valley Form

The predominant valley form fitted best the category 'no obvious valley sides' in the context of the near to mid horizon. There was no distinct flat valley bottom because there were no obvious valley sides, providing a flat area into which water would spill during a flood.

3.3 Number of Riffles, pools and point bars

In this stretch, 4 riffles were recorded. Riffles are a habitat feature characterised by shallow, fast flowing water, with a distinctly disturbed surface over unconsolidated (loose) grave-pebble. Unbroken standing wave is the predominant flow type in a riffle.

No pools were recorded.

3.4 Artificial Features

A minor outfall was recorded at Target Note 3, where a drain discharged into the Yeading Brook (Photograph 1). Minor outfalls are permanent structures occupying <10m of bank length.

The channel had been over-deepened along more than 33% of its length, but had not been obviously realigned. Water was not impounded by a weir.

3.5 Spot checks

Physical Attributes

This section describes the results of spot checks at 10 locations spaced evenly along the 500m RHS stretch. Data for spot-checks are entered on page 2 of the form. At each spot check, information relating to the channel, banks and adjacent land is recorded. This includes predominant channel substrate and flow type; habitat features; modifications to the channel and banks, channel vegetation types; vegetation structure of the banks and banktop; and landuse. Physical features were assessed using a 1m wide 'transect' across the channel, while all other elements were assessed within a 10m wide transect across the river. The side of the bank is determined by facing downstream.

Bank material: The predominant material on both banks on the Yeading Brook was earth (EA). Earth is defined in the RHS manual as soil comprising mainly crumbly loam material, but not predominantly composed of clay. A jab with a ranging pole leaves no distinct hole, or one with ragged or crumbling edges.

Bank modifications: It was evident form the survey that both the left and right banks had been historically reprofiled along most of their length, probably to accommodate flood flows. Since reprofiling has taken place, scrub, and tall ruderal vegetation, has become abundant along much of the river section's length. Occasionally, mature trees have been retained lower down on the bank face.

As well as reprofiling, the river bank has been 'embanked' (EM) with earth for much of its length, on both right and left banks. Vegetation types covering the embankment include dense scrub, tall ruderals, rough grassland and has trees. The embankment formed an integral part of the bank at all the spot checks except Spot Check 1. At the latter, the break of slope was at the same level as the surrounding land level (Photograph 2).

Marginal and bank features: At Spot Check 2, a vegetated side bar was recorded. 'Vegetated' refers to greater than 50% of the total surface area with plant cover. A vegetated side bar is a depositional feature composed of consolidating (stabilising) sediment, along river margins other than inside of distinct bends. It is exposed at low flow, and has a shallow slope into the water. Constituent material is primarily sediment that has been transported from upstream.

At Spot Check 3 and 4, unvegetated side bars were recorded (Photograph 5). 'Unvegetated' refers to a distinctive depositional feature composed of unconsolidated sediment located along the margins of river. 'Unvegetated' refers to less than 50% of the total surface area having plant cover.

No other marginal or bank features were recorded at the other spot checks.

Channel Substrate: The ranging pole was used to prod the river bed to determine the predominant channel substrate. Substrates recorded were gravel/pebble, sand and silt (overlying pebbles).

Flow type: At Spot Check 2, the flow type was 'unbroken standing wave'. This flow type is associated with riffles, and has upstream facing wavelets, with a disturbed 'dragon-back' appearance.

The flow type for the remaining 9 spot checks was 'smooth'. This is laminar flow that does not produce a disturbed surface.

Channel modifications: The 500m stretch of the Yeading Brook showed signs of resectioning for most of its length, resulting in a lowering of the river bed (Photograph 3).

Banktop Land-use and Vegetation Structure

Land Use within 5m of banktop: The predominate land uses within 5 meters of the left bank was scrub, (8 spot checks). Tall herb/rank vegetation was recorded in 2 spot checks. Similarly, the predominant land use within 5m of the right bank was a mixture of scrub an tall herb/rank vegetation, with also including improved grassland (1 spot check) and parkland (2 spot checks).

Banktop structure within 1m: The left banktop structure was mostly simple ie with 2 or 3 vegetation types, (5 spot checks). 4 spot checks had complex vegetation structure ie with four vegetation types, and one spot check had a uniform banktop structure. The right banktop had a mixture of simple (6 spot checks), complex (2 spot checks) and uniform (2 spot checks) structure.

Bankface structure: The left bankface structure was predominantly simple (6 spot checks), but also with complex (2 spot checks) and uniform (2 spot checks) vegetation structure.

Channel Vegetation Types

The most apparent channel vegetation type throughout the channel was filamentous algae, which occurred in each of the 10 spot checks, and was recorded as extensive, covering greater than 33% of the 500m stretch. Submerged linear leaves were recorded as 'present' (less than 33% of the 10m wide transect) in 7 spot checks, while emergent reeds were recorded in one spot check.

3.6 500m Sweep-Up of entire stretch

All sweep up information is based on the occurrence of features and river characteristics over the whole 500m site. It continued another 50m beyond the last spot check to ensure the whole RHS site was 500m long. A summary of sweep up information is given below:

Land use within 50m of banktop: The land use within 50m of the left bank included broadleaved woodland (0 to less than 33%) and extensive scrub (33-95%). Land use within 50m of the right bank included extensive scrub and extensive parkland.

Bank Profile: Both sides of the river bank were extensively re-sectioned and embanked along 33-95% of the 500m stretch. In addition, the right bank had a sent back embankment for 0 to 33% of its length. It is possible that the left bank also had partially set back embankment, but the access to this section was restricted, and not fully visible.

Extent of Associated Features

Trees: Along the 500m stretch, river bank trees were best described as isolated/scattered, on both right and left bank.

Associated features included the following: overhanging boughs, fallen trees and large woody debris. The extent of each of these features was less than 33% of 500m stretch length, and are not specific to either bank.

Extent of Channel features: smooth flow as extensive (greater than 33% of stretch) and unbroken standing waves were present. Unvegetated and vegetated side bars were present.

Notable Nuisance Plant Species: Along the 500m stretch, one clump of Japanese knotweed was recorded at Target Note 1

4.0 EVALUATION

Various methods currently exist for evaluating the importance and quality of an ecological receptor. Most of these are designed for areas of land and their associated habitats, but similar principles can be applied to rivers. For the purposes of this report a method loosely based on Ratcliffe (1977) can be applied as shown in Table 4.1

Table 4.1 Ecological Evaluation of the Yeading Brook, Southall. (adapted from Ratcliffe, 1977)

Criterion	Remarks
Naturalness	Moderate: River appears to follow a relatively natural course but this has historically been reprofiled and sectioned. Earth embankments exists along much of the 500m stretch surveyed and treated sewage out-falls into upstream section. Non-native species and litter are present.
Diversity	Low aquatic and marginal species diversity. Low-Moderate terrestrial species diversity. Moderate physical/structural diversity
Rarity	Low: habitat is common in lowland England. Vegetation species within the river corridor are very common in the south of England. Low potential for rare or scarce faunal species to exist.
Re-creatibility	Moderate: The channel and its vegetation could be recreated within a few years. Some of the tree and scrub habitat on banks are more mature and would take longer to establish.
Ecological linkage	Moderate-High: The Yeading Brook forms a continuous water link both upstream and downstream. The in channel vegetation is poorly developed but the bank vegetation structure is well developed.
Potential value	High: At present, the reach's ecological value is limited by urban impacts such as litter and waste-water inputs, as well as invasive species presence. However, there is good potential for on-going management and restoration of more diverse river features that could provide habitat for a wider range of in-channel species.
Age	The channel appears from historic maps to have followed its present meandering course for at least 150 years. It is not known when re-sectioning took place, it would have been some time prior to 1981. Mature trees (most beyond the banks) are probably at least 30 years old, but the surrounding scrub and rank vegetation may be more recent, following cessation of agricultural activity.

5.0 IMPACT ASSESSMENT

The proposals at Yeading FC include:

- repositioning of the existing football pitches
- demolition of existing stands and construction of new stands

These proposals are considered below. It should be noted that the scope of this report is the channel and banks of the Yeading Brook.

Repositioning of football pitches

It is understood from the proposed new stand site plan (Jeffory Powell Associates, drawing number 2007/731/5) that the proposed re-positioning of the football pitches will not result in the loss of any riparian habitat, and consequently is unlikely to have a direct impact on the river habitat.

The proposed flood lighting has potential to impact upon bats that may be using the site. A bat survey of this stretch of the Yeading Brook has not been carried out. However, a bat survey was conducted along the Grand Union Canal by WYGE in 2007, and found common pipistrelle (*Pipistrellus pipistrellus*) bats using the canal as a foraging commuting route. Use was predominantly where prey (insects) populations are greatest, over the water and marginal vegetation which runs sporadically along each side of the canal.

Consideration should be given to ensuring the impact of lighting is reduced if not eliminated. This may be achieved by one or a combination of: reducing intensity, directing lighting away from the canal side, using low pressure sodium lamps and reducing the period of lighting, particularly during the summer months.

Water run off from the sports pitches and hard standing should be channelled through ditches that run above ground, thereby providing wildlife enhancement and potential to maintain / improve water quality, rather than be culverted underground. We recommend that channels are soft engineered, avoiding the use of building material such as concrete or sheet piling. The shallower the ditch profile, the more beneficial to wildlife (45° being the preferred option). Suitable emergent plants for the ditch include common reed *Phragmites australis*.

Extension of existing recreational stand

Extending the recreational stand is unlikely to have any direct impact on the Yeading Brook. However, it will increase the extend of surface water run-off, which should be channelled, as described above.

6.0 RECOMMENDATIONS

Avoid removing scrub and bank side vegetation during the bird breeding season (beginning March to end August).

Undertake dawn and dusk bat surveys in order to assess the extent to which bats are using this particular stretch of river corridor. Include also assessment of ambient lighting and at times when the floodlights are being used at night, in order to establish baseline of lighting intensity.

Eradicate Japanese knotweed, taking great care to avoid its further spread along the water course. Giant hogweed is present in abundance a short distance downstream from the RHS stretch, and should also be eradicated.

Retain as much bank side vegetation and adjacent trees (including dead wood) as possible.

Litter should be removed from the brook.

Limited clearance of bank side scrub and tall ruderals, to allow establishment of increased diversity of river bank vegetation.

Convey run-off into open channel, planted with common reed or similar marginal riparian vegetation.

7.0 REFERENCES

Environment Agency (2003). River Habitat Survey in Britain and Ireland. Field Survey Guidance Manual, 2003 version.

Office of the Deputy Prime Minister (2005). Planning Policy Statement 9: Biodiversity and Geological Conservation.

WYGE (2007). Reptile Survey Report, Southall Gasworks.

WYGE (2007). Bat Survey Report, Southall Gasworks.

Web references

Planning Policy Statement 9

http://www.communities.gov.uk/documents/planningandbuilding/pdf/147408.pdf

Wildweb web site:

http://www.london.gov.uk/wildweb/PublicSiteView.do?siteid=6685

8.0 TARGET NOTES

Target Note 1 (Photograph 7)

Clump Japanese knotweed.

Target Note 2 (Photograph 6)

Fallen dead tree, within 50m of bank top, (close to Spot Check 9).

Target Note 3 (Photograph 1)

Minor outfall, creating discolouration of watercourse. Location partially hidden by dense scrub vegetation.

APPENDICES

Appendix A – Report conditions

WHITE YOUNG GREEN ENVIRONMENTAL LTD

REPORT CONDITIONS

Yeading and Hayes Football Club – River Habitat Survey

This report is produced solely for the benefit of Yeading and Hayes FC and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This document is prepared for the uses stated in the report and should not be used in a different context without reference to WYGE. In time, improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of WYGE using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to WYGE by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

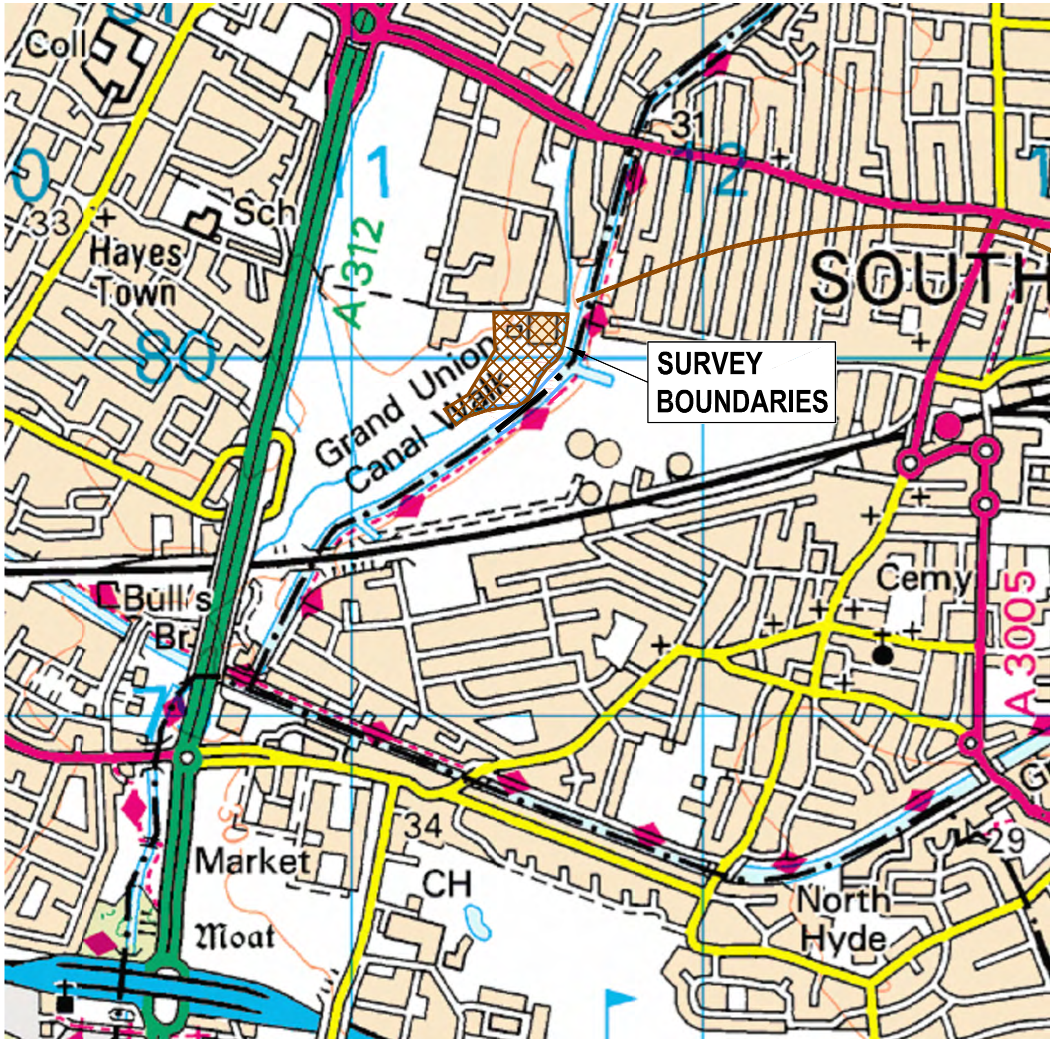
Whilst skill and care have been used, no investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather related conditions.

Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the how representative the data used by the model is, and assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicated in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions.

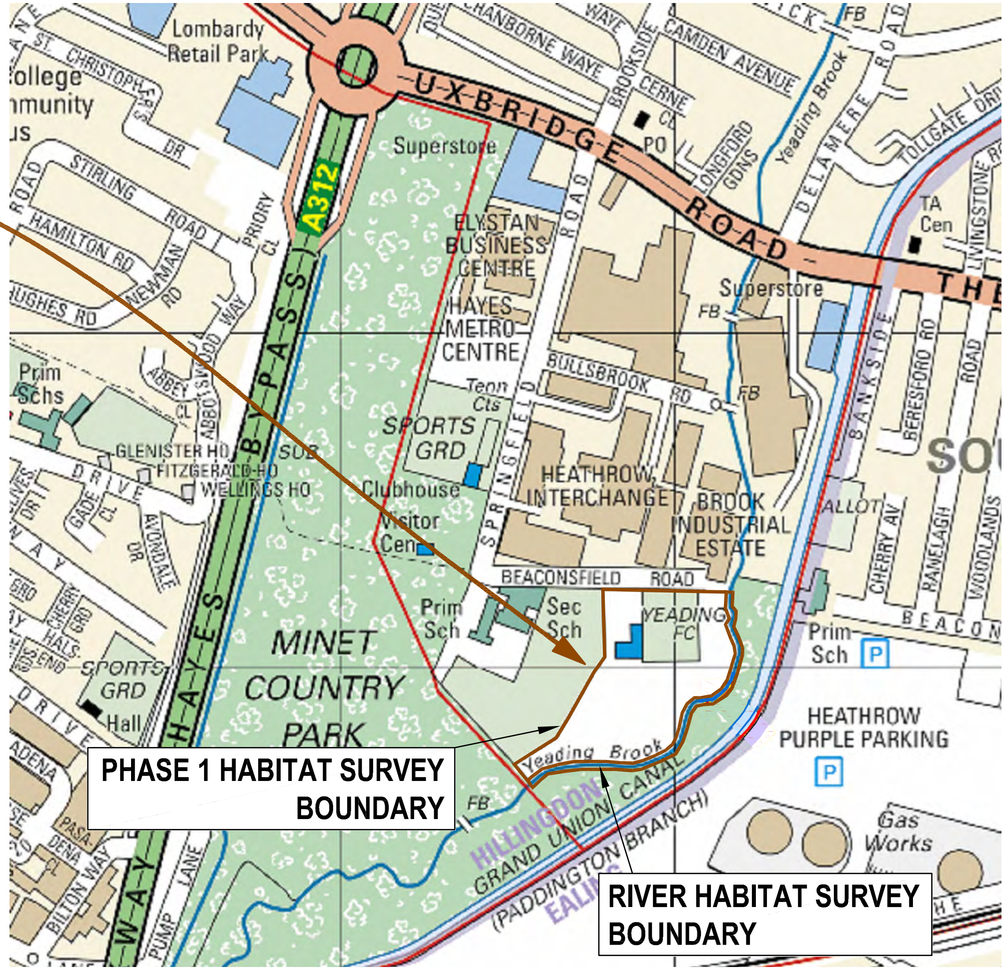
The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYGE accept no liability for issues with performance arising from such factors.

Appendix B – SKETCHES



1000m



500m

REV	DESCRIPTION	BY	CHK	APP	DATE

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White Young Green
Environmental

PROJECT:
YEADING BROOK
WEST SOUTHALL

CLIENT:
YEADING AND HAYES FOOTBALL CLUB

DRAWING TITLE:
SITE LOCATION PLANS

SCALE @ A4	DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
AS SHOWN	P. J. T.	MAY. 2008	D. S.	MAY. 2008	G. C.	MAY. 2008

	OFFICE	TYPE	DRAWING No.	REVISION
A041812	40	ENV	SK. 01	

SHEET SIZE : A4 LANDSCAPE

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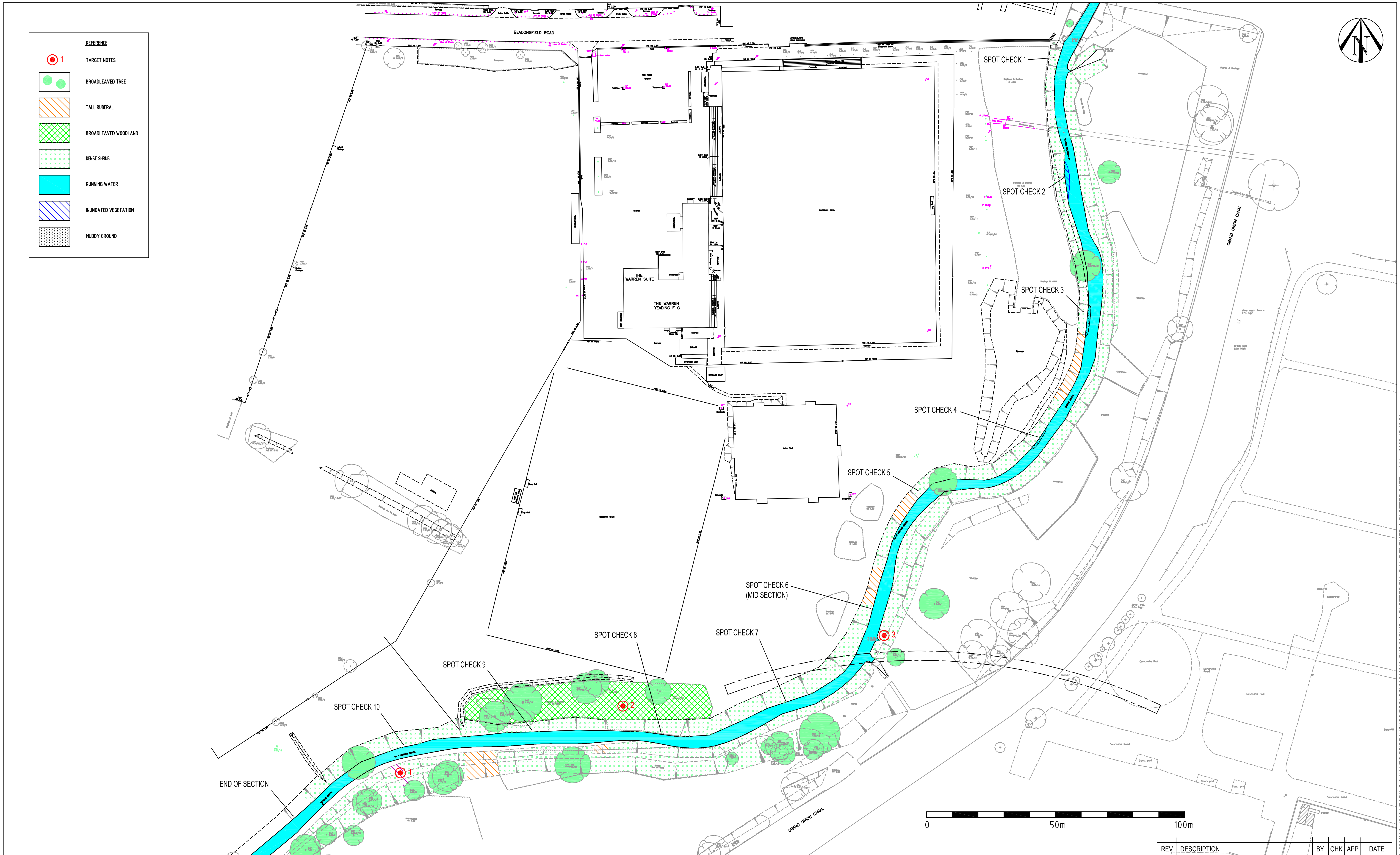

REV	DESCRIPTION	BY	CHK	APP	DATE

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White Young Green
Environmental

PROJECT:
YEADING BROOK
WEST SOUTHALL

CLIENT:
YEADING AND HAYES FOOTBALL CLUB

DRAWING TITLE:
RIVER HABITAT SURVEY

SCALE @ A3	DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
AS SHOWN	P. J. T.	MAY. 2008	V. A.	MAY. 2008	G. C.	MAY. 2008

	OFFICE	TYPE	DRAWING No.	REVISION
A041812	40	ENV	RHS. 01	

SHEET SIZE : A3 LANDSCAPE

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Appendix C - Photographs

Photograph 1, Target Note 3. Minor outfall, creating discolouration of watercourse. Location partially hidden by dense vegetation.

Photograph 2. Location of Spot Check 1, at up stream of Yeading Brook, by fence Grid Ref TQ1158 8012

Photograph 3, showing resectioned bank: uniform steep sided bank, straight river channel.

Photograph 4, showing embankment of the river channel, viewed northwards, in direction of the astro turf.

Photograph 5, Spot Check 3, facing downstream, viewed from mid-channel, showing unvegetated right side bar.

Photograph 6, Target Note 2. Fallen dead tree, within 50m of banktop, close to Spot Check 9.

Photograph 7, Target Note 1. Clump of Japanese knotweed, centre of photograph.

Appendix D – River Habitat Survey

RIVER HABITAT SURVEY 2003 VERSION: SITE HEALTH AND SAFETY ASSESSMENT			
Site Number[1]:	Site Ref: YEADING FC	River Name: YEADING BROOK	Date: 18 APRIL '08
Grid References/Co-ordinates:	Spot 1[2]: TQ1158 8012	Mid-site: TQ 1151 1799	End of site[2]: TQ1129 798
Surveyor Name: DUNCAN SMITH		Accredited Surveyor Code: LB028	
[1] Leave blank if new site.		[2] Optional	

Weather Conditions: Cloudy and overcaste, windy, mostly dry. 11°C

Flow Conditions: Low

Site details: (enter comments or circle if applicable and give details)	**Risk Level (Low/Mod/High)**
Access and Parking: (entry & exit) Yeading FC parking	Low
Conditions: comment on ground stability, footing, exposure/remoteness Solid, stable ground	Low
Obstacles/Hazards: fencing, stiles, dense vegetation, steep bank Dense vegetation, especially brambles in places. Some steep banks.	Low
Occupied/Unoccupied: people, livestock, animals People. Football grounds, by wildlife park	Low
Activities/Land-use: agriculture, woodland, residential, industrial, construction, recreational Conservation and recreation	Low
Risk if lone-working: not lone working; Victoria Alexander, Phase I surveyor, in the vicinity	Low

IF THERE ARE ANY HIGH RISKS OR MORE THAN THREE MODERATE RISKS DO NOT CONTINUE WITH THE SURVEY.

Weil's Disease (*Leptospirosis*)

Instructions to card holders

1. As infection may enter through breaks in the skin, ensure that any cut, scratch or abrasion is thoroughly cleansed and covered with a waterproof plaster.
2. Avoid rubbing your eyes, nose and mouth during work.
3. Clean protective clothing, footwear and equipment etc. after use
4. After work, and particularly before taking food or drink, wash hands thoroughly.
5. Report all accidents and/or injuries, however slight.
6. Keep your card with you at all times.

Lyme Disease

1. Dress appropriately with skin covered up.
2. Regularly inspect for ticks when in the field.
3. Check for, and remove, any ticks as soon as possible after leaving the site.
4. Seek medical attention if bitten by a tick.

leave blank if new site

Site Number: ☐

Site Reference: Yeading FC

Spot-check 1 Grid Ref: TQ1158 8012

Spot-check 6 Grid Ref: TQ1151 1799

End of site Grid Ref: TQ1129 798

Reach Reference: N/A

River name: Yeading Brook

Date 18 /04/20 Time: 12pm

Surveyor name: DUNCAN SMITH

Accredited Surveyor code:

Is the site part of a river or an artificial channel? River ☑ Artificial ☐

Are adverse conditions affecting survey? No ☑ Yes ☐

If yes, state ......N/A......

Is bed of river visible? barely or not ☐ partially ☑ ±entirely ☐

Is health and safety assessment form attached? Yes ☑ No ☐

Number of photographs taken: 7

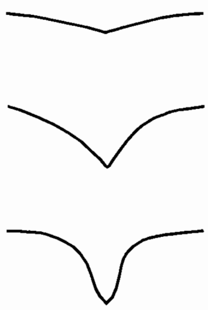
Photo references: see appendices

Site surveyed from: left bank ☐ right bank ☑ channel ☐

☐ **When options shown with 'shadow boxes', tick one box only**

LEFT banks determined by facing downstream RIGHT

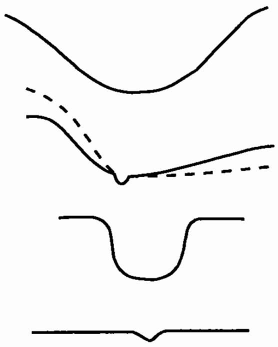
(tick one box only)



☐ shallow vee

☐ deep vee

☐ gorge



☐ concave/bowl

☐ asymmetrical valley

☐ U-shape valley

☑ no obvious valley sides

Distinct flat valley bottom? No ☑ Yes ☐

Natural terraces? No ☑ Yes ☐

Riffle(s)	4	Unvegetated point bar(s)	0
Pool(s)	0	Vegetated point bar(s)	0

If none, tick box ☐

	Major	Intermediate	Minor		Major	Intermediate	Minor
Weirs/sluices				Outfalls/intakes			1
Culverts				Fords			
Bridges				Deflectors/groynes/croys			
Other - state							

Is channel obviously realigned? **No** ☑ **Yes, <33% of site** ☐ **≥33% of site** ☐

Is channel obviously over-deepened? **No** ☐ **Yes, <33% of site** ☑ **≥33% of site** ☐

Is water impounded by weir/dam? **No** ☑ **Yes, <33% of site** ☐ **≥33% of site** ☐

SITE REF.	**RIVER HABITAT SURVEY: TEN SPOT-CHECKS**	**Page 2 of 4**

Spot-check 1 is at: upstream end ☑ downstream end ☐ of site (tick one box)

When boxes 'bordered', only one entry allowed	**1 GPS**	2	3	4	5	**6 GPS**	7	8	9	10	**GPS**
Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	
Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM	RS	RS/EM	RS/EM	RS/EM	RS/EM	RS/EM	RS/EM	RS/EM	RS/EM	RS/EM	
Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Channel substrate NV, BE, BO, CO, GP, SA, SI, CL, PE, EA, AR	GP	GP	SA	SA	GP	GP	SI	SI	SI	SI	
Flow-type NV, FF, CH, BW, UW, CF, RP, UP, SM, NP, DR	SM	UW	SM	SM	SM	SM	SM	SM	SM	SM	
Channel modification(s) NK, NO, CV, RS, RI, DA, FO	RS	RS	RS	RS	RS	RS	RS	RS	RS	RS	
Channel feature(s) NV, NO, EB, RO, VR, MB, VB, MI, TR	NO	NO	TR	TR	NO	TR	NO	TR	TR	TR	
For braided rivers only: number of sub-channels											
Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	
Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM	RS/EM	RS/EM	RS/EM	RS/EM	RS/EM	RS/EM	RS/EM	RS/EM	RS/EM	RS/EM	
Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB	NO	VS	SB	SB	NO	NO	NO	NO	NO	NO	

↑ Enter channel substrate(s) not occurring as predominant in spot-checks but present in >1% of whole site.

Land-use: choose one from BL, BP, CW, CP, SH, OR, WL, MH, AW, OW, RP, IG, TH, RD, SU, TL, IL, PG, NV

	1	2	3	4	5	6	7	8	9	10
LAND-USE WITHIN 5m OF LEFT BANKTOP	SH	SH	SH	TH	SH	SH	SH	SH	SH	TH
LEFT BANKTOP (structure within 1m) B/U/S/C/NV	S	S	C	S	C	C	U	S	C	S
LEFT BANK-FACE (structure) B/U/S/C/NV	S	U	S	H	S	S	C	C	S	S
RIGHT BANK-FACE (structure) B/U/S/C/NV	S	U	U	S	S	S	S	S	S	C
RIGHT BANKTOP (structure within 1m) B/U/S/C/NV	U	S	S	S	S	C	U	C	S	S
LAND-USE WITHIN 5m OF RIGHT BANKTOP	IG	TH	TH	TH	PG	SH	PG	SH	SH	SH

	1	2	3	4	5	6	7	8	9	10	
None (✓) or Not Visible (NV)											
Liverworts/mosses/lichens											
Emergent broad-leaved herbs											
Emergent reeds/sedges/rushes/grasses/horsetails			✓								✓
Floating-leaved (rooted)											
Free-floating											
Amphibious											
Submerged broad-leaved											
Submerged linear-leaved		✓	✓	✓	✓	✓	✓		✓		✓
Submerged fine-leaved											
Filamentous algae	✓	E	✓	✓	E	✓	✓	✓	E	✓	E

Use end column for overall assessment over 500m, including types not occurring in spot-checks (use ✓, E or NV) →

	L	R		L	R
Broadleaf/mixed woodland (semi-natural) (BL)	✓		Natural open water (OW)		
Broadleaf/mixed plantation (BP)			Rough/unimproved grassland/pasture (RP)		
Coniferous woodland (semi-natural) (CW)			Improved/semi-improved grassland (IG)		
Coniferous plantation (CP)			Tall herb/rank vegetation (TH)		
Scrub & shrubs (SH)	E	E	Rock, scree or sand dunes (RD)		
Orchard (OR)			Suburban/urban development (SU)		
Wetland (e.g. bog, marsh, fen) (WL)			Tilled land (TL)		
Moorland/heath (MH)			Irrigated land (IL)		
Artificial open water (AW)			Parkland or gardens (PG)		E
			Not visible (NV)		

Natural/unmodified	L	R	**Artificial/modified**	L	R
Vertical/undercut			Resectioned (reprofiled)	E	E
Vertical with toe			Reinforced - whole		
Steep (>45°)			Reinforced - top only		
Gentle			Reinforced - toe only		
Composite			Artificial two-stage		
Natural berm			Poached bank		
			Embanked	E	E
			Set-back embankment		✓

TREES (tick one box per bank)

	Left	Right
None	☐	☐
Isolated/scattered	☑	☑
Regularly spaced, single	☐	☐
Occasional clumps	☐	☐
Semi-continuous	☐	☐
Continuous	☐	☐

ASSOCIATED FEATURES (tick one box per feature)

	None	Present	E (≥33%)
Shading of channel	☐	☐	☐
*Overhanging boughs	☐	☑	☐
*Exposed bankside roots	☐	☐	☐
*Underwater tree roots	☐	☐	☐
Fallen trees	☐	☑	☐
Large woody debris	☐	☑	☐

	None	Present	E(≥33%)
*Free fall flow	☐	☐	☐
Chute flow	☐	☐	☐
Broken standing waves	☐	☑	☐
Unbroken standing waves	☐	☐	☐
Rippled flow	☐	☐	☐
*Upwelling	☐	☐	☐
Smooth flow	☐	☐	☑
No perceptible flow	☐	☐	☐
No flow (dry)	☐	☐	☐
Marginal deadwater	☐	☐	☐
Eroding cliff(s)	☐	☐	☐
Stable cliff(s)	☐	☐	☐

	None	Present	E (≥33%)
Exposed bedrock	☐	☐	☐
Exposed boulders	☐	☐	☐
Vegetated bedrock/boulders	☐	☐	☐
Unvegetated mid-channel bar(s)	☐	☐	☐
Vegetated mid-channel bar(s)	☐	☐	☐
Mature island(s)	☐	☐	☐
Unvegetated side bar(s)	☐	☑	☐
Vegetated side bar(s)	☐	☑	☐
Unvegetated point bar(s)	☐	☐	☐
Vegetated point bar(s)	☐	☐	☐
*Unvegetated silt deposit(s)	☐	☐	☐
*Discrete unvegetated sand deposit(s)	☐	☐	
*Discrete unvegetated gravel deposit(s)	☐	☐	

SITE REF. Yeading FC	**RIVER HABITAT SURVEY : DIMENSIONS AND INFLUENCES**	

LEFT BANK		CHANNEL		RIGHT BANK	
Banktop height (m)	3m	Bankfull width (m)	10m	Banktop height (m)	2.5m
Is banktop height also bankfull height? (Y or N)	Y	Water width (m)	3	Is banktop height also bankfull height? (Y or N)	Y
Embanked height (m)	3.5m	Water depth (m)	0.1m	Embanked height (m)	2.5m

If trashline lower than banktop, indicate: height above water (m) = width from bank to bank (m) =

Bed material at site is: consolidated ☐ unconsolidated (loose) ☑ unknown ☐

Location of measurements is: riffle ☑ other ☐ (state) (SPOT CHECK 2)

None	☐	Very large boulders (>1m)	☐	Backwater(s)	☐	Marsh(es)	☐
Braided channels	☐	*Debris dam(s)	☐	Floodplain boulder deposits	☐	Flush(es)	☐
Side channel(s)	☐	*Leafy debris	☐	Water meadow(s)	☐	Natural open water	☐
*Natural waterfall(s) > 5m high	☐	Fringing reed-bank(s)	☐	Fen(s)	☐	Others (state)	☐
*Natural waterfall(s) < 5m high	☐	Quaking bank(s)	☐	Bog(s)	☐		
Natural cascade(s)	☐	*Sink hole(s)	☐	Wet woodland(s)	☐		

Is 33% or more of the channel choked with vegetation? No ☑ Yes ☐

		bankface	banktop to 50m		bankface	banktop to 50m
None ☐	*Giant hogweed	☐	☐	*Himalayan balsam	☐	☐
	*Japanese knotweed	☑	☐	*Other (state)..........................	☐	☐

Major impacts: landfill - tipping - litter - sewage - pollution - drought - abstraction - mill - dam - road - rail - industry - housing mining - quarrying - overdeepening - afforestation - fisheries management - silting - waterlogging - hydroelectric power

Evidence of recent management: dredging - bank mowing - weed cutting - enhancement - river rehabilitation - gravel extraction - other (please specify)

Animals: otter - mink - water vole - kingfisher - dipper - grey wagtail - sand martin - heron - dragonflies/damselflies

Other significant observations: if necessary use separate sheet to describe overall characteristics and relevant observations

*Alders? None ☑ Present ☐ Extensive ☐ | *Diseased Alders? None ☑ Present ☐ Extensive ☐

Have you taken at least two photos that illustrate the general character of the site and additional photos of any weirs/ sluices and major/intermediate structures across the channel?	☑
Have you completed all ten spot-checks and made entries in all boxes in E & F on page 2?	☑
Have you completed column 11 of section G (and E if appropriate) on page 2?	☑
Have you recorded in section C the number of riffles, pools and point bars (even if 0) on page 1?	☑
Have you given an accurate (alphanumeric) grid reference for spot-checks 1, 6 and end of site (page 1)?	☑
Have you stated whether spot-check 1 is at the upstream or downstream end of the site (top of page 2)?	☑
Have you cross-checked your spot-check and sweep-up responses with the channel modification indicators given on page 2 of the spot-check key?	☑

RIVER HABITAT SURVEY 2003 VERSION: SPOT-CHECK KEY

PHYSICAL ATTRIBUTES (SECTION E)

BANKS

Predominant bank material

NV = not visible

BE = bedrock
BO = boulder
CO = cobble
GS = gravel/sand
EA = earth (crumbly)
PE = peat
CL = sticky clay

CC = concrete
SP = sheet piling
WP = wood piling
GA = gabion
BR = brick/laid stone
RR = rip-rap
TD = tipped debris
FA = fabric
BI = bio-engineering materials

Bank modifications

NK = not known
NO = none

RS = resectioned (reprofiled)
RI = reinforced
PC = poached
PC(B) = poached (bare)
BM = artificial berm
EM = embanked

Marginal and bank features

NV = not visible (e.g. far bank)
NO = none

EC = eroding cliff (EC if sandy substrate)
SC = stable cliff (SC if sandy substrate)

PB = unvegetated point bar
VP = vegetated point bar

SB = unvegetated side bar
VS = vegetated side bar

NB = natural berm

CHANNEL

Predominant substrate

NV = not visible

BE = bedrock
BO = boulder
CO = cobble
GP = gravel/pebble (G or P if predominant)
SA = sand
SI = silt
CL = clay
PE = peat
EA = earth
AR = artificial

Predominant flow-type

NV = not visible
FF = free fall
CH = chute
BW = broken standing waves (white water)
UW = unbroken standing waves
CF = chaotic flow
RP = rippled
UP = upwelling
SM = smooth
NP = no perceptible flow
DR = no flow (dry)

Channel modifications

NK = not known
NO = none

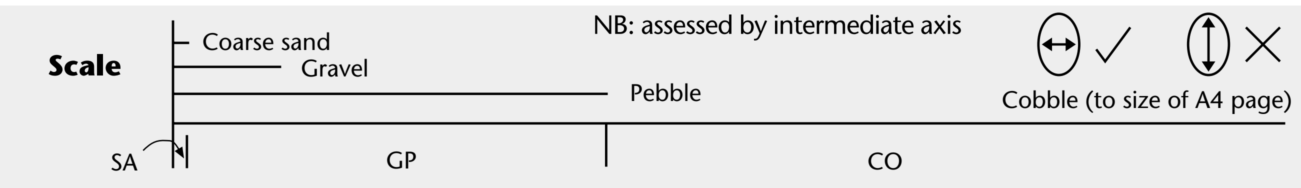
CV = culverted
RS = resectioned
RI = reinforced
DA = dam/weir/sluice
FO = ford (man-made)

Channel features

NV = not visible
NO = none

EB = exposed bedrock
RO = exposed boulders
VR = vegetated rock
MB = unvegetated mid-channel bar
VB = vegetated mid-channel bar
MI = mature island
TR = Trash (urban debris)

FLOW-TYPES	DESCRIPTION
FF: Free fall	clearly separates from back-wall of vertical feature ~ associated with waterfalls
CH: Chute	low curving fall in contact with substrate ~ often associated with cascades
BW: Broken standing waves	white-water tumbling waves must be present ~ mostly associated with rapids
UW: Unbroken standing waves	upstream facing wavelets which are not broken ~ mostly associated with riffles
CF: Chaotic flow	a chaotic mixture of three or more of the four fast flow-types with no predominant one obvious
RP: Rippled	no waves, but general flow direction is downstream with disturbed rippled surface ~ mostly associated with runs
UP: Upwelling	heaving water as upwellings break the surface ~ associated with boils.
SM: Smooth	perceptible downstream movement is smooth (no eddies) ~ mostly associated with glides
NP: No perceptible flow	no net downstream flow ~ associated with pools, ponded reaches and marginal deadwater
DR: No flow (dry)	dry river bed



LEFT **Banks are determined by looking downstream** **RIGHT**

CHANNEL MODIFICATION INDICATORS

One or more of the following may be indicative of resectioning:

1. Uniform bank profile
2. Straightened planform
3. Bankfull width/bankfull height ratio <4:1
4. Uniform/low energy flow-types
5. No trees/uniformly-aged trees along bank
6. Intensive/urban land-use

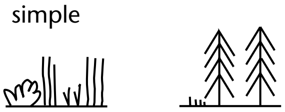
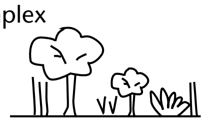
LAND-USE WITHIN 5m OF BANKTOP (SECTION F) & 50m (SECTION H)

BL = Broadleaf/mixed woodland (semi-natural)
BP = Broadleaf/mixed plantation
CW = Coniferous woodland (semi-natural)
CP = Coniferous plantation
SH = Scrub & shrubs
OR = Orchard
WL = Wetland (e.g. bog, marsh, fen)
MH = Moorland/heath

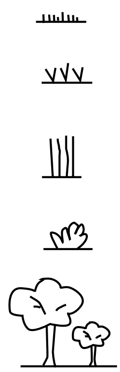
AW = Artificial open water
OW = Natural open water
RP = Rough unimproved grassland/pasture
IG = Improved/semi-improved grassland
TH = Tall herb/rank vegetation
RD = Rock, scree or sand dunes
SU = Suburban/urban development

TL = Tilled land
IL = Irrigated land
PG = Parkland or gardens
NV = Not visible

BANKTOP AND BANKFACE VEGETATION STRUCTURE To be assessed within a 10m wide transect (SECTION F)

bare	B	bare earth/rock etc.
uniform 	U	predominantly one type (no scrub or trees)
simple 	S	two or three vegetation types
complex 	C	four or more types

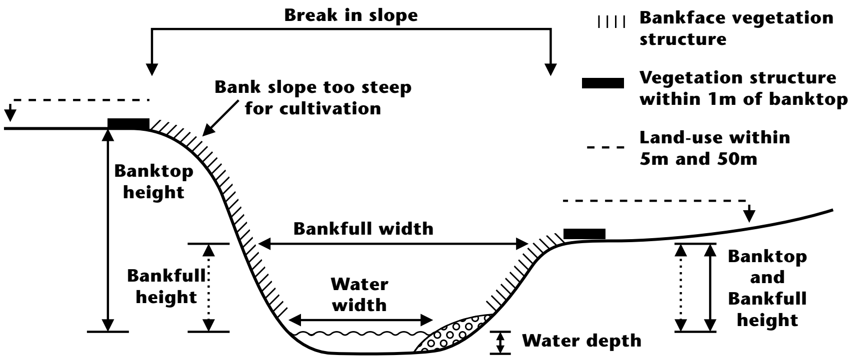
vegetation types



Channel dimensions guidance (Section L)

- Select location on uniform section.
- If riffle is present, measure there. If not, measure at straightest and shallowest point.
- **Banktop** = first major break in slope above which cultivation or development is possible.
- **Bankfull** = point where river first spills on to floodplain.

Cross-section of channel showing definitions used to define where spot-check recording and channel dimensions measured



Ecological Mitigation Plan

West Southall Development Site, London

thinking beyond construction

ECOLOGICAL MITIGATION PLAN

FOR THE

WEST SOUTHALL DEVELOPMENT SITE

FOR

NATIONAL GRID PROPERTY

Reference: E000357 Southall MIT R01 PXJ				
Issue:		Prepared by:	Reviewed by:	Verified by:
V1	Jan 06			
V2	Feb 06			
V3	Jan 08			
V4	Mar 08	**Dr Paul Joyce** Senior Ecologist	**Duncan Smith** Senior Ecologist	**Dr Greg Carson** Associate Ecologist
V5	Jul 08			
File Ref: H:\Data\Projects\E00001 - E01000\E00357 Southall Gasworks\4004\E00357\Environmental Statement\2007 Environmental Statement\Ecology\Ecological Mitigation Plan\E000357 Southall MIT R01 PXJ.doc				

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CONTENTS

EXECUTIVE SUMMARY

Site Location	West Southall, London. A former Gas Works owned by National Grid Property close to Minet Country Park, the Yeading Brook and Grand Union Canal.
Development actions/ecological receptors and mitigation	**Storm drain diversion/Yeading Brook Enhancement** – to allow construction of the Pump Lane link road and associated bridge. *Mitigation*: Opening up and naturalisation of banks, creation of a more natural stream bed, set back abutments to allow movement and migration. **Bridge Crossings** – to allow vehicular access to the site from Pump Lane and foot access from Minet Country Park and at Springfield Road. *Mitigation*: Mammal tunnels and fencing, vegetated buffer and abutments set back at least 4m from water courses, bat nesting boxes within the structure. **Shading** - from buildings and bridges on the water courses. *Mitigation*: Buildings which will be set back from the canal edge, impacts will be intermittent. **Flood Compensation Hollow** – for balancing flows and prevention of floods. *Mitigation*: Low level planting and management for habitat enhancement. **Bats** – potential impacts due to habitat fragmentation and disturbance. *Mitigation*: Controlled lighting and provide bat boxes on bridges. **Breeding birds** – damage to scrub habitat. *Mitigation*: Provision of nesting sites and boxes (eg for swifts, kingfishers) for breeding birds. Inclusion of variety of trees to provide habitat. **Reptiles** – may be impacted during bridge construction. *Mitigation*: Translocation of reptiles from construction areas. **Landscaping** – Main Site and impacted areas of water course banks are habitats for giant hogweed and Japanese knotweed. *Mitigation*: Suppression/control of invasive plants and ecologically minded landscaping of the new development.

1.0 INTRODUCTION

White Young Green Environmental (WYGE) was commissioned by National Grid Property to prepare a detailed ecological mitigation plan for the West Southall development in west London.

This plan relates to the proposed mixed use redevelopment of the former gas works site and specifically its associated access points crossing the Yeading brook corridor, and details the measures and enhancement schemes that are required to mitigate for identified impacts upon ecological receptors. Few mitigation measures have been recommended for the Main Site which is mainly hard standing, however protection of valuable trees and border habitats, along with removal and control of the invasive plant Japanese knotweed (*Fallopia japonica*) will be carried out. These have been discussed in the site EcIA.

1.1 Site description

Land use within the development area currently consists of an extensive vehicle parking and storage compound that occupies the Main Site with a 2-3m high security fence on its boundary (except along the railway to the south where a lower fence and embankment are present). Most habitats within these areas are ephemeral and comprise opportunistic species in addition to dense scrub at the periphery. The land at the extreme eastern part of the site consists of dense scrub. What we understand to be regular spraying of vegetation with herbicides has resulted in limited floral diversity.

To the north-west of the Main Site lies Minet Country Park which is owned and managed by the London Borough of Hillingdon. Additionally, there are two watercourses: the Grand Union Canal and the Yeading Brook, along with a storm drain channel from the north. The land situated between the Grand Union Canal and the Yeading Brook, referred to in the west portion as the Minet Tip, is owned and managed by British Waterways. Although these features and land uses are primarily beyond the boundaries of the main development area, they do form part of the areas considered for the proposed access roads and bridges, and are considered in overall area context.

An access road (Pump Lane Link Road in the west) is proposed along with two pedestrian footbridges (Minet Country Park Footbridge and Springfield Road Footbridge) crossing from the Main Site to the Country Park.

1.2 Background

Following the previous 2006 submission of detailed planning applications for the access roads and footbridges, the Environment Agency (EA) sustained an objection primarily in relation to the need for multiple crossing points, but also sought further clarification in respect of flooding and enhancement of biodiversity. Since then, consultation has been undertaken within the project team and with the EA to establish appropriate design to mutual agreement relating to these aspects.

The former culverting of the storm drain as part of the proposals for the Pump Lane link road junction was also historically of key concern, and the scheme previously included a 50m (approx.) culvert of the existing concrete storm drain channel. Taking into consideration the views of the EA, the previous surveys and assessments undertaken and feasibility of alternative options, two alternative approaches were proposed for mitigation of potential impacts associated with the Pump Lane Junction to the south of Minet Country Park:

- Diversion of the storm drain to reduce the length of the culvert to 23m.
- Extensive enhancement of the existing storm drain, Yeading Brook and certain habitats associated with Minet Country Park.

Following a number of discussions, the EA indicated their preference for a diverted storm drain in order to reduce the length of culvert and in turn reduce shading impacts upon the storm drain.

More recent design developments propose that the culvert could be removed entirely giving an open channel crossed only by bridges where necessary. This ecological mitigation plan outlines the provisional details of this new channel and other associated measures, and secondly assesses any adverse ecological impact associated with these new proposals.

The EA's objections formerly relating to the proposed road bridge crossing at Springfield Road (a footbridge is now planned) were primarily related to the positioning of the bridge crossing, the amount of shading of the water courses, and fragmentation of habitats and wildlife corridors. These concerns have been acknowledged and proposals to reduce and mitigate for these impacts by the use of a light structure footbridge only, have been provided.

The Environment Agency also objected in principle to the proposed footbridge crossing to Minet Country Park. The project team have provided justification for this crossing, and responded to the Environment Agency's needs for certain features to be built into the design in order to mitigate for impacts on ecology. This mitigation plan details proposals to meet these requirements.

This plan also details how mitigation will be applied in order to reduce or eliminate significant impact upon the ecology of the Main Site and other areas affected by the development, to provide, where possible, a negligible residual impact.

1.3 Report conditions

For a detailed review of the extent and limitations of this report, attention is drawn to the report conditions in Appendix A plus those detailed in the original accepted services offer letter.

1.4 Overall plan of mitigation and enhancement

An outline map showing mitigation and enhancement is included in Appendix B.

2.0 STORM DRAIN DIVERSION

2.1 Channel specifications

It is proposed that the existing storm drain engineered concrete channel will be diverted, as part of the development of the Pump Lane link road. The replacement channel will be natural in form and have variable banks with an average slope of 1 in 3, on both sides made from ‘natural’ substrates other than concrete. Any hard obstructions will be removed up to 1m below the surface level of the slope. The ground will be then covered with topsoil and a biodegradable geo-textile or buried armour system for erosion protection, unless this is deemed unnecessary as a result of optimal timing for the planting/seeding. The slopes will be seeded with a native (preferably locally obtained) grass mix that is suitable for wetter conditions.

The channel bed will be constructed of a similar substrate to the slopes, but incorporating existing substrate if appropriate. A firm clay bed will underlie this. If appropriate, gravel will be introduced to the substrate so that the bed material replicates that of a natural channel.

In order to provide natural toe protection at the base of each slope, pre-planted coir pallets or rolls will be staked to the bed of the river to provide a wet and vegetated shelf. This will protect the soft banks from erosion and provide opportunities for natural siltation and vegetative re-colonisation. These coir shelves will be pre-planted with native emergents prior to positioning so that the plants have a well established root system. The coir shelves will be positioned at a height so that they remain wet throughout the year i.e. below or on the MSWL of the channel. It is proposed that these coir shelves will be between 0.5m and 1m wide, varying along the entire length of the channel, thereby creating a soft meander and in turn a varied flow (albeit very slow).

The bed of the channel will be flat, but vertical variation will be created through the use of coir shelves at different depths. This will maintain flow at times of low discharge by confining water to a narrow channel, but allowing overflow as discharge increases to a wide channel.

Where the channel bends additional toe protection will be necessary to cope with periodic fast storm flows. Rock armour will be used, albeit kept to a minimum, and buried where possible in order to allow the channel to develop a natural profile. Additionally, at these points of increased erosion, loose dump rip rap will be placed along the bed that will enhance bed substrate diversity as well as protection from erosion.

At the point at which the new channel begins, the concrete storm drain will end and the soft banks will gradually decline in height. The banks joining the storm drain will be profiled so that they gradually meet the 1 in 3 slopes of the new channel. Additional toe protection at the start of the new channel may be required.

2.2 Storm drain backwater

The abandoned storm drain channel is to be retained in part from the new southern embankment of the new road up to the point where it meets with the Yeading Brook downstream; having been identified as a surface run-off attenuation area from the new road. As such, it is to be blocked off at each end with an overflow pipe that allows excess water to pass into the Yeading Brook at the southern end of this channel.

A reed bed will planted at the northern end of this channel at the point where the surface-run off from the new road enters the channel. This will filter particulate pollution and act as a fixed-film filter with in-built sedimentation. Semi-aquatic vegetation will be allowed to naturally colonise the attenuation area and some planting will be implemented to make the engineered drainage structures more ‘natural’.

This sheltered aquatic feature will diversify the range of organisms and habitats along the river corridor.

2.3 Channel monitoring and management

Ongoing monitoring and management of the new channel will be provided to monitor the success of the feature and to maximise biodiversity benefits. Annual checks of the new river channel will be undertaken to check water flow, vegetation growth and bank erosion.

Encroachment by emergent and aquatic plants could potentially adversely affect flood conveyance in the new channel in the long-term and as such, channel management would include vegetation manipulation and clearance as and when required.

Once the details of the channel are finalised, a 5 year monitoring and management plan will be adopted for the new channel.

3.0 BRIDGE CROSSINGS AND ROAD EMBANKMENTS

3.1 Bridge abutments

These have been designed to minimise adverse ecological impact and have a minimum clearance of at least 2.7m above high water level, more where practical, therefore minimising shading impacts upon the water course below.

Additionally, abutments will be set back by at least 4m from the edge of the main channel bank top of each watercourse, therefore allowing continuous passage of fauna along both banks of each channel and reducing habitat fragmentation. The pathways that pass underneath each bridge will be roughly finished with a substrate appropriate for use by migratory mammals (as opposed to a smooth and artificial tarmac surface) and which may be naturally colonised by vegetation where light intensities allow.

With the above in place, the bridge abutments will not have a significant effect on the passage of animals, in particular notable river-corridor species such as bats, birds, fish and riparian mammals.

3.2 Bat roosts

Bat boxes of the Schwegler type made of woodcrete (wood chippings in a concrete matrix) will be located on bridge abutments to provide roosting space for bats. Each abutment will carry 4 boxes.

3.3 Mammal tunnels

The Pump Lane link road and associated bridge will be constructed upon a raised embankment next to the south-west corner of the Minet Country Park that may create a local barrier to migrating terrestrial animals within the immediate area. However this new embankment will be adjacent to a similar railway embankment in place for over 100 years and only a small area of scrub will be isolated. To maintain a link between this area and the Minet Country Park, a mammal tunnel (also referred to as a dry culvert) will be provided within the structure of the embankment to allow the safe passage commuting and migratory animals.

A single tunnel will be provided, located close to the central area of the embankment rather than adjacent to the watercourses where wide bank top access is already provided. It is important to ensure mammals can easily reach the tunnel, and fencing will be installed to help direct animals towards the pipe entrance. Additionally, planting will be used for the same purpose and initially trails of syrup and peanuts will be laid to bait some mammals (e.g. badgers) through the tunnels in order to habituate them to these routes.

Both plastic and concrete pipes can be used for mammal tunnels (refer to Appendix D for a typical examples). However engineering or highways constraints may dictate the size of pipe that can be used. Tunnels should be partially filled with soil to provide a natural substrate on which mammals are comfortable, necessitating pipes wider than the actual required diameters for mammal passage. Table 3.4.1 outlines minimum clear diameters needed within pipes for mammal passage.

Table 3.4.1 – Pipe diameters potentially used in mammal tunnel construction.

Diameter	Comments
600mm	The preferred minimum size as it can be used by large mammals including badgers.
450mm	This size of pipe is adequate for otters and smaller mammals.
300mm	This size of pipe is adequate for otters and smaller mammals, but should only be used for short distances.

A number of alternative tunnel configurations were considered and consultation identified a need to maximise their size as much as possible to provide opportunities for badgers if they were to colonise the area. As such, the tunnel provided will be formed from 1000mm pipes partially filled with soil and gravel to provide at least 600mm of clear diameter. These plans are considered optimal for their purpose.

3.4 Fencing

Fencing constructed from high-density polyethylene (HDPE) will be used to guide mammals to the safe passage provided under bridges and mammal tunnels. The lower edge of the fence needs to be buried underground to prevent animals digging underneath. Refer to Appendix C for two fence designs that may be adopted

4.0 SHADING IMPACTS

It should be noted that a detailed shading assessment is provided in the Environmental Statement in the application package, and specific ecological aspects only are discussed herein.

4.1 From buildings

The construction of multi-storey buildings adjacent to a water course can cause shading impacts and reduced light levels that in turn potentially have an adverse impact upon aquatic biodiversity and water quality.

Waterside buildings for the proposed development (although only at outline stage at present) have been designed with these impacts in mind and have been configured to reduce shading of the water courses.

There are a number of residential apartments between six and eight storeys high proposed for the eastern bank of the Grand Union Canal. Buildings along this boundary will be set back by at least 8m and are spaced so that shading effects will be minor and breaks in buildings will provide light to reach the canal (a comprehensive study of shading by Make Architects accompanies this plan).

4.2 From bridges

It is inevitable that bridge crossings will result in some degree of shading at certain times during the day. To reduce the magnitude of shading, bridges have been designed with relatively open structures and as high as practically feasible relative to the water level, taking into consideration other limiting factors such as structural aspects, visual and noise impacts, traffic safety, etc.

It is considered that, with these measures, the extent of shading resulting from the completed bridges is minor (refer to the associated Environmental Statement for a more detailed assessment) and will not effect the ecological integrity of the watercourses or the conservation status of any species present.

5.0 WETLAND AND NEW FEATURES

5.1 Flood channel

Storm channel opening up proposals at Pump Lane access point will create a small wetland area to the north-east of the crossing. Although this is primarily a flood channel function, the wetland feature has potential to provide positive ecological benefit.

The design and management of this feature will primarily focus upon maintaining and enhancing invertebrate populations within the locality, and other taxa which depend upon invertebrates for food (bats, birds, insectivorous mammals) and pollination (wild flowers). The wetland feature may also provide suitable habitat for the different life-stages of amphibians

The following principles will be adopted:

- The channel will be excavated with an undulating bed and the edges will be scalloped with small bays to increase edge habitat.
- Natural colonisation, rather than planting, will ensure banks are vegetated and ensure dominance of native, local species is maintained. Trees and scrub are likely to be required to provide adequate cover and protection from soil erosion.
- The edges will be shallow and gently sloping where possible.
- It will be constructed without a liner.
- The depth will vary throughout.

Once the water body has been created, it is anticipated that vegetative colonisation will occur within two years, and that minimal management will be required during this time. However, after colonisation monitoring will be required in order to ensure that the condition of the channel remains favourable for biodiversity (checking for presence of fish, aquatic invasive plants, pollution, fly tipping).

It should be noted that due to the predicted infrequency of inundation of this feature, a high water-level is unlikely to be maintained for long periods of time. As such, the channel will be ephemeral. Such channel can support specialised flora and fauna, with occasional or regular drying out providing benefit in the long term. Although drying out inevitably excludes some plants and animals (especially fish), many tolerate or require periods of drought. Water level fluctuation of 0.5 - 1m or more is normal, and the drawdown zone created by this fluctuation is one of the richest areas of a water feature (SEPA, 2003).

5.2 Wetland area on the Main Site

Current plans intend for a wetland feature being constructed on the Main Site within the Central Park area. Outline landscape plans intend this feature to provide both aesthetic and ecological value, and detailed plans of ecological enhancement will be produced describing how this will be achieved at a later stage in development.

5.3 Dry flood compensation hollow

At the request of the EA a flood compensation hollow will be created outside the flood plain to the north. This will be inundated very irregularly but will be enhanced as a clear habitat feature with riparian vegetation, a varied substrate (mud, rocks, gravel etc) and a varied habitat structure to create opportunities for wildlife. The habitat will be particularly enhanced for use by reptiles although no hibernacula will be placed to avoid animals drowning.

6.0 BATS

6.1 Lighting

Excessive lighting not only causes light pollution and consumes energy but also impacts upon the natural environment by affecting the activity rhythms of both plants and animals. Bright light may reduce bats social flight activity and cause them to move away from the illuminated area to area darker environment. Illuminating a bat roost creates disturbance and may cause the bats to desert the roost.

Bat activity associated with the proposed development is focused along the water courses, in particular the Grand Union Canal, and the peripheral areas of the Minet Country Park. As such, in order to avoid adverse impacts upon the local bat population, sensitive lighting design in line with current good practice guidelines is proposed for the Pump Lane Link Road.

The lighting will include the following design features:

- Low pressure sodium light (typical yellow lamps seen along most road sides) will be used. Light is emitted at one wavelength, contains no ultraviolet (UV) light and has a low attraction to insects*.
- The brightness of street lighting will be as low as legally permitted (to be confirmed with the local planning authority).
- The time periods during which the lighting is used will be restricted to periods of darkness only.
- The lighting will be directed to where it is needed to avoid light spillage. No upward lighting is proposed along the access roads or along the banks of the water courses. The light will be restricted to selected areas by fitting hoods that direct the light below the horizontal plane, at an angle of less than 70 degrees. Lighting columns will be limited and will direct light at a low level in order to reduce the ecological impact.
- New building will be designed to reflect good practice guidelines.

*It should be noted that brighter mercury lighting attracts large numbers of invertebrates. Whilst this may in turn attract some bat species, such enhanced light intensity would have an overall negative affect on the presence of bats. As such, in order to maintain the value of the area for all bat species, low pressure sodium lamps are considered to be the most appropriate, subject to human and road safety.

6.2 Bat box requirements

As noted previously in Section 3.2, bat boxes will be placed on bridge abutments.

7.0 BREEDING BIRDS

Refer to section 9.0 for details of restriction of vegetation removal during the bird breeding season.

It is also proposed that bird nesting boxes are installed within the areas of greenspace within the development boundaries in addition to adjacent areas, primarily within the river corridor area of the Minet Country Park.

These installations are likely to include:

- Nesting features for Swifts – these birds traditionally nest in tall buildings such as churches, but modern buildings rarely offer opportunities for nest sites. Provision of nest holes can redress the balance.
- Kingfisher nesting tubes – These features will be installed along the banks of watercourses (Yeading Brook, Grand Union Canal) where the condition of the bank is sub-optimal for nesting, but within their local range.
- Standard small bird boxes.

8.0 REPTILES

Reptiles are known to be present within the Minet Country Park, including the belt of land between the Yeading Brook and the Grand Union Canal at the south of the park in particular. No suitable habitat is present on the Main Site, and the proposed link road to the west of the site (Pump Lane) is not considered to impact upon areas that support reptiles. However precautionary measures will be undertaken in order to deliver best practice during the construction phase.

If reptiles are observed during construction, a responsive reptile translocation program will be undertaken prior to construction of the link road and footbridges according to standard guidelines (HGBI, 1998). Reptile-proof fencing will be installed around the construction areas prior to commencement and artificial refugia (corrugated tin, roofing felt and/or carpet tiles) will be laid at a density of around 100 per ha. Refugia will be checked each morning and/or afternoon during appropriate weather conditions by an experienced ecologist. Reptiles may be captured in almost all weather conditions where temperatures are above 10˚C. To ensure the survival of released animals, reptiles should not be translocated and released into new receptor sites during very wet, cold and/or windy conditions. Optimal conditions for capture are when the air temperature is low, but with at least intermittent or hazy sunshine and little or no wind, the ideal months being around April, May and September.

Any reptiles found will be captured and placed outside the construction area within the Minet Country Park close to the flood compensation hollow in areas that are considered optimal habitat.

It is anticipated that very low numbers of reptiles will be captured due to the nature of the habitat within the construction zones. The capture period should continue until there have been 10 consecutive suitable days of non-capture within each construction zone. This would take place during British Summer Time between mid March and early October (avoiding the hottest period around June, July and August) on suitable days as noted above.

Once construction is complete, the areas of bare ground would be re-instated with suitable habitats for reptiles so that, following removal of fencing, reptiles can re-colonise the original area. Habitat enhancement - hibernacula and log pile creation - will be undertaken.

It is anticipated that this translocation works will commence at least four months prior to the proposed start date of the construction phase for each access road.

In order to avoid any restrictions on the construction phase programme, it should be noted that only areas that are suitable for reptiles will undergo the above outlined procedures and not the entire footprint area of each bridge. As such, during the translocation process, areas of limited value for reptiles can be cleared first, thereby undertaking a phased approach to the works. Additionally, it should be noted that the translocation works can be undertaken a significant amount of time (one season) prior to the commencement date for construction if the reptile-proof fencing is monitored and maintained during the intervening period.

9.0 LANDSCAPING AND DEVELOPMENT FEATURES

The reader is referred to detailed landscape proposals accompanying this report.

9.1 Vegetation removal

Due to the high potential of the vegetation within limited areas of the main site and each of the road access zones to support nesting birds, all scrub and tree removal are planned to be undertaken outside of the bird breeding season. As such, significant tree or scrub removal will be avoided between March and August.

Due to unforeseen circumstances, there may be instances when vegetation removal will be required during the active breeding season. If this is the case, then an experienced ecologist will check the vegetation for nesting birds immediately prior to removal. If nesting birds are identified during this time period, then the area, along with an adequate buffer zone, will be left untouched until the young have fledged, unless agreed appropriate with an qualified ecologist.

Brash and cut debris arising from the vegetation clearance will be removed prior to the active nesting season as many birds are known to utilise these materials for nesting.

Additionally, the specification report for Existing Tree Removal/Clearance, Retention and Protection (produced by Capita Lovejoy for the development and accompanying this plan) will be adhered to by the appointed contractor during vegetation clearance works. Details of the measures adopted are summarised below:

- All tree/hedge and undergrowth removal will be undertaken by an experienced arboricultural contractor
- Where necessary, trees shall be removed in sections to avoid damage to any vegetation that is to be retained
- All arisings resulting from the removal of the vegetation shall be disposed of offsite (although it is recommended that some are retained for placement within the Minet Country Park as log/brash piles for reptiles).

9.2 Use of native species

Native species will be used within the landscaping scheme associated with the site where possible, however further specific planting details are to be confirmed. However, the majority of vegetation will comprise native species unless there are overriding landscape and amenity reasons dictating otherwise.

9.3 Retention of trees

Where possible, individual trees and tree lines will be retained as part of the development proposals where remediation measures are not required and where they provide landscape, amenity and biodiversity benefits. The following measures will be adopted to ensure the protection and vigour of the retained vegetation:

- No branches shall be lopped or roots severed from growing retained trees.
- No soil, spoil, demolition materials or rubbish shall be stored within the root-spread of existing trees.
- No bonfires will be lit within the zone of influence of retained trees.
- Any un-intentional damage or destruction of retained vegetation will be replaced and/or made good on a like for like basis.
- Vehicles will not be tracked over the root spread of retained trees.
- All vegetation that is to be retained will be protected by protective fencing (in accordance with the requirements of BS 5837) which shall be located as indicated on the Tree Retention/Removal Plans, outside the perimeter of the canopy spread, except where existing structures are within this root spread area.
- Tree protective fencing will be erected prior to the commencement of any works and will be maintained until either completion of the development or implementation of landscaping works within those protected root areas.
- No level changes (soil movement) will be undertaken within these protected tree root areas unless clearly specified as part of any relevant detailed consent.
- Excavation within the root spread of retained trees will be undertaken by hand and tree roots greater than 25mm in diameter will not be cut or damaged.

9.4 Urban greenspace provision

The Main Site development is to include a network of open spaces to meet the needs of residents and to create an attractive environment with biodiversity benefits.

Although plans are at outline stage, a spine of green space runs through the the site. This creates a green link and wildlife corridor from the canal to the Northern Park and onwards to the Eastern Gateway to the site. Additionally, landscape fringes are proposed along the railway in the south-western part of the site as well as between the southern boulevards and the single remaining gas holder. These will be planted as wildlife refuges and green corridors where not used for public recreation use. The small parks provided within 400m of each residence are scattered throughout the site and provide additional linkages of natural habitats for wildlife, in particular for birds, invertebrates and commuting bats.

Development proposals include outline proposals for the provision of ’green walls’, those which either include structural components allowing plant colonisation or vessels for planting retrofitted to the wall (eg gabion baskets). The installation of green walls is a relatively new approach and, coupled with appropriate monitoring, the work undertaken will assist in furthering understanding of this innovative technique.

9.5 Screening

Impacts from the Pump Lane access road to the west of the site are predicted, given increased traffic levels will result from trips into and out of the development. Consequently landscaping associated with this area will provide enhanced screening through the planting of trees and hedgerows to offer a buffer zone between road traffic and existing habitats of value, particularly associated with Minet Country Park and the banks of the Yeading Brook and Grand Union Canal.

This landscaping will incorporate native plants so that it provides a varied vertical structure and well-established margins to maximise biodiversity benefits.

9.6 Embankment planting

The proposed access roads and bridges will result in some removal of vegetation during their construction phase. This will include the footprint area for the bridges but additionally the temporary construction area that is required for access to the new structures.

Following the completion of the access points, landscaping will be undertaken using native vegetation of a similar composition to that which was lost. This will include the planting of whips, young trees and areas of dense and scattered scrub. Low level and sparse planting will be avoided. This is particularly important along the banks of the existing (and newly bridged) watercourses that are currently used as migratory wildlife corridors. The replacement planting will be undertaken right up to the base of the bridges, therefore providing shelter and protection, as well as cover for emerging mammals (see above) and commuting routes for bats.

9.7 Removal of invasive species

We understand management and control measures are being undertaken both on the Main Site and along the banks of all three water courses in order to arrest the further spread of invasive plants (Japanese knotweed and giant hogweed). However both are still heavily predominant on the Yeading tip.

At the time of writing current methodologies being undertaken were unavailable and consequently the following details are a proposed method for future removal within the application areas.

A mixed strategy of a number of eradication techniques should be used depending upon the temporal, financial and spatial constraints associated with each construction zone. Where possible, a long-term, sustainable spraying regime would be undertaken of targeted areas with bi-annual spraying for a minimum of 4 years. On-going monitoring of the site will ensure the efficacy of this regime. The management techniques would be undertaken in accordance with the Environment Agency guidelines and code of practice.

Given the timescale of development this approach may not be possible, primarily due to time constraints, and a number of other techniques can be adopted. These are likely to include a degree of excavation and treatment on or off site and potential burial.

Due to the dynamic nature of watercourses and their interaction within the landscape up and down stream, complete and permanent eradication of invasives from the river corridor is often not feasible as fragments and/or seeds of these plants are easily transported by the water, frequently re-infesting areas downstream. However, a long-term suppression and control regime can minimise the spread of these plants and allow native vegetation to recover.

10.0 MONITORING

Post-construction monitoring will include:

- An annual bat activity survey of the bridge crossings over the three water courses and the development site itself;
- An annual reptile status survey of any reptile populations adjacent to the construction zones of the proposed access points within Minet Country Park;
- An annual badger activity survey of Minet Country Park, particularly focused upon any severance effects on badger trails as a result of the bridge crossings and access roads;

All of the above survey work will be undertaken in accordance with standard methodologies and at the appropriate time of year.

11.0 YEADING BROOK ENHANCEMENTS

This water course flows to the north of the Grand Union canal and separates the Minet Country Park from the Minet Tip. Although confined by revetments to the east and west, the brook follows a relatively natural course while passing the Main Site and Minet Country Park. The brook has a history of modification and has been straightened in places and also dredged, which in turn has lowered its value for biodiversity. Invasive species control measures are also understood to have taken place. The following measures are proposed to enhance the biodiversity value of the Yeading Brook in certain key areas between the proposed Pump Lane and Springfield Road bridges.

11.1 Overhanging vegetation thinning and light penetration

The course of the Yeading Brook is overgrown in many places by trees and bramble which prevent riparian vegetation development by shading these plants out. Shading vegetation will be selectively thinned to open up the river channel to sunlight and encourage riparian vegetation development.

11.2 Improvement of streambed

Currently the bed of the Yeading Brook is over-deepened by dredging creating low flows and encouraging silt deposition. This is turn lowers the value of the brook for fish and invertebrates which mainly rely on gravel patches for spawning and shelter.

Gravel will be added to the water course to raise the level of the stream bed and consequently increase flows, preventing siltation, and providing habitat for invertebrates and fish. The type of gravel (eg size, composition) will aim to replicate what would have been found naturally in the stream before dredging, and consultation with the Environment Agency will be undertaken to establish this.

However, it should be noted that the catchment in which the Yeading Brook flows is highly urbanised and thus subject to volatile flows during times of high rainfall. Flows are not moderated and fluctuate from low discharges with slow flow rates to high discharges with fast flow rates quickly. During times of high discharge deposited gravel may be washed down stream, and a feasibility study with advice from the Environment Agency will be conducted to determine if deposited gravel will remain within the brook during floods. If this study shows gravel will not be retained in the channel then further consultation with the Environment Agency will be undertaken to determine any further streambed improvements that could be implemented.

11.3 Flow deflectors

Several flow deflectors will be installed in straightened sections of the brook to create habitat diversity for fish and invertebrates and provide sheltered sections for the development of riparian vegetation. Due to the high discharges associated with storm flows in the Yeading Brook, deflectors will need to be created from stone rather than wood (as with lower energy systems such as chalk streams) to allow them to resist currents.

11.4 Improvement of channel profile diversity

Due to dredging and other works on the brook in the past, its banks are steep and vertical in places. This presents problems for the development of marginal riparian vegetation as there is a stark interface between land and water. In certain suitable areas (to be determined through consultation with the Environment Agency and A Rocha, who manage the site for Hillingdon Council) the banks of the brook will be re-profiled to provide a slope down to the water rather than steep drop. This will facilitate development of riparian vegetation and further enhance habitat diversity in the area.

Buried gabion baskets planted with a variety of aquatic vegetation will be placed along the water’s edge to encourage development of a riparian border and prevent erosion in the short term. In the longer term plants such as common reed *Phragmities australis* will provide effective protection of river banks from storm flows.

Also, in-line reedbeds will be planted in certain areas (to be determined in consultation with the Environment Agency) to create a diverse riparian vegetation structure within the brook.

12.0 REFERENCES

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APPENDICES

Appendix A – Report Conditions

WHITE YOUNG GREEN ENVIRONMENTAL LTD

REPORT CONDITIONS

West Southall - Ecological Mitigation Plan

This report is produced solely for the benefit of National Grid Property and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This document is prepared for the uses stated in the report and should not be used in a different context without reference to WYGE. In time, improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of WYGE using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to WYGE by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

Whilst skill and care have been used, no investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather related conditions.

Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the how representative the data used by the model is, and assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicated in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions.

The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYGE accept no liability for issues with performance arising from such factors.

Appendix B – Outline map of mitigation and enhancements

Appendix C – Mammal Fencing Design

Appendix D – Dry Culvert Design

THE FORMER SOUTHALL GASWORKS
Southall
London
UB3

London Borough of Ealing

Archaeological desk-based assessment

June 2008

REGISTERED IFA ORGANISATION

MUSEUM OF LONDON

Archaeology Service

THE FORMER SOUTHALL GASWORKS
Southall
London
UB3

London Borough of Ealing

Archaeological desk-based assessment

National Grid Reference: 511730 179790

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Figures

Note: site outlines may appear differently on some figures owing to distortions in historic maps. North is approximate on early maps.

Executive Summary

RPS on behalf of National Grid Gas (NG Gas) has commissioned the Museum of London Archaeology Service to carry out an archaeological desk-based assessment of proposed development at the former Southall Gasworks, London, UB3. The proposed mixed-use development comprises residential, business, leisure, and community uses and associated infrastructure (the 'Main Site') along with four access roads. At present there are only outline details of the proposed development, which include basement but not foundation information.

This desk-based assessment forms a baseline assessment of the site's archaeological background and potential in order to enable the development of an Environmental Statement chapter on archaeology.

The area of proposed development contains no nationally designated (protected) sites, such as Scheduled Monuments, Listed Buildings or Registered Parks and Gardens and is not located in a Local Planning Authority designated Archaeological Priority Area.

The baseline assessment suggests that, taking into account the levels of natural geology and the level and nature of later disturbance, the area of proposed development has medium archaeological potential for early prehistoric remains. Palaeolithic remains and artefacts have been located within the Main Site and in the surrounding area, and at least one possible kill site is identified in the vicinity. The area also contains areas of alluvial floodplain, which may contain environmental and geoarchaeological remains which could be used to reconstruct the palaeoenvironment. There is low potential for archaeological remains of the Roman, early and later medieval periods, when the area of proposed development lay in common fields. There is a medium to high potential for archaeological remains of the post-medieval period.

The proposed mixed-use development comprises residential, business, leisure, and community uses and associated infrastructure. The principal ground impacts of the will derive from ground remediation works (in response to contaminated land issues), basement construction, and piling.

1 Introduction

1.1 Origin and scope of the report

1.1.1 RPS on behalf of National Grid Gas has commissioned the Museum of London Archaeology Service (MoLAS) to carry out an archaeological desk-based assessment of area of proposed development at the former Southall Gasworks, Southall, London UB3 (National Grid Reference 511730 179790: Fig 1). The proposal comprises the redevelopment of the former Southall Gas Works (the 'Main Site'), entailing demolition of existing warehouses and extensive mixed use development. In addition, four access routes are proposed. These comprise:

- Springfield Road Link (north of Main Site) - a proposed new link road between Beaconsfield Road and the proposed Main Site, with associated embankment and bridges over the Yeading Brook and Grand Union Canal.
- Minet footbridge (north-west of Main Site) - a proposed new footbridge over the Yeading Brook and Grand Union Canal to link the Minet Country Park with proposed Main Site.
- Pump Lane Link Road (west of Main Site) – proposed new link road between Pump Lane on the Hayes Bypass (A312) and the proposed Main Site, with associated embankment and culverts over the flood relief channel and bridges over the Yeading Brook and Grand Union Canal.
- Eastern Access (east of Main Site) - proposed new link road under South Road and transport interchange between proposed Main Site and Park Avenue, and proposed new link road between The Crescent and Randolph Road.

1.1.2 The Main Site and Eastern Access fall within the London Borough of Ealing. The three other access routes lie mostly within the London Borough of Hillingdon (the boundary between the boroughs is formed by the Yeading Brook on the western and north-western sides of the Main Site).

This desk-based assessment forms an initial stage of archaeological investigation of the area of area of proposed development and may be required at a future date in order to enable the development of an Environmental Statement chapter on archaeology.

1.1.3 This assessment relates to the below ground archaeological implications of the scheme only, and does not consider built heritage issues as they are the subject of an alternative assessment.

1.1.4 The desk-based assessment has been carried out in accordance with the standards specified by the Institute of Field Archaeologists (IFA 2001) and the Association of Local Government Archaeological Officers. Under the 'Copyright, Designs and Patents Act' 1988 MoLAS retains the copyright to this document but grants full licence to the National Grid Gas and their Agents to use in relation to the described scheme.

1.1.5 Note: within the limitations imposed by dealing with historical material and maps, the information in this document is, to the best knowledge of the author and MoLAS, correct at the time of writing. Scheme alteration may require changes to parts of the document.

1.2 Status of the area of proposed development

1.2.1 The area of proposed development contains no nationally designated (protected) sites, such as Scheduled Monuments, or Registered Parks and Gardens. Nor does it lie within a local authority Archaeological Interest Area/Archaeological Priority Area.

1.3 Aims and objectives

1.3.1 The aim of the assessment is to:

- Describe the survival and extent of known or potential archaeological features that may be affected by the proposals;
- Assess the likely impacts arising from the proposals;

2 Methodology and sources consulted

2.1.1 For the purposes of this report the documentary and cartographic sources, including results from any archaeological investigations in the close proximity of the area of proposed development and a study area around it were examined in order to determine the likely nature, extent, preservation and significance of any archaeological remains that may be present.

2.1.2 In order to set the area of proposed development into its full archaeological and historical context, information was collected on the known archaeology within a 1500m-radius study area it, as held by the primary repositories of archaeological information within Greater London. These comprise the Greater London Sites and Monuments Record (GLSMR) and the London Archaeological Archive and Resource Centre (LAARC). The GLSMR is managed by English Heritage and includes information from past investigations, local knowledge, find spots, and documentary and cartographic sources. LAARC includes a public archive of past investigations and is managed by the Museum of London.

2.1.3 In addition, the following sources were consulted:

- MoLAS – Geographical Information System for Greater London
- the MoLAS deposit survival archive - MoLAs's in-house record of archaeological; survival and geological levels.
- published historic maps and archaeological publications
- The London Society Library – published histories and journals
- Southall Library and Ealing Local History Library – historic maps and published histories
- British National Copyright Library – Ordnance Survey maps
- British Geological Survey (BGS) – Sheet 254
- National Monuments Record (NMR) – information on statutory designations including Scheduled Monuments
- RPS Planning West Southall – Masterplan - Revision 01 (24th October 2007);
- Site Investigation Report (White Young Green 2002);
- Ground Conditions Report (White Green Young 2008)
- Internet - web-published material including Local Plan

2.1.4 Given the nature and past uses of the site, it was considered that the study of aerial photographs and a site walk-over would not yield relevant information and were not conducted.

2.1.5 Kim Stabler Archaeology Adviser to the London Boroughs of Ealing and Hillingdon at the Greater London Archaeology Advisory Service (GLAAS) at English Heritage and David Morgan of Brown and Root (contracted to the London Borough of Ealing) were consulted as part of this report.

2.1.6 The degree to which archaeological deposits actually survive will depend on previous land use, so an assessment is made of the destructive effect of the previous and present activity and/or buildings, from the study of available plan information, ground investigation reports, or similar.

2.1.7 Fig 2 shows the location of known archaeological sites and finds within the study area. These have been allocated a unique assessment reference number (**DBA 1, 2**, etc), which is listed in a gazetteer at the back of this report and is referred to in the text. A full bibliography and list of sources consulted may be found in Section 10.

3 Legislative and planning framework

3.1 National planning policy guidance

Archaeology

3.1.1 Planning Policy Guidance Note 16: Archaeology and Planning (PPG16) sets out the Secretary of State's policy on archaeological remains, and provides recommendations subsequently integrated into local development plans. The key points in PPG16 can be summarised as follows:

> Archaeological remains should be seen as a finite and non-renewable resource, and in many cases highly fragile and vulnerable to damage and destruction. Appropriate management is therefore essential to ensure that they survive in good condition. In particular, care must be taken to ensure that archaeological remains are not needlessly or thoughtlessly destroyed. They can contain irreplaceable information about our past and the potential for an increase in future knowledge. They are part of our sense of national identity and are valuable both for their own sake and for their role in education, leisure and tourism.
>
> Where nationally important archaeological remains, whether scheduled or not, and their settings, are affected by a proposed development there should be a presumption in favour of their physical preservation.
>
> If physical preservation *in situ* is not feasible, an archaeological excavation for the purposes of 'preservation by record' may be an acceptable alternative. From an archaeological point of view, this should be regarded as a second-best option. Agreements should also provide for the subsequent publication of the results of any excavation programme.
>
> The key to informed and reasonable planning decisions is for consideration to be given early, before formal planning applications are made, to the question of whether archaeological remains are known to exist on a site where development is planned and the implications for the development proposal.
>
> Planning authorities, when they propose to allow development which is damaging to archaeological remains, must ensure that the developer has satisfactorily provided for excavation and recording, either through voluntary agreement with the archaeologists or, in the absence of agreement, by imposing an appropriate condition on the planning permission.

3.2 Regional guidance: The London Plan

3.2.1 The over–arching strategies and policies for the whole of the Greater London area are contained within the GLA's London Plan (Feb 2008) also include statements relating to archaeology:

> Policy 4B.15 Archaeology
>
> The Mayor, in partnership with English Heritage, the Museum of London and boroughs, will support the identification, protection, interpretation and presentation of London's archaeological resources. Boroughs in consultation with English Heritage and other relevant statutory organisations should include appropriate policies in their DPDs for protecting scheduled ancient monuments and archaeological assets within their area.

3.3 Archaeology and planning in Ealing

3.3.1 The London Borough of Ealing's Revised *Unitary Development Plan* (UDP) ('New Plan for the Environment') was adopted in 2004. The policies set out in this document determine the position of archaeology as a material consideration in the planning process and incorporate recommendations from the Department of the Environment's *Planning Policy Guidance Note 16* (PPG 16). The principal policies and statements on archaeology are as follows:

> **Section 4.9** Ancient Monuments and Archaeological Interest Areas
>
> **1**. The protection of Scheduled Ancient Monuments and their settings is required by law. Any development affecting such an ancient monument requires an impact evaluation, including an archaeological assessment where appropriate.
>
> **2**. It is the Council's intention to also protect archaeological sites, and any proposal:
>
> • must provide adequate opportunities for archaeological investigation prior to development;
>
> • must be carried out in accordance with the British Archaeologists and Developers Liaison Code of Practice.
>
> **3**. Where development would adversely affect Archaeological Interest Areas or archaeological remains, the applicant will normally be required to:
>
> Modify designs to avoid adverse effects;
>
> Design suitable land use and management strategies to safeguard any important remains, with the option to seek an agreement covering access and interpretation arrangements;
>
> Preserve in situ: where this is not feasible, appropriate provision for excavation.
>
> Where nationally important archaeological remains and their settings are affected by proposed development, there should be a presumption in favour of their physical protection. On other sites where remains are known to exist, preservation in situ can be achieved by appropriate design or location of landscaped areas. Where this is not feasible, an archaeological excavation for record purposes may be acceptable. Preservation in situ is preferred because a full excavation is expensive, time consuming and if postponed could enable more information to be obtained with improved techniques in the future. English Heritage hold the Sites and Monuments Record for the Borough and Greater London. When remains of significance are located, the Secretary of State can schedule a site.

3.3.2 The Council has designated a number of Archaeological Interest Areas in the borough. The area of proposed development does not lie within one of these.

3.4 Archaeology and planning in Hillingdon

3.4.1 The emerging Local Development Framework will eventually replace the current 'saved' policies of the *Unitary Development Plan* (UDP) ('New Plan for the Environment'), which was adopted in 2004. The policies set out in this document determine the position of archaeology as a material consideration in the planning process and incorporate recommendations from PPG 16:

> **Policy BE1:** Only in exceptional circumstances will the local planning authority allow development to take place if it would disturb remains of importance within the Archaeological Priority Areas.
>
> Para 5.2 Archaeological remains constitute the principal surviving evidence of the Borough's distant past but are a finite and fragile resource very vulnerable to modern development and land use. Once removed, that part of the Borough's physical past is lost forever. The Council considers that Hillingdon's archaeology is a community asset and that its preservation is a legitimate objective against which the needs of development must be balanced and assessed. This is confirmed in government guidance (PPG16, para 15). The destruction of archaeological remains should be avoided wherever possible and should never take place without prior archaeological excavation and record.
>
> **Policy BE2:** Scheduled Ancient Monuments and their setting will be preserved.
>
> Para 5.3 Scheduled Ancient Monuments are protected under the Ancient Monuments and Archaeological Areas Act, 1979 and the consent of the Secretary of State is required for any works that may affect such features. Under the Town and Country Planning General

Development Order 1988 local authorities are also required to notify English Heritage of any applications for planning permission which might affect a scheduled Ancient Monument. The five scheduled Ancient Monuments in the Borough are:-

- the Ruislip Motte and Bailey;
- Manor Farm Moat, off Long Lane, Ickenham;
- the moated site by River Pinn off Copthall Road West;
- Brackenbury Farm Moated Site, Breakspear Road South; and
- the Barn at Manor Farm, Harmondsworth..

Policy BE3: The local planning authority will ensure whenever practicable that sites of archaeological interest are investigated and recorded either before any new buildings, redevelopment, site works, golf course or gravel extraction are started, or during excavation and construction. Development which would destroy important archaeological remains will not be permitted.

Para 5.4 The archaeological heritage of the Borough has been incorporated in a Sites and Monuments Record, and summarised on an Archaeological Constraints Map prepared by the Museum of London and maintained by the Historic Buildings and Monuments Commission. In addition to scheduled Ancient Monuments, the Constraints Map identifies a number of 'Archaeological Priority Areas', which are shown on Fig. 4 and also the Proposals Map. These are areas in which protection of the archaeological resource will be regarded by the Local Planning Authority as a primary consideration in determining planning applications, and applicants will be required to submit a preliminary archaeological site evaluation before proposals are considered.

Para 5.5 The Constraints Map identifies further archaeological sites and findspots, and areas of geology and topography especially attractive for early settlement. These include areas of unexcavated gravels, policies for which are set out in Chapter 13. Where development may affect areas of archaeological significance or potential, both within Archaeological Priority Areas and elsewhere, the Local Planning Authority will expect applicants to have properly assessed and planned for the archaeological implications of their proposals. If the buried heritage does not require permanent preservation and is likely to be damaged or destroyed by proposed development the Local Planning Authority will seek to ensure that sites are properly investigated by a recognised archaeological organisation before development takes place.

Para 5.6 The Local Planning Authority consults the Museum of London and the Historic Buildings and Monuments Commission on proposals affecting other sites of archaeological interest, and in appropriate cases will attach conditions to planning permissions or seek to enter into legal agreements to ensure proper investigation of sites. It will promote co-operation between landowners, developers and archaeological organisations in accordance with PPG15, PPG16 and RPG3 (1996).

3.4.2 The Council has designated a number of Archaeological Priority Areas in the borough. The area of proposed development does not lie within one of these.

4 Archaeological and historical background

4.1 Site location, topography and geology

Main Site

4.1.1 The former Southall Gasworks is a 75-acre triangular plot of land bounded to the north-west by the Paddington Branch of the Grand Union Canal, to the north-east by the backs of residential housing fronting on to Beaconsfield Road, and to the south by the mainline railway to Paddington. The proposals exclude the easternmost of the existing gasometers of the Gas Holder Station in the centre/southern part of the Main Site.

4.1.2 The Main Site falls within the historic parish of Norwood (along the boundary with Hayes parish) and lay within the county of Middlesex prior to being absorbed into the administration of the Greater London Borough of Ealing.

4.1.3 The Main Site is partially derelict with areas of rough hard surfacing used for the secure storage and preparation of motor vehicles. On the north-eastern boundary of the Main Site, there are derelict allotment gardens and industrial buildings. The Main Site is generally flat with modern street level to the east side at 31m Ordnance Datum (OD). The Grand Union Canal follows approximately the 30m OD contour. The area around the gasometers is raised compared to the surrounding hard standing.

4.1.4 The Yeading Brook runs parallel to the north-western boundary of the Main Site; in some areas it is as close as 30m. According to the British Geological Survey (BGS 1993, Sheet 254), the Main Site does not lie within the alluvial floodplain, but in an area consisting of Langley Silt (commonly known as brickearth) at the top of the geological sequence, with Lynch Hill Gravel beneath. London Clay is recorded throughout the area beneath these Pleistocene sediments. Bridgland (1994) suggests that the Lynch Hill Gravel was deposited during Marine Isotope Stage 8 (dating to between 250,000 and 300,000 years ago). Dating of the Langley Silt is more complex as it was deposited on the surface of gravel deposits in the Thames and can range in age from 250,000 years old, to the end of the late glacial period *c* 10,000 years ago (Gibbard 1994).

4.1.5 In 2001 White Young Green undertook a geotechnical survey of the Main Site comprising a series of boreholes and trial pits located across the Main Site (White Young Green 2002). The results were divided up into areas which broadly reflect historic and, in some cases, present ground usage. A summary of the results (by area) is provided in Table 1 with levels in metres Ordnance Datum (m OD) and thickness in metres (m). The Areas given below were defined by the geotechnical survey report.

Table 1: Summary of Main Site geotechnical survey (White Young Green, 2002)

Area	Ground level (m OD)	Thickness of made ground	Typical thickness of made ground	Thickness of Alluvium	Top of Gravel (m OD)
A	30.0	0.2–2.0m	0.5m	0.2–0.95m	27.9–29.5
B	31.0	0.9–3.5m	1.0–2.0m	0.5–2.2m	27.5–29.9
C1	31.0	1.2–3.2m	1.0–2.0m	0.4–3.3m	27.0–29.7

C2	31.0	0.9–2.2m	0.8–1.6m	0.2–1.0m	29.7–28.8
C3	31.5	1.0–4.0m	1.75m	0.4–1.5m	27.5–30.1
D1	33.0 (N)–30.5 (S)	0.7–3.6m	1.0–1.5m	0.4–1.6 m	26.5–29.0
D2	31.0	0.8–3.2m	1.5–2.0m	0.4–0.8m	27.8–30.2
D3	32.5(NE)–31.0(W)	0.7–4.0m	1.2–1.8m	0.3–1.25m	26.76–31.7
D4	31.0	0.6–2.8m	1.0–1.2m	0.37–1.8m	27.43–30.4
D5	31.0	0.3–2.1m	1.0m	0.5–1.3m	29.0–29.8
D6	31.0	0.8–3.8m	0.2–1.2m	0.2–1.0m	27.97–29.2
D7	31.0	0.2–2.9m	1.0m	0.1–1.75m	27.6– 29.4
GW	30.0	0.2–4.0m	2.7–4.0m	–	27.21–28.75

4.1.6 The geotechnical data for the Main Site (White Young Green 2002) indicate that the natural gravel within the Main Site rises gently from 26.50m OD in the south to 30.11m OD in the north. The overlying deposit, which varies between an upper level of 29.40 and 30.41m OD, is identified as alluvium in the geotechnical report. This alluvium may be divided into two main types (Fig 10)

- An ‘orange-brown’ clay varying from soft to firm with differing quantities of gravel inclusions that is typically found on the south-central and eastern areas of the Main Site. This deposit has been identified as the brickearth from the British Geology Survey (Sheet 254).
- A grey-green clay sometimes with hues of black or brown, which may contain stones or gravel. This deposit is typically found on the south-western part of the Main Site, close to the Yeading Brook. It is possible that this is alluvial sediment of the Yeading Brook, not mapped by the British Geological Survey. Alternatively this deposit may be a form of the brickearth, perhaps stained by contaminants.

4.1.7 Above the brickearth/alluvium is a layer of made ground which varies considerably across the Main Site between 0.2–4.0m thick. The geotechnical report does not differentiate between modern made ground, containing identifiably modern inclusions such as concrete or plastic and undated made ground, which may potentially contain deposits of archaeological interest. However, examination of the borehole and trial pit logs indicates that most all of the made ground recorded is likely to be of modern origin, although the presence of archaeological remains in the lower levels cannot be excluded.

4.1.8 The Lynch Hill Gravel is one of the oldest and highest gravel terraces. This gravel deposit has produced many Lower Palaeolithic implements in the past and has a potential for *in situ* material of Lower Palaeolithic date. A number of finds in the past confirm this potential, with the discovery of Palaeolithic animal bones and flint tools (see section 4.3).

4.1.9 The Langley Silt deposits (brickearth) represents the ancient land surface from the Upper Palaeolithic/Mesolithic and any features of these and later periods would potentially be found cut into the surface of the brickearth and at the base of, and potentially within, any undated made ground.

4.1.10 Where alluvium is present (ie the south-western part of the Main Site), Upper Palaeolithic/Mesolithic would potentially be located beneath the alluvium at the alluvial/gravel interface. The alluvium also has the potential to contain a sequence of buried landscapes, including palaeoenvironmental remains, from the later prehistoric periods onwards.

Springfield Road Link

4.1.11 The area of the Springfield Road Link is at 30m OD at Beaconsfield Road, falling to 25m OD near to Yeading Brook and rising to 30m OD by the canal. The Springfield Road Link lies within open land on the Yeading Brook floodplain.

Minet Footbridge

4.1.12 The Minet Footbridge lies within open land on the Yeading Brook alluvial floodplain.

Pump Lane Link Road

4.1.13 The Pump Lane Link Road lies within open land on the Yeading Brook alluvial floodplain. The area of the Pump Lane Link Road is at *c* 24m OD in the west rising to 30m OD by the canal to the east.

Eastern Access

4.1.14 The Eastern Access lies to the east of the Main Site at *c* 31m OD at the junction of South Road and Park Avenue. The area currently comprises a residential area around South Road, The Crescent and Park Avenue and industrial land adjacent to the railway. According to the BGS, the Eastern Access lies on brickearth above Lynch Hill Gravel rather than being within the Yeading Brook alluvial floodplain.

4.2 Overview of past archaeological investigations

4.2.1 No archaeological investigations have been carried out on the Main Site, although chance finds were recovered during the construction of the gasworks in the 19th century (**DBA 1a–d**). Finds observed by antiquarians are often difficult to locate exactly, but their numbers indicate a high-level of prehistoric activity within the study area. The archaeological potential has been based on these finds as well as later archaeological investigations in the surrounding study area. Four evaluations (**DBA 5–7 & 24**), three watching briefs (**DBA 4, 5, 21**), and an excavation (**DBA 33**) have produced mainly prehistoric and palaeo-environmental evidence. At least two evaluations have produced no evidence of archaeological survival. The results of these "positive" investigations are discussed by period, below.

4.3 Chronological summary

Prehistoric period (c 500,000 BC–AD 43)

4.3.1 The study area has produced evidence for prehistoric activity. The Lower and Middle Palaeolithic saw alternating warm and cold phases and intermittent perhaps seasonal occupation. During the Upper Palaeolithic (*c* 40,000–10,000 BC), after the last glacial maximum, and in particular after around 13,000 BC, further climate warming took place and the environment changed from being a treeless steppe-tundra to one of birch and pine woodland. It is probably at this time that this part of England saw continuous occupation. Subsequent erosion has removed many of the land-surfaces on which Palaeolithic people lived and hunted and consequently most Palaeolithic finds are typically residual (located outside the context in which it was originally deposited), and often discovered during gravel extraction.

4.3.2 According to the GLSMR, “handaxes and elephant bones” were found within the north-eastern area of the Main Site (**DBA 1d**). During excavations for gasholders in the 19th century, the bones of an elephant and associated Lower Palaeolithic (Acheulian) handaxes were uncovered (Brown 1896). The GLSMR entry is taken from Wymer (1968, 261), who reports that “several palaeoliths”, “teeth and bones of elephant” and “a quartzite hand-axe close to the underlying London Clay” were found at the Southall Gasworks in 1890. In the same entry, Wymer relates that Brown recorded 25 ft of gravel and some teeth and bones of elephant.

4.3.3 The GLSMR also reports that flint tools were found within the northern part of the Main Site (**DBA 1a–1b**), while towards the south (just outside the Main Site boundary by the gasholder), several Palaeolithic flint implements, including six handaxes, and more elephant bones were discovered during the 19th-century excavations for one of the gasholders (**DBA 3**) (Brown 1889). In total, Roe (1968, 261) reports that 21 hand-axes and 6 flakes were recovered from the gas works. The GLSMR notes that these finds may possibly be a “kill site”. Another kill site is known from Norwood Lane, *c* 1.5km from the south-eastern corner of the Main Site (outside the study area), where an apparently complete mammoth skeleton was found in a brickearth deposit at a depth of 13ft (4m) and in close proximity to stone tools (Brown 1889; GLSMR no 050024).

4.3.4 In common with other antiquarian references, these entries and their interpretation present several problems. The flint tools (**DBA 1a-1b**) are given as a 4-figure grid reference which place them just inside the site boundary, but refer to a 1km radius of the given coordinates. The GLSMR entry refers to brickfields in Southall, of which several are shown on the historic mapping, but makes no specific reference to the gasworks. Whilst it cannot be wholly discounted that these artefacts were from the gasworks, it cannot be said with any certainty that this is the case. In addition, the reference to Wymer (**DBA 1d**) appears to be a duplication of the GLSMR entries relating to the gasholders to the south (**DBA 3**) but given different grid co-ordinates – there are no gasholders in the location given in Wymer. **DBA 3** is confusing in itself as the grid references given relate to both sets of gasholders. In view of the fact that the eastern gasholders are of 1930’s vintage, it appears likely that this entry relates to the western gasholders.

4.3.5 The Wymer reference (**DBA3**), and consequently the GLSMR entry, may be superficially misleading in this respect. Brown 1896 reports on “some large excavations” made during the preceding three or four years for gas-holders in Southall. From these excavations “several teeth and the bones of *Elephas primigenius*” were found at about the 100 foot contour, but does not specifically mention the discovery of palaeoliths. He notes that the site is “two and a half to three miles N.W of the spot where remains of the hairy Elephant and other bones were associated with flint implements, 13 feet from the surface at Norwood Lane, and described by me.” He references his previous paper in the Proceedings of the Geological Association (Brown 1889) at this point. This reference is to “apparently the greater portion, if not the whole skeleton, of a mammoth associated with human relics” in “extensive drainage works” in Southall (i.e Norwood Lane).

4.3.6 In the next paragraph of Brown 1896 he then discusses flint implements found “in these excavations”, and herein may lie some confusion. Wymer has interpreted these finds to relate to the gasworks site, but it is not explicit that Brown was referring to two assemblages. Two implements are quoted as being found "very close to the London clay" and at "22 feet from the surface" respectively, both are described as being "very much abraded" and "battered almost all over by contact with other stones".

4.3.7 In contrast, the Norwood artefacts relate to 10 implements described in detail with the majority being recorded as being unabraded or with only slight abrasion, and Brown notes that "….most of them show little effect of rolling with the stones of the gravel, and have not been carried far, if removed at all". None of the artefacts described appears to tally with the descriptions given in the 1896 paper in terms of size, material or condition. In addition, the Norwood artefacts are described as being recovered at between 10-13 feet depth as compared to the 22 feet depth described in 1896. On balance, therefore, it would appear that assemblages are being described from both locations, and that the Wymer reference, and consequently the GLSMR is correct.

4.3.8 The abraded condition of the Southall finds would appear to cast doubt on the identification of the finds as being from a possible 'Kill Site', but it would appear likely that these two artefacts were recovered from the excavations for the gasholders in the 1890's, as reported by Ross and Wymer, and consequently in close rather than direct association with the faunal remains; which is in itself significant.

4.3.9 The Mesolithic hunter-gather communities of the postglacial period (*c* 10,000–4,000 BC) inhabited a still largely wooded environment. Water sources, such as the Yeading Brook and the River Crane to the south, would have been especially favoured in providing a predictable source of food (from hunting and fishing) and water, as well as a means of transport and communication. As mentioned above, evidence of human activity is largely characterised by finds of flint tools and waste rather than structural remains. A Mesolithic axe (**DBA 2**) and flint borer (**DBA 17**) were retrieved within the study area.

4.3.10 The Neolithic (*c* 4000–2000 BC), Bronze Age (*c* 2,000–600 BC) and Iron Age (*c* 600 BC–AD 43) are traditionally seen as the time of technological change. With the establishment of farming and settled communities, forest clearance occurred for the cultivation of crops and the construction of communal monuments, resulting in the increasing population putting pressure on available resources throughout each period.

4.3.11 Evidence for later-prehistoric occupation in the study area was found during the 2005–6 excavations at Western International Market (**DBA 33**), *c* 700m south-east of the Main Site. The investigations revealed a group of Middle Bronze Age cremation burials as well as an intense concentration of postholes dated by finds to the Late Bronze Age to Middle Iron Age periods. The earliest feature was a ring ditch (the ploughed-out remains of a round barrow), probably of Late Neolithic or Early Bronze Age date, which was located directly to the north of the concentration of cremation burials. Twenty further cremations were excavated in this area during the excavation phase. An east-west aligned ditch to the south of the cremations may have marked the edge of the cemetery, though one cremation was located to the south of this. Further ditches may also have been later prehistoric boundary markers, although there also appears to have been a sub-rectangular enclosure in the south-west quadrant of the area investigated, marked by small linear gullies, probably of Late Bronze Age or Early Iron Age date (source: PCA website).

4.3.12 A Late Bronze Age founders' hoard was found to the north of the Main Site and, although its exact location is unknown, it was associated with excavations in the brickfields and may have come from the Main Site itself (**DBA 1c**). As with the Palaeolithic finds (4.3.4 above) this reference is given to the nearest kilometre, and may not relate specifically to the gasworks site, but to the area generally. Further prehistoric activity was identified at the Westmount Centre, *c* 650m north of the Main Site (**DBA 24–26**). An archaeological evaluation there in 1998 revealed undiagnostic prehistoric finds, one small fragment of pottery, three broken flint flakes, and 13 pieces of burnt flint.

4.3.13 Linear ditches, a probable field system have been identified from aerial photographs *c* 600m west of the Main Site (**DBA 38**). Although undated these may be of prehistoric date. In addition, an oval enclosure and linear ditches were identified on aerial photographs to the north of Beaconsfield Road, *c* 200m north-west of the Main Site (**DBA 39**) (now removed by development). Although undated, these too may have been of prehistoric date and were recorded in the area of Springfield Road Link.

4.3.14 The Study Area lies in a generally flat landscape on brickearth capped terrace gravels close to a water source. These conditions are found across much of the west London landscape. Recently archaeological excavations to the west of the River Crane at Cranford Lane (Elsden 1996), Imperial College Sports Ground, Sipson Lane (Wessex Archaeology 1998) and in advance of the construction of Terminal 5, Heathrow (Andrews et al 1998) have revealed extensive Middle to Late Bronze Age field systems and associated dispersed settlement. Similar activity may be present within the Main Site, where it has not been removed by later activity.

Roman period (AD 43–410)

4.3.15 There are no known sites and finds dated to this period within the Main Site and Study Area. The route of the Roman road from London to Silchester lies *c* 5km to the south of the Main Site. Archaeological investigations to the west of the River Crane at Cranford Lane (Elsden 1996), Imperial College Sports Ground, Sipson Lane (Wessex Archaeology 1998), *c* 4.5km to the west, and in advance of the construction of Terminal 5, Heathrow (Andrews *et al* 1998), *c* 5km to the south-west, have revealed extensive Roman field systems including an enclosure at Cranford Lane. The undated oval enclosure and field system discussed above may potentially have been of Roman date.

Early medieval period (AD 410–1066)

4.3.16 Following the withdrawal of the Roman army from England in the early 5th century AD, the whole country fell into an extended period of socio-economic decline. Around the 9th and 10th century, the local parochial system began to replace the earlier Saxon Minster system, with formal areas of land centred on nucleated settlement served by a parish church.

4.3.17 Southall Manor and Norwood Manor, together with Hayes, were bequeathed to Wulfred of Canterbury in 830 (Weinreb and Hibbert 1995, 823). The occurrence of two Saxon place name settlements in the study area (Northcott and Southall) and several others in the vicinity is a recurrent feature in west London, where there is an abundance of documentary evidence for settlement, but until recently few material remains. Nonetheless recent excavations, at Western International Market (**DBA 33**), revealed a substantial ditch aligned north-east/south-west dated to the Early Anglo-Saxon period (*c* 5th–6th centuries AD). A rectangular post-built structure measuring *c* 25m by 5.5m was identified and also tentatively dated to this period (PCA website). A sunken-featured building of Anglo-Saxon date and an area of possible industrial activity were excavated to the south of the Anglo-Saxon ditch. This evidence is likely to relate to Cranford Manor, since the motte for the manor of Cranford is just south of the study area and *c* 200m south of the excavation.

Later medieval period (AD 1066–1485)

4.3.18 Although it was not mentioned in the Domesday Survey of 1086, a church, and presumably settlement, existed around Norwood by the 12th century (VCH *Middlesex* iv, 40–43). The church stood in the centre of the southernmost part of the manor, almost on its southern boundary, *c* 1.5km to the south-east of the Main Site.

4.3.19 In 1212, William of Southall (de Suhalle) held a knight's fee in Southall of the Archbishop of Canterbury. This was probably the origin of the manor of Southall (VCH *Middlesex* iv, 43–45), where the Main Site was located. Southall is mentioned in 1274, and in 1384 the names of 'Dormoteswell' (Dorman's or Dormer's Wells) and Northcott both occur in a court roll (ibid.). Norwood, Southall, and Northcott were settled by the 14th century and probably much earlier (VCH *Middlesex* iv, 40–43). There was also a moated manor house at Dormer's Wells, *c* 775m to the north-east of the study area.

4.3.20 The position of the settlements is likely to have been the same as in the post-medieval period: Southall in the mid-17th century appears to have clustered around the area later known as Southall Green, centring on King Street and the Green (*c* 350m south of the Main Site, where the later manor house is located – see below). In the late-16th century, Northcott lay on the main Uxbridge road, round the junction of South Road and High Street (**DBA 15**), *c* 800m north-east of the Main Site. In 1573, Northcote Field and Northcote Oaten Field are mentioned, and Southall Street is mentioned in 1580 (VCH *Middlesex* iv, 40–43).

4.3.21 The area of proposed development lay in rural land during the medieval period and fell within Southall's common fields, known later as North Field, South Field and Middle Field (see below). As communally used land, they are unlikely to have been built on. A farm and a few cottages (**DBA 13**) are known from documentary sources *c* 1200m south of the Main Site.

Post-medieval period (AD 1485–present)

<u>Main Site</u>

4.3.22 Until 1936 Southall Manor, within which the area of proposed development was located, fell within the administration of Hayes. A survey of Hayes, carried out between 1596 and 1598 for Roger, Lord North, the lord of the manor of Norwood, mentions four open fields around Southall: South Field (229 a.), North Field (201 a.), East Field (139 a.), and Middle Field (118 a.). These presumably occupied the positions they held later in the 18th and 19th centuries, when all but East Field lay in the area between the Yeading Brook and Southall Green (i.e. partly within the Main Site), with Uxbridge Road on the north.

4.3.23 Rocque's map of 1754 (Fig 3) shows the Site straddling three of the fields with no buildings: Southfield, Middlefield, and Northfield. The village of Southall Green consisted of a few houses, with orchards to the north and east, at the end of a by-road off the main London to Oxford road. This general pattern can still be observed in the Norwood Precinct Valuation map of 1821 (Fig 4), although the Paddington Canal is now shown on the map. The map shows that the North Field and Middle Field were now owned by a private individual (Thomas Parker), while the South Field was a Tithe allotment or common land.

4.3.24 The Grand Junction Canal was finished in 1796 and the Paddington branch opened in 1801 (**DBA 34**). The opening of the canal had beneficial effects on the brick-making industry, which grew in the 19th century and resulted in the extraction of brickearth from some areas of the Main Site.

4.3.25 Several GLSMR entries relate to the canal or landfill sites (possibly the infilling of extraction pits for brick making). One such area, or brick field, lies within the southern part of the Main Site (**DBA 1e**).

4.3.26 The area remained rural until the construction of the railway in 1841 (Weinreb and Hibbert 1993, 823). The Great Western Railway (**DBA 37**) was constructed along what is now the southern boundary of the Main Site, and the Grand Union Canal along the Main Site's western and north-western boundary. On the 1865 Ordnance Survey 1st edition 25" map (Fig 5), brickfields are shown within the central and eastern parts of the Main Site and to its north, where a dock is also shown but not marked as such. To the south-east, Southall Green is beginning to be developed.

4.3.27 The 1865 OS map also shows 'oil works' in the central part of the Main Site. These consisted of paraffin oil works built in the former Middlefield.. This became the Aldersgate Chemical Works in 1884 and produced a wide range of products, including medicines. The company moved to Fulham in 1918, as the Main Site was required for an extension to the neighbouring gasworks. The paraffin oil works were located next to the canal, with a dock leading off the canal to the north presumably to serve the works. To the east is a brickfield with four clay mills, for mixing and tempering clay, and there is a pond to the south. To the south of the Great Western Railway there is a brick works, which may have used the clay from the Main Site. In the northern part of the Main Site, adjacent to the canal, is what appears to be a ropewalk, where ropes were made, laid out and stretched. The rest of the Main Site was relatively undeveloped with further buildings, probably also served by the canal, to the north (see Fig 5).

4.3.28 The Ordnance Survey 2nd edition 25" map of 1895 shows the existing gasworks (Fig 6) built by the Brentford Gas Company in 1868 (Neighbour 1959). The gasworks comprised four gas holders (which still exist today) and two new docks (in the central and southern areas), all of which fall within the Main Site. The gasworks were laid out by George Trewby (Everard 1992, 328). The map indicates that the gasworks were provided with coal via a branch line off the main railway. In addition, the Aldersgate Chemical Works and the Norwood Chemical Works are shown. Two docks are marked, one to the north of the Aldersgate Chemical Works, the other in the far south-west corner of the Main Site. The earlier brickfield is not illustrated. In the extreme south-west of the Main Site is a smaller branch of the canal.

4.3.29 The map also shows that in the area to the north-east of (outside) the Main Site, residential streets had been constructed including Randolph Road and Beasconsfield Road. To the south, the Great Western Railway had been widened and Southall Station to the east had been enlarged. South of the railway, Southall Green continued to expand with a mix of residential streets and industrial works. The brickworks noted on the 1865 map had disappeared as had the clay mills on the Main Site.

4.3.30 The Ordnance Survey 3rd edition 6" map of 1904 (not reproduced) shows the adjacent residential area of Southall developing with a new road layout to the - and north-east, and what appears to be the present water tower in the south-east corner of the Main Site.

4.3.31 The Ordnance Survey 25" map of 1914 (Fig 7) shows a similar layout to the earlier 1895 map, with a few changes. To the east of the gasworks, is a football pitch and further east a cricket ground. It is unclear whether the football pitch is associated with the gasworks, but in the 1920s and 1930s social facilities for the gas work employees included a cricket pitch and bowling green to the east of the Main Site (Neighbour 1959). In the surrounding area outside the Main Site, along the southern boundary of the Main Site, the Great Western Railway has been widened with several new sidings, while there are allotments shown north of the Main Site. The area south of the railway has further developed with more residential streets and industrial units. To the north-east of the Main Site, Southall has expanded and includes several streets of terraced housing.

4.3.32 The Ordnance Survey 25” map of 1935 (Fig 8) shows that the gasworks have expanded to include the entire south-west corner of the Main Site, the areas of the former Aldersgate Chemical works and to the east of White Street where the still-standing blue gasometer was constructed. The football field has been replaced by allotment gardens although the cricket ground and bowling green survive. The northern part of the Main Site remains relatively open and undeveloped. To the north of the Main Site, Southall has continued to expand westwards and terraced housing now line most of the northern boundary. To the south of the Great Western Railway, Southall Green has similarly expanded. Only the area west of Yeading Brook is undeveloped.

4.3.33 This layout is similar on the Ordnance Survey 25” map of 1965 (Fig 9), except that additional railway tracks extend into the western part of the Main Site.New buildings have been constructed on the northern part of the Main Site, which appear to be in existence today.

4.3.34 The gasworks ceased to operate in the early 1970s, although buildings, other than the gasometers, were still standing in 1980. Since then the entire Main Site, excluding the green field to the east, has been levelled and consolidated (David Morgan, Brown and Root, pers comm 2004). The Main Site has been levelled and the docks infilled. Allotment gardens remain to the north-east.

<u>Springfield Road Link</u>

4.3.35 Historic maps show the proposed Springfield Road Link within open fields alongside Yeading Brook. The Grand Union Canal crosses the eastern end of the proposed road. The OS 25” map of 1965 shows industrial buildings in the vicinity of the western end of the proposed road.

<u>Minet Footbridge</u>

4.3.36 Historic maps show the proposed footbridge and access road as open fields on either side of Yeading Brook. The south-eastern end of the access road crosses the Grand Union Canal.

<u>Pump Lane Link Road</u>

4.3.37 Historic maps show the area of the Pump Lane Link road was located within open fields cut by the Yeading Brook and the Grand Union Canal. The 19th-century and 20th-century Ordnance Survey maps indicate land in the area of the Pump Lane Link Road has remained open to the present day.

<u>Eastern Access</u>

4.3.38 In Rocque’s map of 1746 (Fig 3) and the Norwood Precinct Valuation map of 1821 (Fig 4) the Eastern Access is shown located in fields adjacent to the west side of South Road. When the Ordnance Survey 1st Edition 25”:mile map of 1865 (Fig 5) was produced, the southern half of the Eastern Access was occupied by a collection of buildings, probably a farm, which had been replaced by terraced houses along South Road, Randolph Road, The Crescent and Beaconsfield Road by 1895 (Fig 6).

These roads continued to be lined with terraced housing up to the present day. The octagonal water tower, which is encircled by the Eastern Access, had been constructed by 1914 and is shown on the Ordnance Survey 3rd Edition 25”:mile map of that date (Fig 7).

4.3.39 The Great Western Railway was constructed along the southern boundary of the Eastern Access in 1841. The Ordnance Survey map of 1865 shows Southall Station to the south-east and St Marylebone School beyond the north boundary.

5 Factors affecting archaeological survival

5.1 Natural geology

Main Site and Eastern Access

5.1.1 The ground level of the Main Site and Eastern Access is located at *c* 31.0m OD with some localised variation. The geology of the Main Site and Eastern Access is comprised of:

- Typically 1–2m of made ground, with up to 4m of made ground in some areas of the Main Site. There is no information on the depth/presence of made ground within the Eastern Access.
- Langley Silt/alluvium (0.2–2.0m thick) at 30.41m OD to 29.40m OD.
- The terrace gravels generally level at 27.0–29.0m OD, but may be found as deep as 26.5m OD and as high as 31.7m OD. They slope slightly down to the Yeading Brook to the west.

Springfield Road Link, Minet Footbridge and Pump Lane Link Road

5.1.2 In the area of Springfield Road Link, Minet Footbridge and Pump Lane Link Road, there is no data on the levels of natural gravel terrace deposits or for the overlying Yeading Brook floodplain alluvial deposits, although the BGS shows the floodplain alluvium to be a narrow strip close to the river and the majority of the areas appear to lie on London Clay.

5.2 Past Impacts

Main Site

5.2.1 The Main Site was undeveloped and lay in open fields until the 19th century and has since had considerable building development and quarrying. Foundations of the Gas Works in the south-west part of the Main Site (Fig 6 to Fig 9) along with the construction of associated three canal docks, service runs, and other deep installations may have extended into the terrace gravels. Any archaeological remains within the brickearth/alluvium may have been removed to the full extent of the feature or construction (Fig 10). It is possible that the underlying gravels within the areas of truncation still survive. Where constructions are shallower, archaeological remains within the brickearth, alluvium and underlying terrace gravels may survive beneath localised truncation.

5.2.2 The area of the gasworks typically contains 1–2m (up to 4m in some areas) of modern made ground partly originating in the remains of former structures and partly the result of consolidation necessary to make safe the contamination caused by the gasworks, i.e. tar tanks and dumping of waste (David Morgan of Brown and Root, pers comm., 2004). This made ground would have potentially protected archaeological remains from truncation by any activities taking place since the area was consolidated. However, it is likely that most truncation of deposits took place before consolidation.

5.2.3 The Aldersgate Chemical Works and associated buildings occupied a substantial plot as did the Norwood Works. The depth of the foundations of these works is unknown, but all foundations would have truncated any archaeological remains within their footprints to the maximum depth of the construction. If the foundations did not penetrate the terrace gravels, archaeological remains may survive within the brickearth and terrace gravels beneath the truncation.

5.2.4 Other industrial infrastructure, comprising the docks, railways and access roads would also have required a certain amount of localised ground levelling and disturbance of nearby areas during construction. This may have caused some localised truncation of any archaeological remains within the brickearth.

5.2.5 Brickfields shown on late 19th-century Ordnance Survey maps are extensive, covering much of the central/eastern parts of the Main Site. The geotechnical report (White Young Green 2002) indicates that either through construction or quarrying, the brickearth or alluvium has been removed from substantial areas of the Main Site (Fig 10). This will have removed any archaeological deposits dating from the Upper Palaeolithic/Mesolithic onwards. Removal of the brickearth and alluvium would not affect any potentially *in situ* Lower Palaeolithic artefacts occurring within the gravels. The quarry pits noted on the 1914 and 1935 Ordnance Survey maps (Fig 7–Fig 8) may have removed all underlying archaeological deposits from their footprint, including the gravels.

5.2.6 Open areas comprise three separate areas of the Main Site: a small section of the Main Site's south-western tip, and the northern and eastern parts, which have mostly never been built on. The geotechnical report (Fig 10) indicates that some of these areas have been quarried for brickearth and would therefore only have potential for Lower Palaeolithic remains.

5.2.7 In addition to the physical impacts, which will have compromised archaeological survival to varying extent, areas occupied by the gasworks, the Aldersgate Chemical Works and Norwood Works, have left significant contamination with presence of Benzene, Naphthalene, Arsenic, Cadmium, Mercury and other hazardous contaminants (White Green Young 2008, 12–15).

Eastern Access

5.2.8 The area remained relatively undeveloped until the later 19th century when the existing street layout and residential terraces were developed. It is not known if the 19th century houses in this area had cellars or basements. Basements would potentially have removed the brickearth and may have extended in the upper part of the terrace gravels. The foundations will have caused localised truncation of any archaeological remains within their footprint to the maximum extent of the construction.

Springfield Road Link, Minet Footbridge and Pump Lane Link Road

5.2.9 These areas have been open land from at least the mid 1700s. A tramway was constructed by the early 20th century in the area of Springfield Road Link and was later replaced by Beaconsfield Road. The construction of the railway, canal and drainage west of Yeading Brook would have required a certain amount of ground levelling and disturbance of nearby areas during construction. This may have caused some localised truncation of any archaeological remains within the alluvium, but may not have affected remains at the base of the alluvial sequence of within the underlying gravels.

5.2.10 The Minet Island part of the Pump Lane Link Road was partially excavated to produce the canal embankment and subsequently used for contaminated waste disposal (White Green Young 2008, 12–15). This would have removed any archaeological remains on Minet Island. The existing flood relief channel that runs north-south across the area of the Pump Lane Link Road, west of the Yeading Brook, is likely to have removed any archaeological remains to the maximum depth of the cut (not known).

5.3 Likely depth/thickness of archaeological remains: Main Site

5.3.1 Fig 10 shows areas of archaeological potential based on the truncation noted in geotechnical investigations (White Young Green 2002), with areas subdivided by the geotechnical report:

Area A

5.3.2 Area A is shown as a "Brick Field on the 1865 Ordnance Survey map. Current ground level in Area A is located at 30m OD, and archaeological remains of the 19th century clay mills may be found within the 0.2–2.0m of made ground noted here. The 0.2–0.95m of surviving brickearth below the made ground may potentially contain Upper Palaeolithic/Mesolithic and later remains although the brickearth will have been subject to truncation by C19th extraction activities. Lower Palaeolithic remains may be located within the underlying gravel at 27.9–29.5m OD.

Area B

5.3.3 Area A is shown as a "Brick Field on the 1865 Ordnance Survey map. Current ground level in Area B is located at 31m OD, with 0.9–3.5m of modern made ground beneath. Gravel and brickearth extraction pits have resulted in localised survival of 0.5–2.2m of brickearth, which may contain Upper Palaeolithic/Mesolithic and later remains although the brickearth will have been subject to truncation by C19th extraction activities. Lower Palaeolithic remains may be located within the gravel located at 27.5–29.9m OD.

Area C1

5.3.4 Current ground level in Area C1 is located at 31m OD, with 1.2–3.2m of modern made ground beneath. Much of the brickearth has been removed by the Norwood Chemical Works (1.7–1.8m deep) and the canal dock (Fig 10). Brickearth (0.4–3.3m thick) does however survive in the north-east part of C1, with some isolated patches along the southern side, and has potential for Upper Palaeolithic/Mesolithic and later remains. Lower Palaeolithic remains might potentially be found within the gravel at 27.5–29.9m OD, but would have been truncated within the area of the canal dock.

Area C2

5.3.5 Current ground level in Area C2 is located at 31m OD, with 0.9–2.2m of modern made ground beneath. Much of the brickearth has been removed and only two test pits (TPC202 and TPC205) produced evidence of 0.2–1.0m thick brickearth. Two other test pits revealed redeposited brickearth (TP10A and TP13A). Upper Palaeolithic/Mesolithic and later remains would potentially be present within the *in situ* brickearth. Any Lower Palaeolithic remains might potentially be found within the gravel at 29.7–28.8m OD.

Area C3

5.3.6 Current ground level in Area C3 is located at 31.5m OD, with 1.0–4.0m of modern made ground beneath. The brickearth has been removed from western part of C3, although one test pit (BHC302) located localised survival. Test pits indicate the survival of 0.4–1.5m of brickearth in the north-east and south-east corners of C3. Upper Palaeolithic/Mesolithic and later remains would potentially be present within the *in situ* brickearth. Any Lower Palaeolithic remains would be found within the gravel at 29.7–28.8m OD, but these may have been truncated by the canal dock crossing the northern section of Area D2 adjacent to C3.

Area D1

5.3.7 Current ground level lies at 33.0 in the north to 30.5m OD in the south, with 0.7–3.6m of modern made ground beneath. Brickearth has been removed across most of the area, with the exception of three small areas, where 0.4–1.6m of brickearth survives. Upper Palaeolithic/Mesolithic and later remains would potentially be present within the *in situ* brickearth and within the green-grey possible alluvium in the south (possibly part of the Yeading Brook floodplain or a palaeo-channel). Any Lower Palaeolithic remains may be located within the gravel at 26.5–29.0m OD, but these may have been truncated by the gasworks.

Area D2

5.3.8 Current ground level in Area D2 is located at 31m OD, with 0.8–3.2m of modern made ground beneath. Any Upper Palaeolithic/Mesolithic or later remains within the brickearth or alluvium have been removed across most of the area, although there is potential for such remains along with palaeoenvironmental evidence, within the 0.4–0.8m green-grey alluvium in west of the area (if it originated as part of the Yeading Brook floodplain). Any Lower Palaeolithic remains would potentially be found within the gravel at 27.8–30.2m OD, but these are likely to have been truncated by the canal dock crossing the northern part of the area.

Area D3

5.3.9 Current ground level in Area D3 is located at 32.5m in the north-east to 31.0m in the west, with 0.7–4.0m of modern made ground beneath. Any Upper Palaeolithic/Mesolithic and later remains potentially survive within 0.8m brickearth to the north and east of the area, where not truncated by gasworks structures. Green-gray alluvium (0.3–1.25m thick) noted in the west of the D3, potentially contains such archaeological remains, along with palaeoenvironmental evidence. Any Lower Palaeolithic remains would be found within the gravel at 26.76–31.7m OD, but these are likely to have been truncated by the canal dock crossing the south-west part of the area.

Area D4

5.3.10 Current ground level in Area D4 is located at 31m OD, with 0.6–2.8m of modern made ground beneath. Upper Palaeolithic/Mesolithic and later remains potentially survive within 0.37–1.8m thick brickearth and alluvium. Brickearth survives in the south-east corner of D4 (apart from an isolated area at TPD435 to the north) and the green-gray alluvium (containing organic remains in some test pits) to the south and west. Any Lower Palaeolithic remains may be located within the gravel at 27.43–

30.4m OD.

Area D5

5.3.11 Current ground level in Area D5 is located at 31m OD, with 0.3–2.1m of modern made ground beneath. Upper Palaeolithic/Mesolithic and later remains potentially survive within 0.5–1.3m thick brickearth and alluvium in the north-east corner of D5. The alluvium also has potential for palaeoenvironmental evidence. Any Lower Palaeolithic remains may be located within the gravel at 29.0–29.8m OD.

Area D6

5.3.12 Current ground level in Area D6 is located at 31.0m OD with 0.8–3.8m of modern made ground above. Upper Palaeolithic/Mesolithic and later remains potentially survive within the 0.2–1.0m thick green-gray alluvium which survives across the area. Any Lower Palaeolithic remains would be found within the gravel at 27.97–29.2m OD but construction of the canal dock (3.8m deep) in the southern part of D6 is likely to have removed all remains.

Area D7

5.3.13 Current ground level in Area D7 is located at 31.0m OD, with 0.2–2.79m of made ground above. Upper Palaeolithic/Mesolithic and later remains potentially survive within the 1.0–1.75m of brickearth noted across the area. Any Lower Palaeolithic remains may be located within the gravel at 27.6–29.4m OD.

Gasholder West (GW)

5.3.14 Current ground level in GW is located at 30.5m OD, with 0.2–4.0m of modern made ground. No brickearth was located within the geotechnical pits and it is likely that any Upper Palaeolithic/Mesolithic and later remains were removed. Any Lower Palaeolithic remains would be found within the gravel at 27.21–28.75m OD, although these may have been truncated by the deepest structures.

5.4 Likely depth/thickness of archaeological remains: Springfield Road Link and Minet Footbridge

5.4.1 Upper Palaeolithic/Mesolithic and later archaeological remains and palaeoenvironmental evidence may be found within the alluvium of the floodplain, but borehole evidence suggests 3.0m depth of dumping.

5.5 Likely depth/thickness of archaeological remains: Pump Lane Link Road

5.5.1 Outside areas of past impact noted above, the remainder of the Pump Lane Link Road may contain prehistoric remains and palaeoenvironmental evidence within the alluvium of the floodplain. The depth of the alluvium and any archaeological remains within it is unknown.

5.6 Likely depth/thickness of archaeological remains: Eastern Access

5.6.1 Current ground level on the Eastern Access area is located at 31.0m OD. The presence/depth of any made ground is unknown. Archaeological remains may include the remains of the 19th century terraced housing with earlier archaeological remains cut into the brickearth (0.2–2.0m thick) at 30.41m OD to 29.40m OD. Any Lower Palaeolithic remains may be located within the terrace gravels below *c* 27.0–29.0m OD.

6 Archaeological potential

6.1 Introduction

6.1.1 The nature of possible archaeological survival in the area of the proposed development is summarised here, taking into account the levels of natural geology and the level and nature of later disturbance and truncation discussed above.

6.1.2 It is considered that the Lynch Hill gravels, the River Thames's oldest and highest terrace, have potential to contain material of Palaeolithic date although truncation and contamination would have affected the potential survival. According to the White Young Green geotechnical survey (WYG 2002) the height of the gravel varies from an upper height of 26.5 m OD in Area D1 (circa 4.0m+ below current ground surface) to an upper height of 31.7m OD in Area D3 (circa 0.80m below current ground surface).

6.1.3

6.2 Main Site and Eastern Access

6.2.1 *The Main Site and Eastern Access have a medium potential to contain Lower Palaeolithic remains.* The previous recovery of Palaeolithic faunal remains within and immediately adjacent to the site, indicates that the Main Site and Eastern Access may have the potential for the discovery of *in situ* remains within the Lynch Hill gravels although these areas have been subject to extensive impacts. In addition, there is potential for further finds of isolated redeposited flint tools.

6.2.2 *The Main Site and Eastern Access have a medium to contain remains of Upper Palaeolithic/Mesolithic and later prehistoric date.* Such remains would potentially be cut into the brickearth, which has been removed and truncated across large sections of the Main Site, and at the base of the alluvium and cut into the underlying gravels. The topography and geology of the Main Site and Eastern Access are favourable for settlement activity and field systems adjacent to the Rivers Crane and Colne. The undated enclosure and field system identified from aerial photographs (the nearest are located *c* 200m north-west of the Main Site) suggest that similar activity may be present on it. A Bronze Age hoard is shown on the GLSMR within the north of the Main Site, though its exact location is uncertain and the entry may relate to the general potential of the area for prehistoric activity of all periods.

6.2.3 *The Main Site and Eastern Access have a low potential to contain archaeological remains dated to the Roman period.* There is no conclusive evidence for archaeological remains from the Roman period on the Main Site or Eastern Access, although the local topography and geology are favourable for Roman agricultural activity. The undated enclosure and field system identified from aerial photographs suggest that similar activity may be present on the Main Site and Eastern Access.

6.2.4 *The Main Site and Eastern Access have a low potential to contain archaeological remains dated to the early medieval period.* Although evidence for early medieval activity is known in the study area to the south, there is no evidence for archaeological remains from this period on the Main Site or Eastern Access.

6.2.5 *The Main Site and Eastern Access have a low potential to contain archaeological remains dated to the later medieval period.* There is no conclusive evidence for archaeological remains dated to this period within the Main Site or Eastern Access, despite the proximity of two medieval settlements. The Main Site and Eastern Access lay in common fields and as communally used agricultural land would not have been developed.

6.2.6 *The Main Site and Eastern Access have a medium to high potential to contain archaeological remains dated to the post-medieval period.* The industrial activity identified on the Main Site includes the brickfields (possible remains of brick kilns, water tanks, etc.); and late 19th/early 20th century industry including a chemical works, the gasworks and the associated canal docks. Sub-surface footings of earlier structures are likely to be present within the Main Site, where the 19th-century structures are still extant. The Eastern Access may contain the remains of a farm and 19th century terraced housing.

6.3 Springfield Road Link, Minet Footbridge

6.3.1 *These areas have medium potential to contain archaeological remains dated to the prehistoric period.* The resources of the alluvial floodplain are likely to have attracted occupation from both early and later prehistoric groups, and alluvial sediments would contain any surviving archaeological remains (possibly including organics) and palaeoenvironmental evidence.

6.3.2 *These areas have a low potential to contain archaeological remains of later periods.* There is no evidence for Roman or later activity in these areas and it is likely that such activity would have been focussed upon the higher land of the Main Site. Historic maps of the post-medieval period indicate that these areas were located within open fields cut by the Yeading Brook and canal.

6.4 Pump Lane Link Road

6.4.1 *The Pump Lane Link Road area has a low potential to contain archaeological remains dated to the prehistoric period.* The area to the west of the Yeading Brook is cut by the canal and is known to have undergone excavation to provide material for the embankment of the canal. The area to the east of the Yeading Brook contains the cut for the flood relief channel, and only a small area of the Pump Lane Link Road is therefore likely to retain alluvium and prehistoric archaeological remains.

6.4.2 *The Pump Lane Link Road area has a low potential to contain archaeological remains of later periods.* There is no evidence for Roman or later activity in this area and it is likely that such activity would have been focussed upon the higher land of the Main Site. Historic maps of the post-medieval period indicate that this area was located within open fields cut by the Yeading Brook and canal. Any archaeological remains from later periods would also have been removed or truncated by the creation of the canal and the flood relief channel.

7 Conclusions

7.1.1 The area of proposed development does not lie in a local authority Archaeological Interest Area/Archaeological Priority Area. The Site contains no nationally designated (protected) sites, such as Scheduled Monuments, or Registered Parks and Gardens. Taking into account the levels of natural geology and the level and nature of later disturbance it is considered that the area of proposed development has medium archaeological potential for prehistoric remains. Palaeolithic remains and artefacts were located within the Main Site in the late-nineteenth century but the accuracy of the located reported findings is not known. A possible Palaeolithic kill sites has been identified in the Main Site, although closer study suggests that these may represent duplicate entries of an antiquarian source possibly attributed in error to the gasworks site, and the interpretation of this find as a kill site may be questionable. In addition, there is potential for further finds of isolated redeposited flint tools, reflecting the general potential of the area for prehistoric finds of all periods. There is low potential for archaeological remains of the Roman, early and later medieval periods, when the Site lay in open fields. There is a medium to high potential for archaeological remains of the post-medieval period, when a number of early industrial structures (such as the Aldersgate Chemical Works and the Brentford Gas Company) were erected on the Main Site, as seen from the historic maps consulted as part of this assessment.

7.1.2 The proposed mixed-use development comprises residential, business, leisure, and community uses and associated infrastructure. The principal impact of the proposals on any surviving archaeological remains will derive from ground remediation, basement construction, and piling in areas where brickearth and alluvial deposits survive, or where the works are sufficiently deep as to affect any Lower Palaeolithic remains within the underlying gravel.

8 Gazetteer of known archaeological sites and finds

8.1.1 The table below represents a gazetteer of known archaeological sites and finds within the 1500m-radius study area around the area of proposed development. The gazetteer should be read in conjunction with Fig 2.

DBA No.	Description	Site code/ GLSMR No.
1a	Southall - Antiquarian findspot: ovate handaxe and four pointed handaxes found 1887–8.	MLO13734
1b	Southall - Antiquarian findspot: Triple pointed bifacially worked flint object. Often known as "tribrachs".	MLO4520
1c	Southall - Antiquarian findspot: Late Bronze Age founder's hoard found last century by workmen from a Brickfield who discarded some copper cakes. Vulliamy (1930) mentions that a lead axe head had been cast in the two halves of the socketed axe mould.	MLO4538
1d	Southall Gasworks. Antiquarian findspot: Handaxes and elephant bones, possibly a kill site. This appears to be a duplication of the entry for **DBA 3** below. (see section 4.3 above)	MLO522
1e	Southall Gasworks - The Straight - Site of landfill taken from British Geological Survey data supplied to the Environment Agency. It is not known whether this site was made or worked land, and the date of infill is unknown, although all of are 19th/20th-century date. A digitised map showing the extent of each landfill site is also held.	MLO72513
2	Southall Gasworks. Antiquarian findspot: Mesolithic axe.	MLO25537
3	White Street (Near). Prehistoric kill site: several palaeolithic flint implements, including six handaxes, were discovered during 19th-century excavations for a gasholder. The bones of a mammoth were found in association with flint tools during the 1860s. The bones and teeth of a mammoth are identified with the gas-holder excavations in the primary source (see section 4.3 above) along with two abraded hand-axes.	MLO68438 MLO68439
4	A watching brief at Sri Guru Singh Sabha Gurdwara Project, Havelock Road, Southall, observed that natural brickearth above gravels was overlaid by made-ground.	HCK00
5	A watching brief followed by a geoarchaeological evaluation at land adjoining 2 Lady Margaret Road, Southall. The watching brief recorded surviving Quaternary stratigraphy but no archaeological features or finds. The evaluation revealed a 3.5m-section through Langley Silt (brickearth) and Lynch Hill gravels. No archaeological evidence was observed, but the evaluation has improved the understanding of quarternary stratigraphy in this area.	LMG04 LMG05 1446702
6	An evaluation at Westmount Centre, Delamere Road, Hayes indicated the site had been truncated down to the natural brickearth by modern features. Five prehistoric struck flints and a fragment of pottery, possibly of Bronze Age date, were recovered from the surface of the brickearth.	DLM98 1161852
7	An evaluation at Serco Site, 13 Hayes Road, Southall indicated natural brickearth was probably extensively extracted in the 19th or early 20th century.	HYR97
8	South Road. Air raid shelter.	MLO72354
9	Grand Union Canal. Post-medieval bridge.	MLO73022
10	Grand Union Canal. Post-medieval bridge.	MLO73023
11	Grand Union Canal. Post-medieval bridge and footbridge.	MLO73031
12	Grand Union Canal. Post-medieval bridge.	MLO73032
13	North Hyde Lane. This location is shown on Glover's map as a medieval farm and a few cottages on the edge of Heston. Not shown on Rocque's map of 1746.	MLO73134
14	King Street. Antiquarian findspot: Palaeolithic lithic implement.	MLO73145
15	High Street junction with South Road. The VCH advises that by the 16th century this hamlet was sited here, but that it was probably settled much earlier.	MLO73147
16	Botwell. Antiquarian findspot: 3 handaxes; 1 tortoise core;1 levallois flake.	MLO10556
17	Rustor Road. Antiquarian findspot: Mesolithic flint borer. Location is probably	MLO11287

DBA No.	Description	Site code/ GLSMR No.
	Ruskin Road.	
18	Macklins Pit. Antiquarian findspot: Palaeolithic findspot: 2 implements general provenance Norwood. 3 from Macklins gravel pit.	MLO12589
19	Hayes Bridge brickfield (near). Antiquarian findspot: 1 Levallois blade, 1 scraper. Exact location unknown, first of two alternatives given in location details (see below).	MLO2928
20	Hayes Bridge brickfield (near). Antiquarian findspot: 1 Levallois blade, 1 scraper. Exact location unknown, second of two alternatives given in location details (see above).	MLO2928
21	A watching brief at the Former Bull's Bridge Power Station, Hayes observed boreholes with London Clay or natural gravels, an organic-rich deposit or alluvium and post-medieval or later made-ground above, suggesting truncation had occurred.	BBD98
22	Heston. Antiquarian findspot: Lower Palaeolithic lithic implement.	MLO2603
23	Norwood Road. Antiquarian findspot: Palaeolithic lithic implement	MLO2668
24	Westmount Centre. Evaluation undertaken in Jan'98. Undiagnostic prehistoric finds were recovered. The finds were one small fragment of pottery, a broken flint flake and 13 pieces of burnt flint. Two broken flint flakes and a piece of burnt flint were recovered from the subsequent evaluation (May'98). No further periods recorded under this site code.	MLO71676
25	Westmount Centre. As above.	MLO71676
26	Westmount Centre. As above.	MLO71676
27	Westmount Centre. As above.	MLO71676
28	A watching brief at 22 King Street revealed demolition deposits of 19th to 20th century buildings above natural brickearth and gravels.	KNU05 1436392
29	Featherstone Terrace. Lower Palaeolithic axe.	MLO292
30	Southall. Gold Gallo-Belgic B (Bellovaci) Stater coin.	MLO4530
31	Ruston Road or Ruskin Road. 1 rolled flake, 1 steep end scraper, 1 flake used as a scraper.	MLO4612
32	Western International Market. 2 flakes, 1 scraper, 1 core found on site of market.	MLO10575
33	Excavation at Western International Market found a Late Neolithic ring ditch, Late Bronze Age cremation cemetery, ditch and linear gullies, as well as an Anglo-Saxon ditch and sunken building.	
34	The Grand Union Canal. The main trunk canal linking Birmingham with London, and Leicester with London.	1339424
35	The Brentford Branch Railway was authorised from Southall to Brentford Dock to provide the GWR access to the Thames. Authorised in 1855, it opened in 1859.	1378208
36	The first section of what is now the District Line, but known when it opened as the Metropolitan and District Line, started operation on 24th December 1868 between South Kensington and Westminster.	1310408
37	Brunel's Great Western Railway between London and Bristol opened as a broad gauge railway on 30th June 1841, the Swindon - Bristol Section being converted to narrow gauge in 1872, mixed gauge in use from Swindon to Paddington.	1359288
38	Linear ditches, a probable field system have been identified from aerial photographs. Although undated these may be of prehistoric date.	050796
39	An oval enclosure and linear ditches were identified on aerial photographs to the north of Beaconsfield Road (now destroyed by development). Although undated, these too may have been of prehistoric date.	

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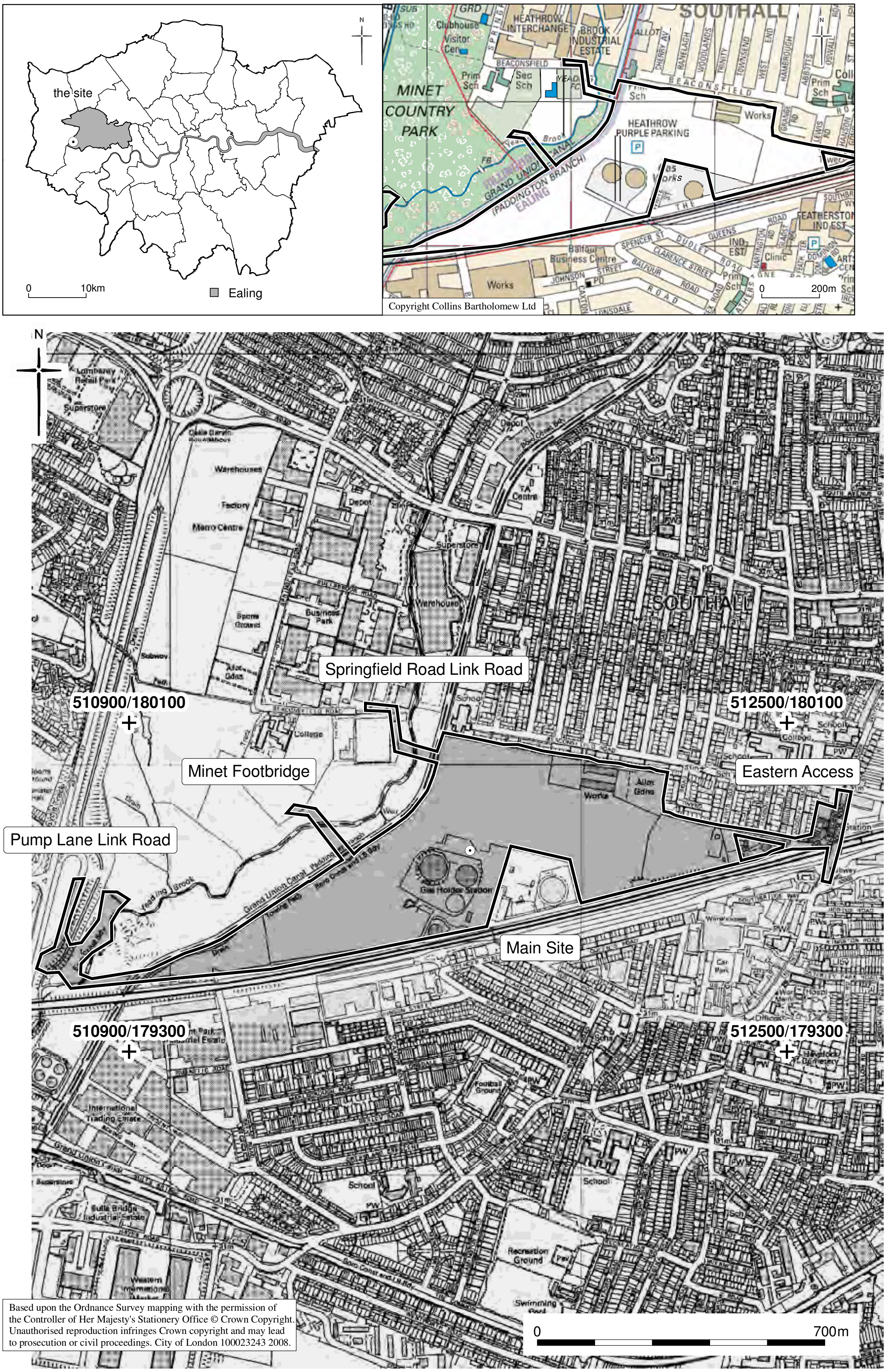


Fig 1 Location map

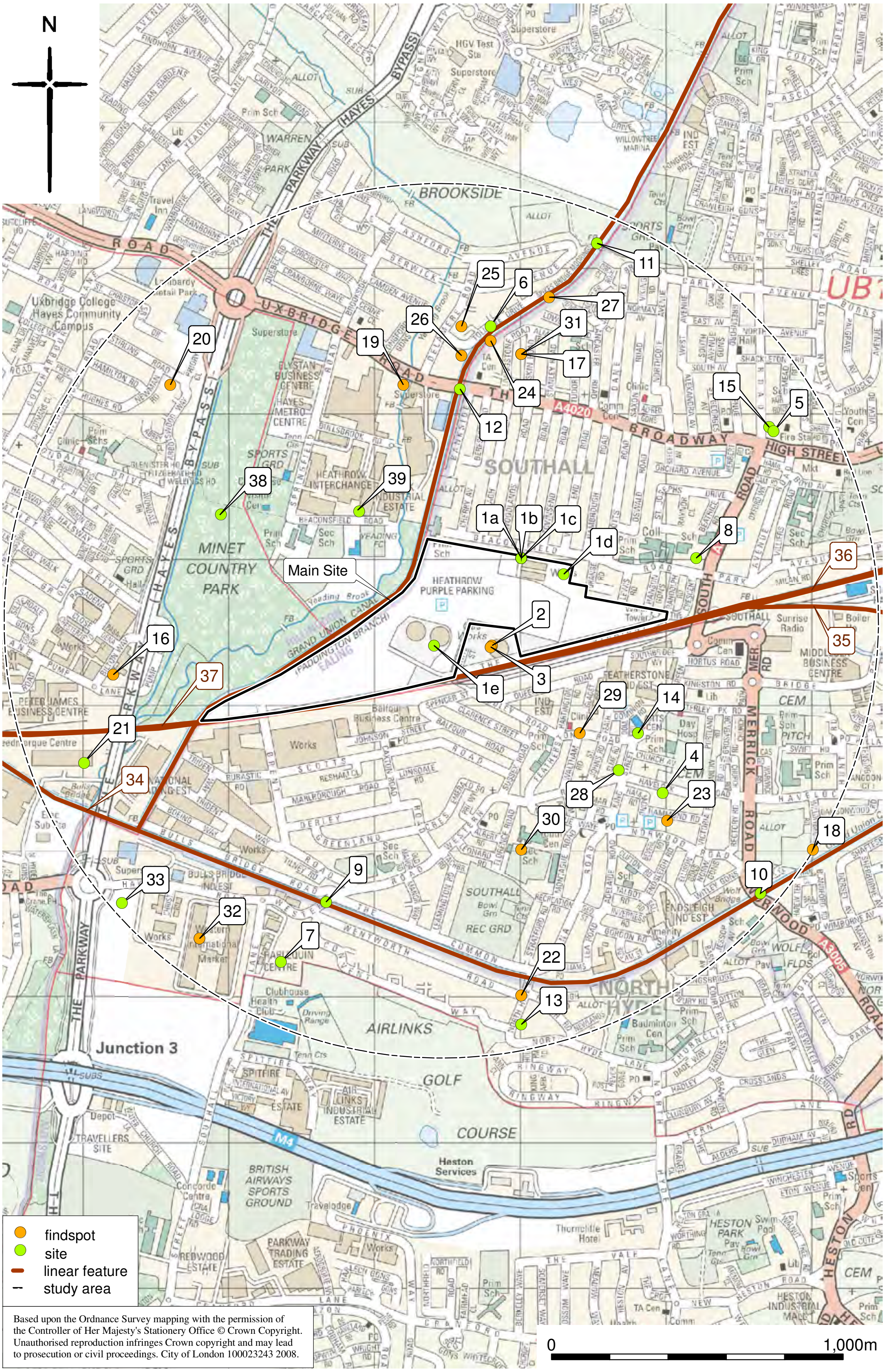


Fig 2 Archaeological features map

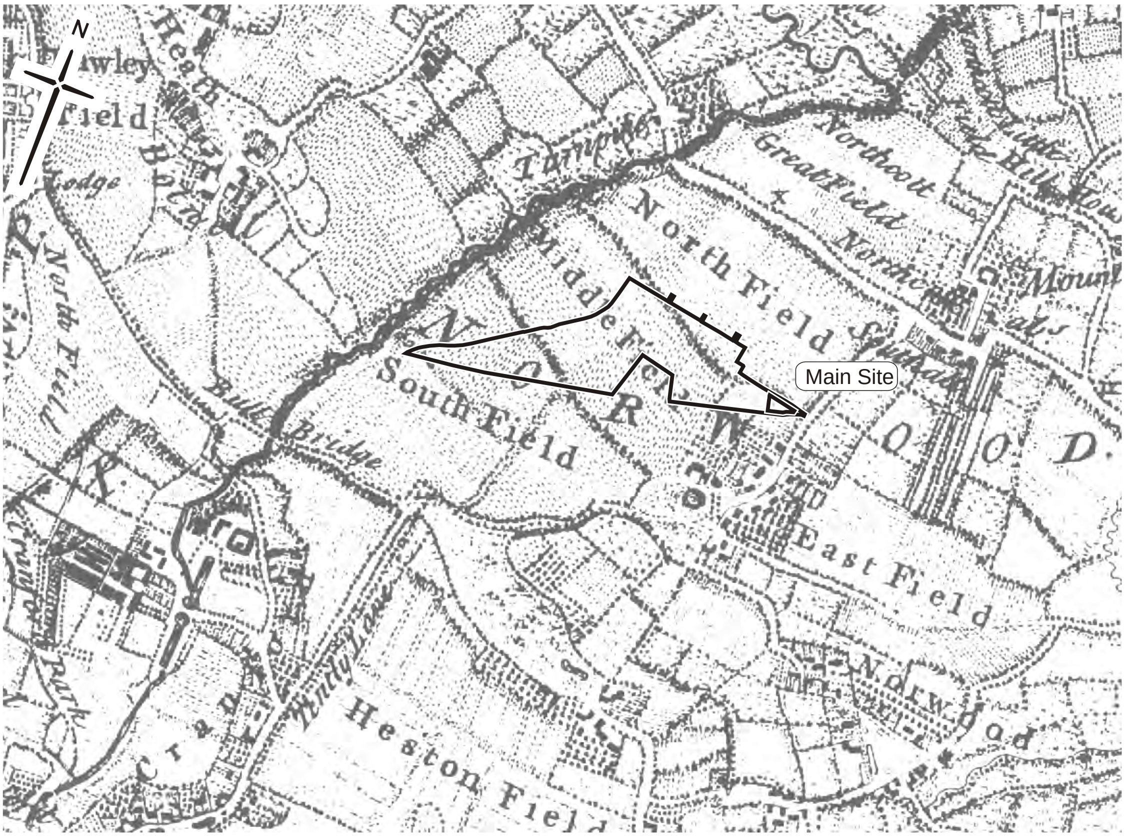


Fig 3 Rocque's map of 1754

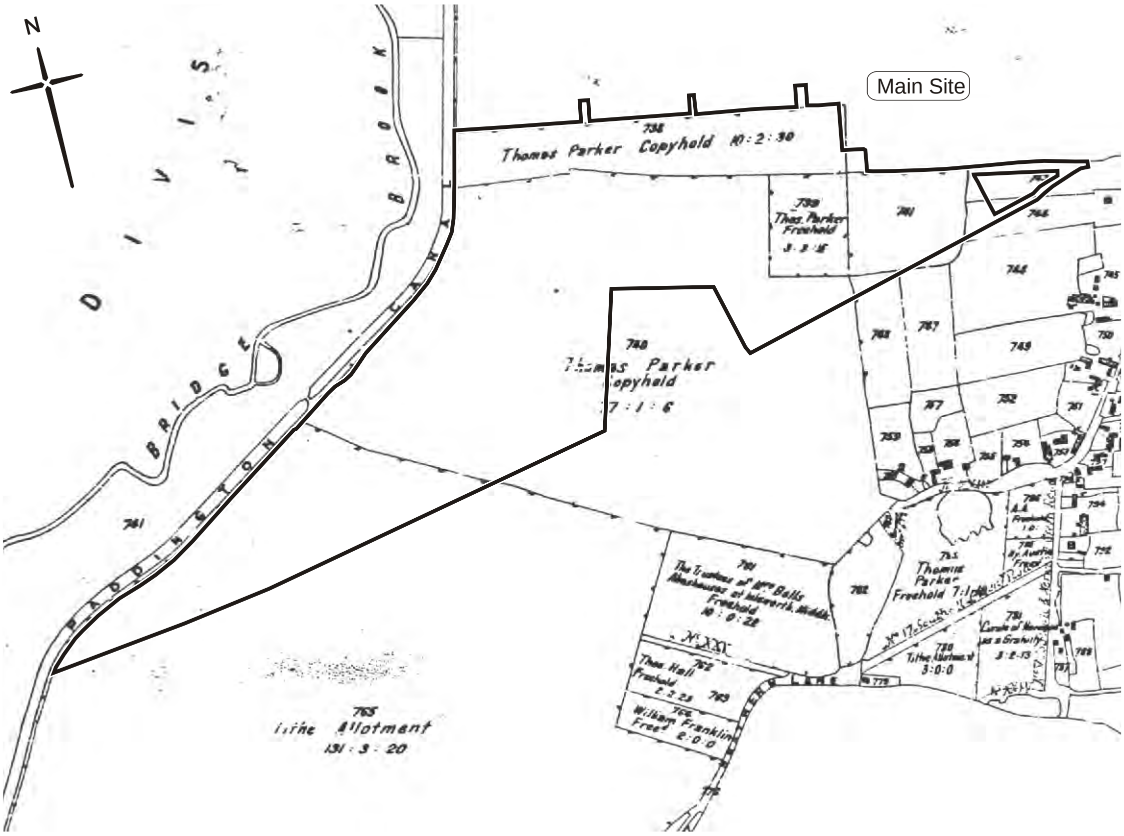


Fig 4 Norwood Precinct Valuation map of 1821

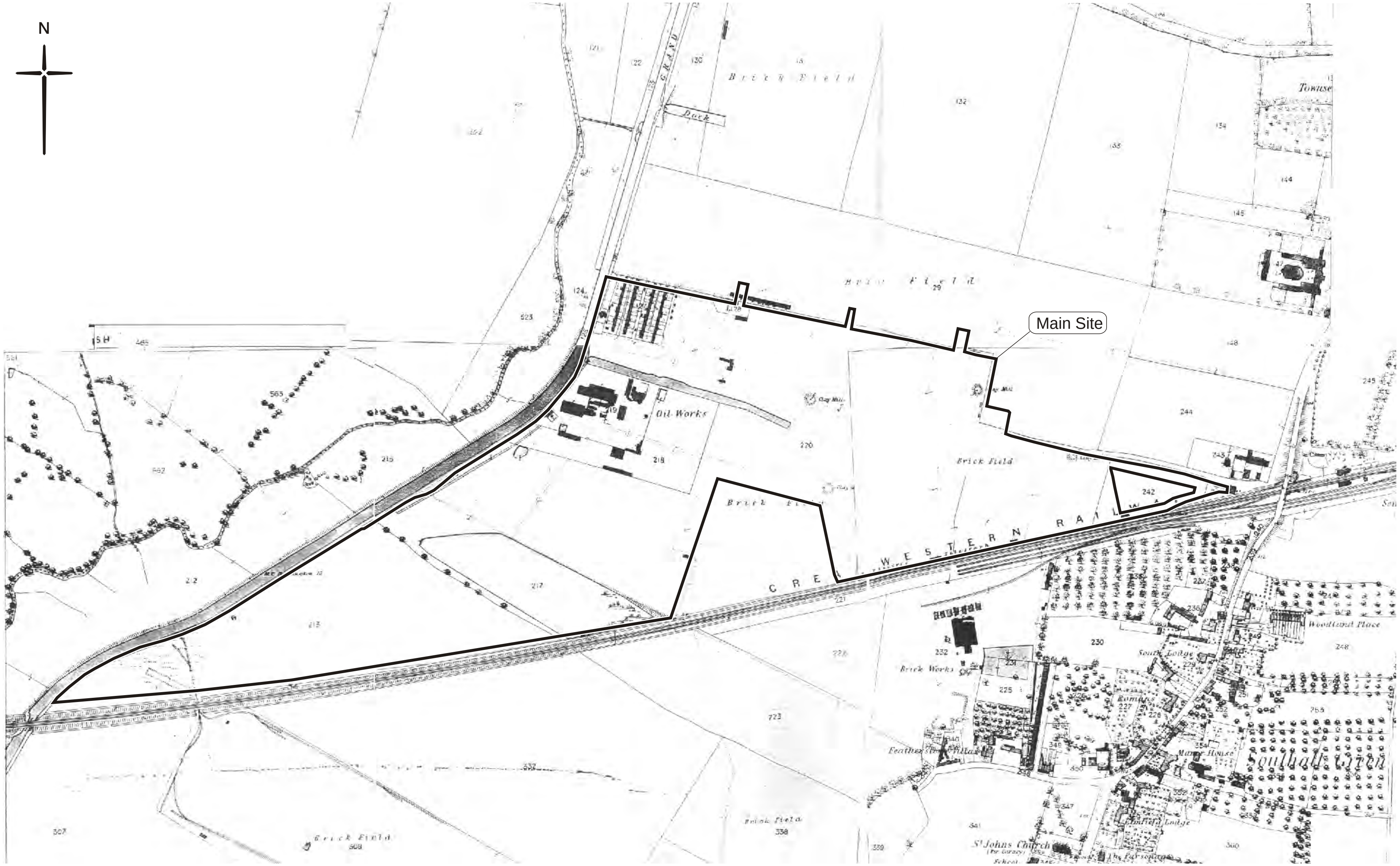


Fig 5 Ordnance Survey 1st edition 25" map of 1865, showing the area of the gasworks prior to their construction (not to scale)

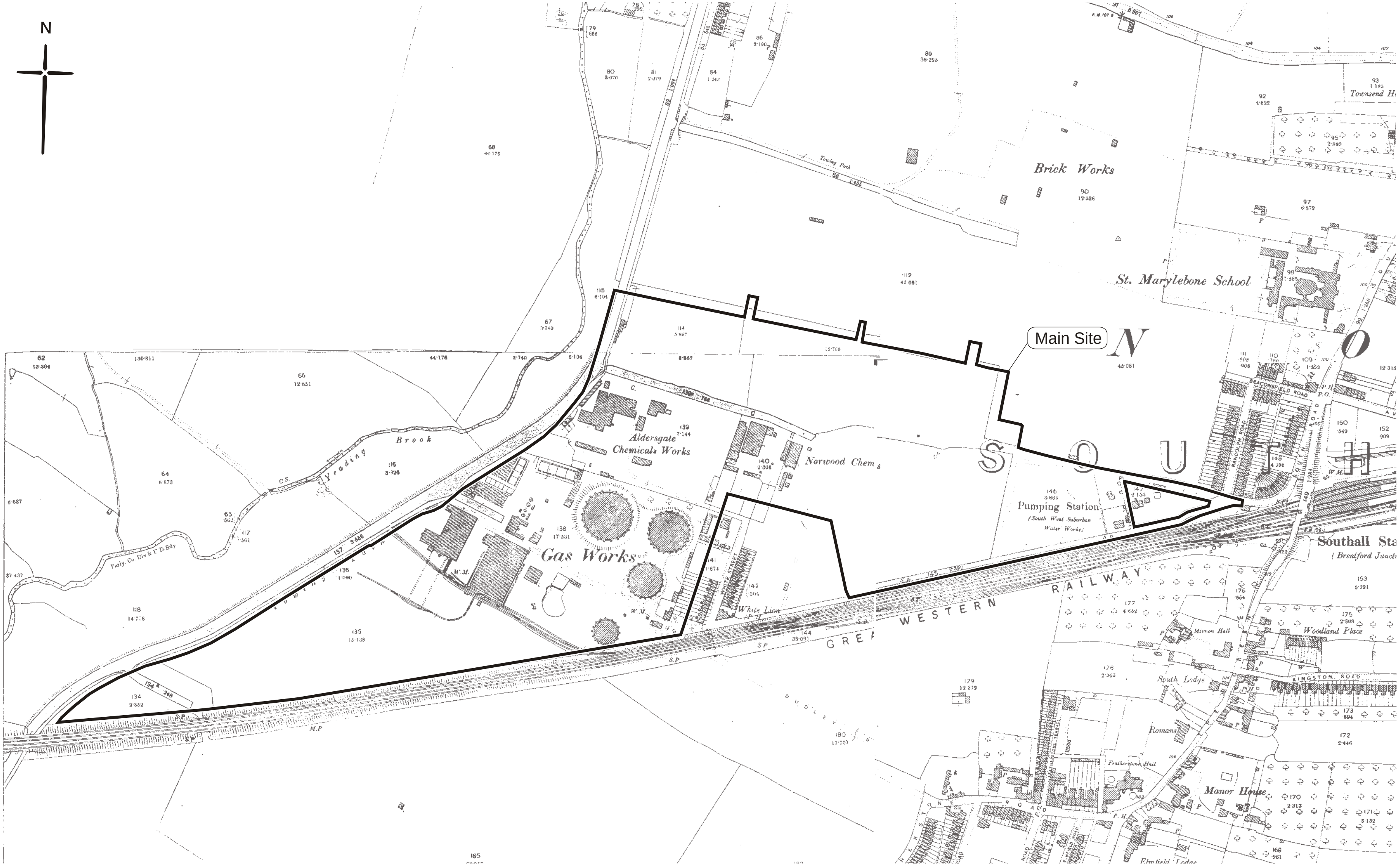


Fig 6 Ordnance Survey 2nd edition 25" map of 1895, showing the gasworks (not to scale)

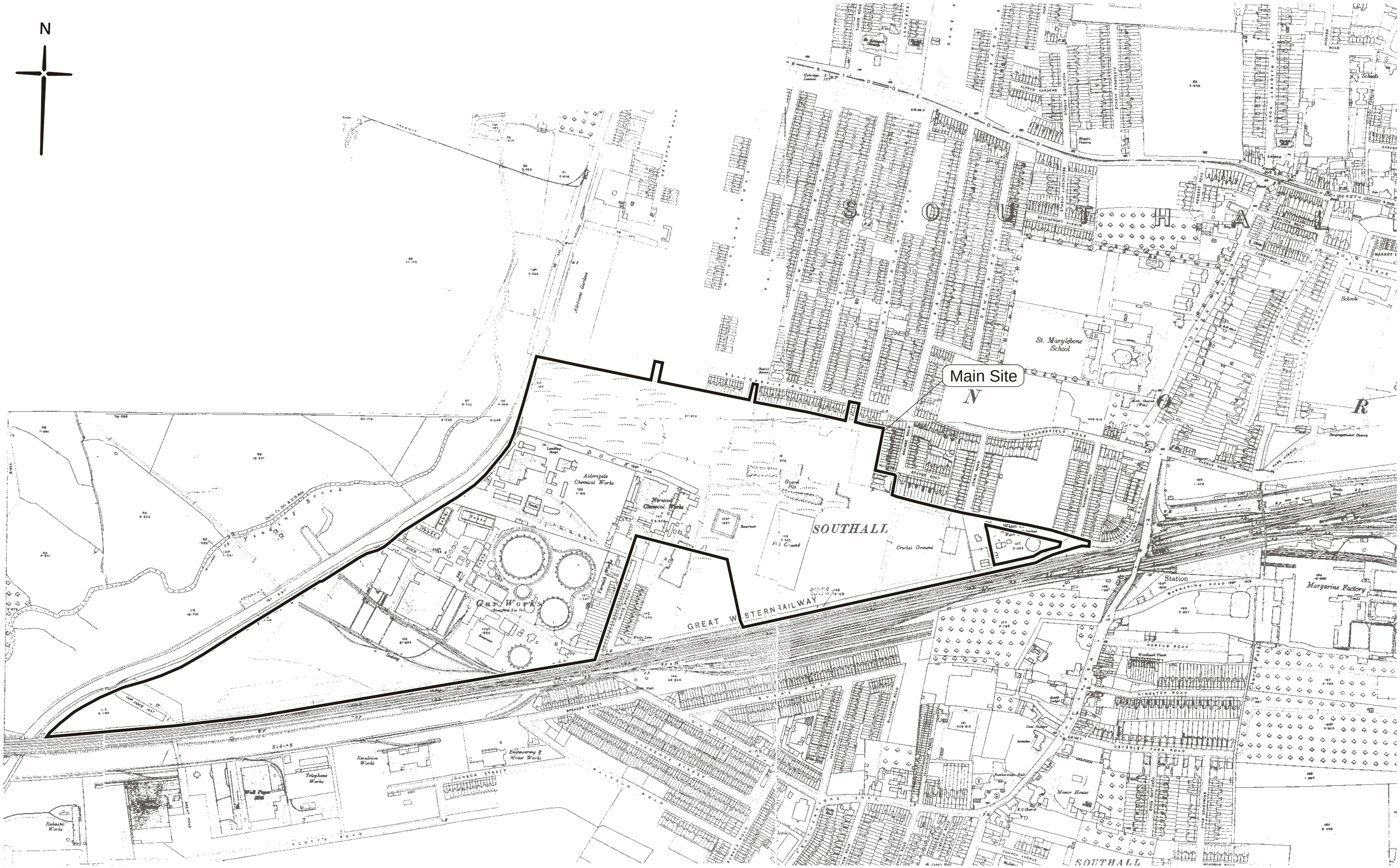


Fig 7 Ordnance Survey 3rd edition 25" map of 1914 (not to scale)

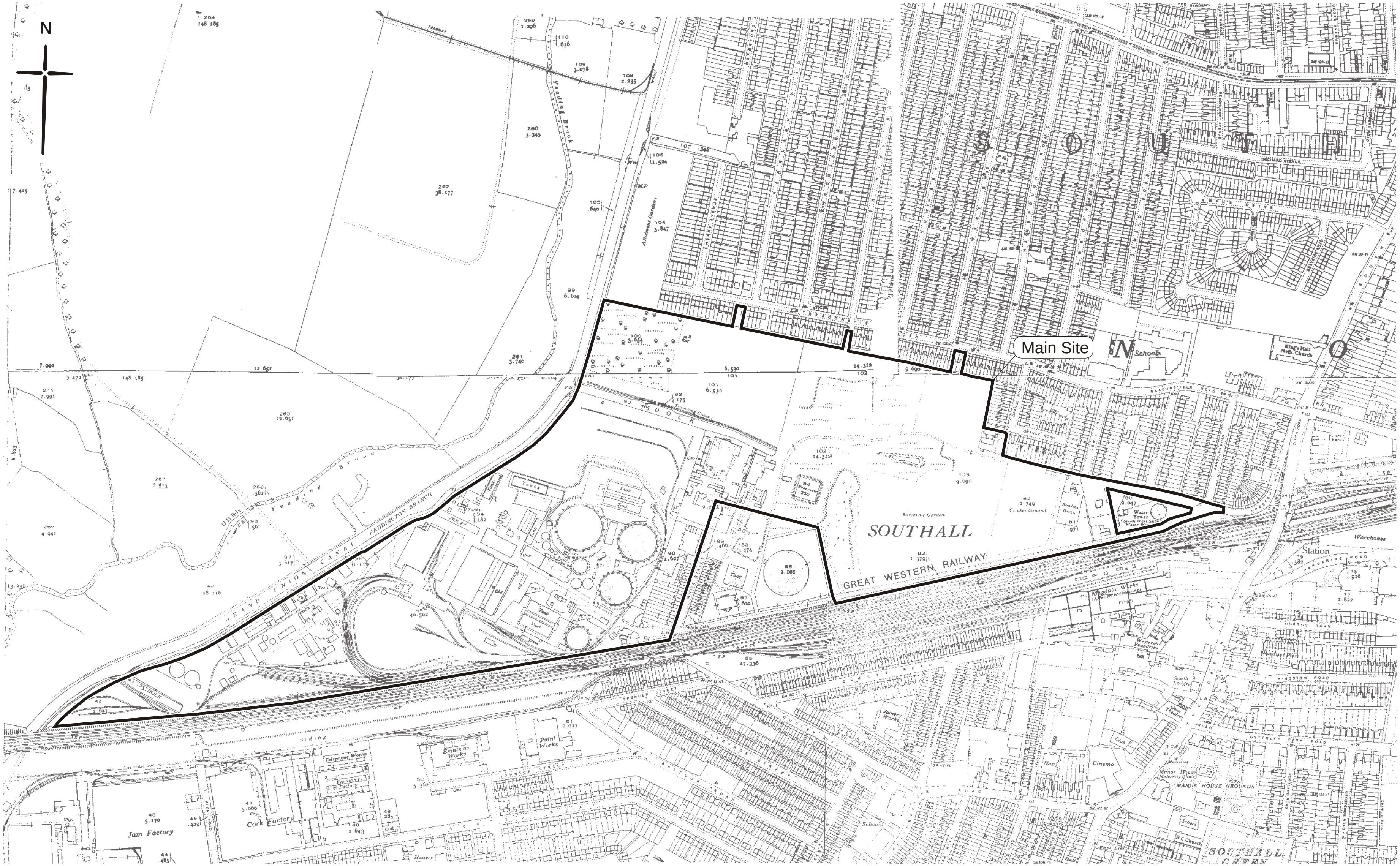


Fig 8 Ordnance Survey 25" scale map of 1935 (not to scale)

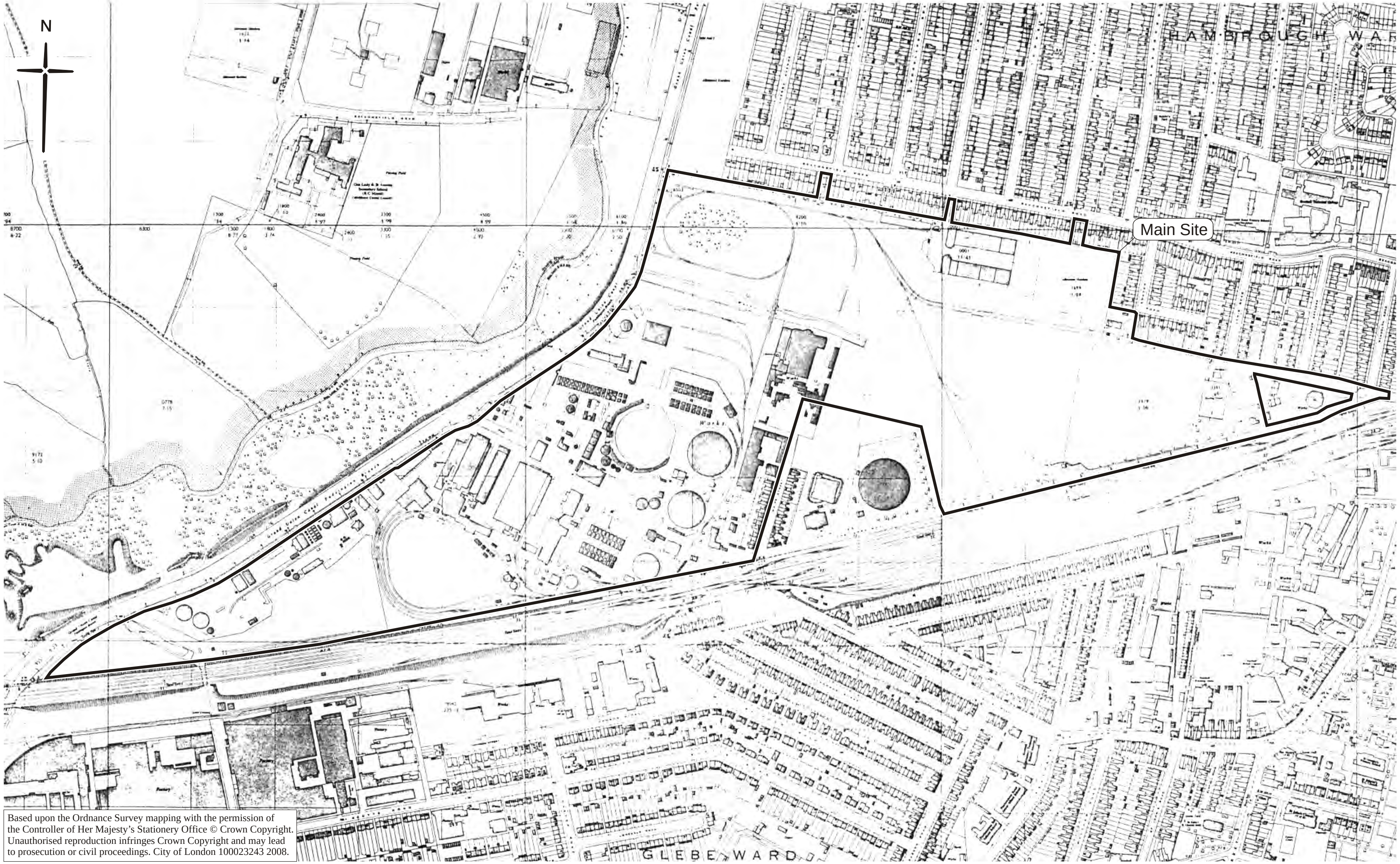


Fig 9 Ordnance Survey 25" scale map of 1965 (not to scale)

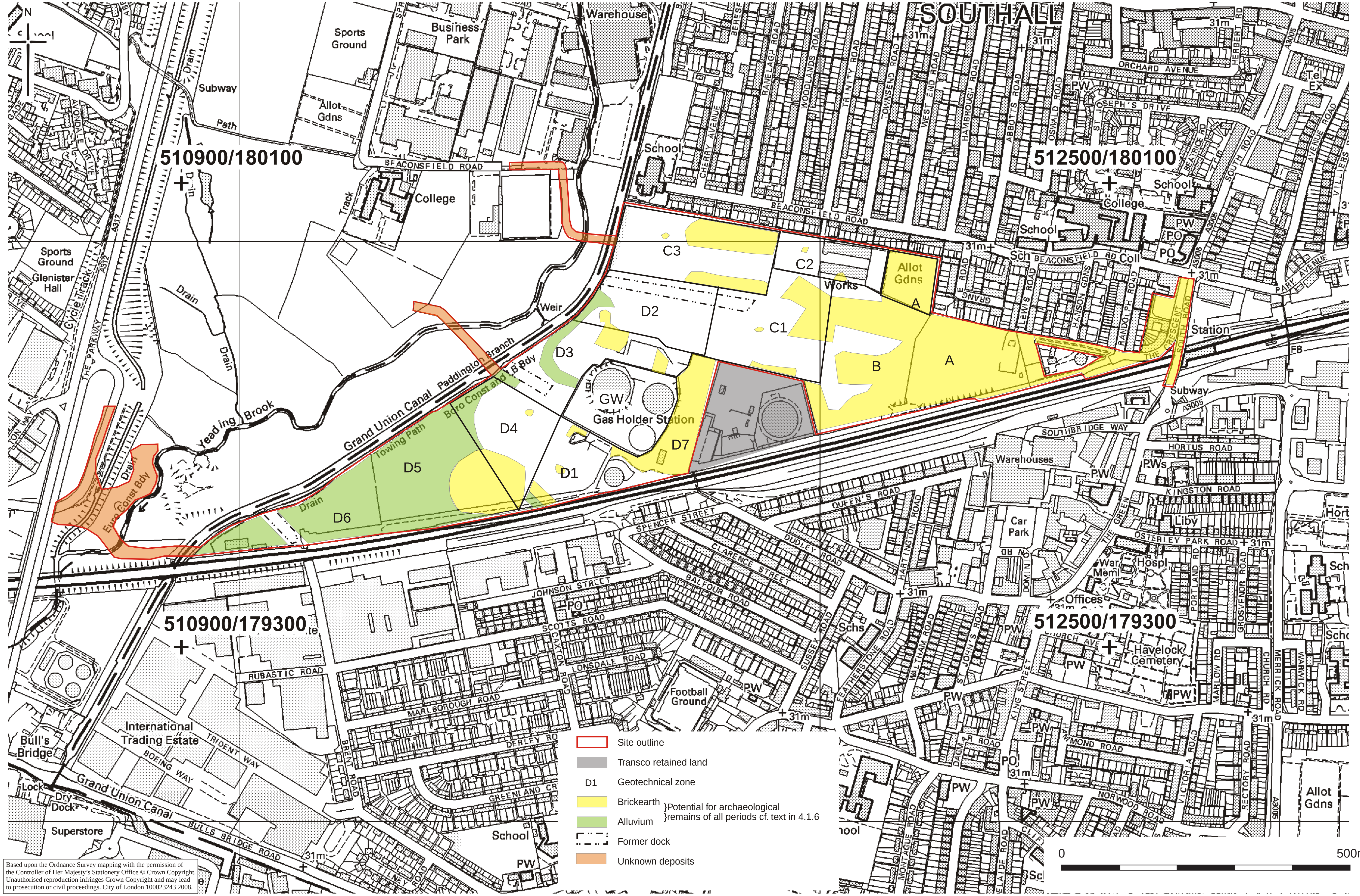


Fig 10 Location of surviving brickearth and alluvium and areas of archaeological potential. (Based on White, Young Green 2002)

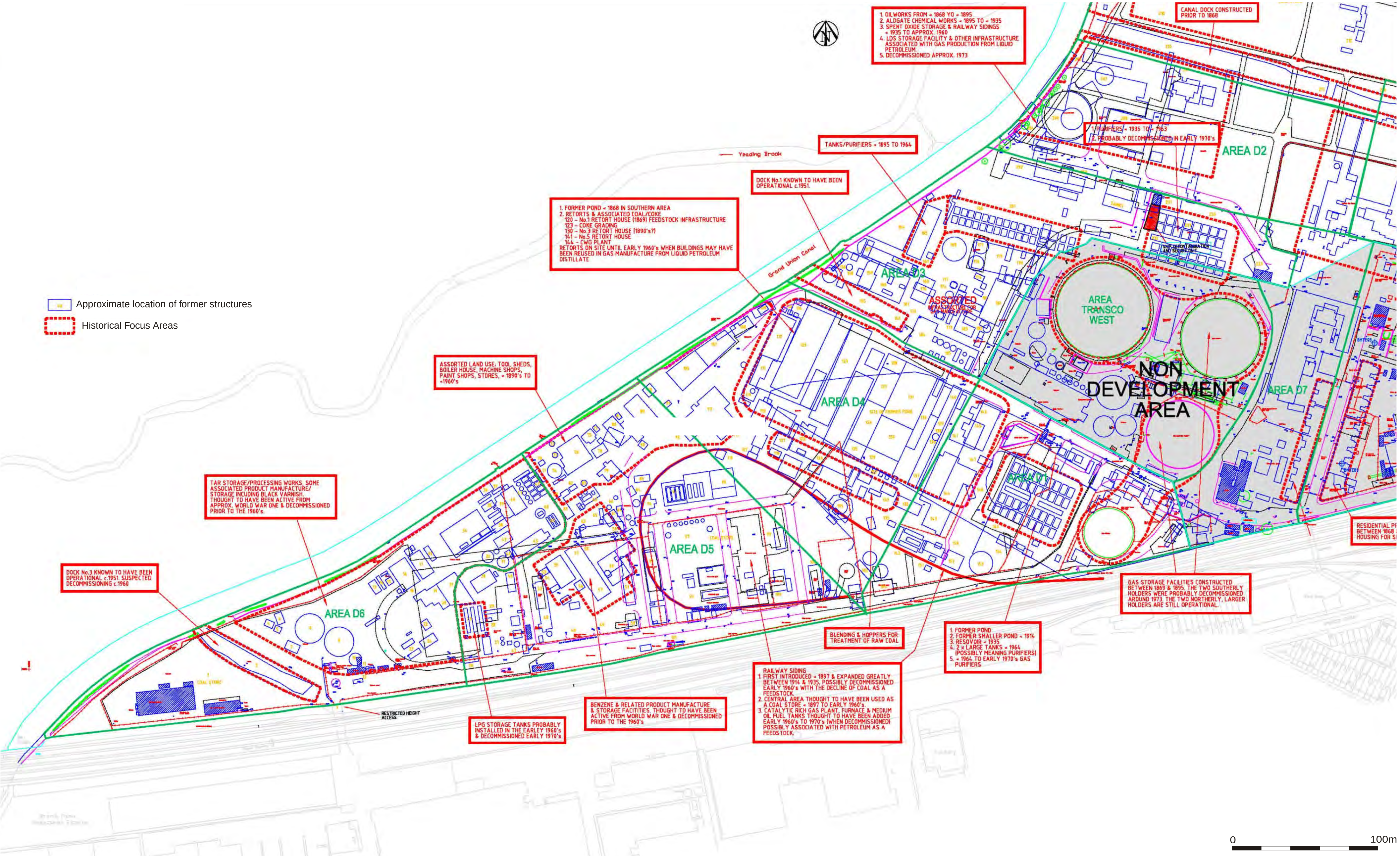


Fig 11a Previous industrial usage of the Main Site: Wast Side (After White, Young, Green Dwg. No E0357-802W)

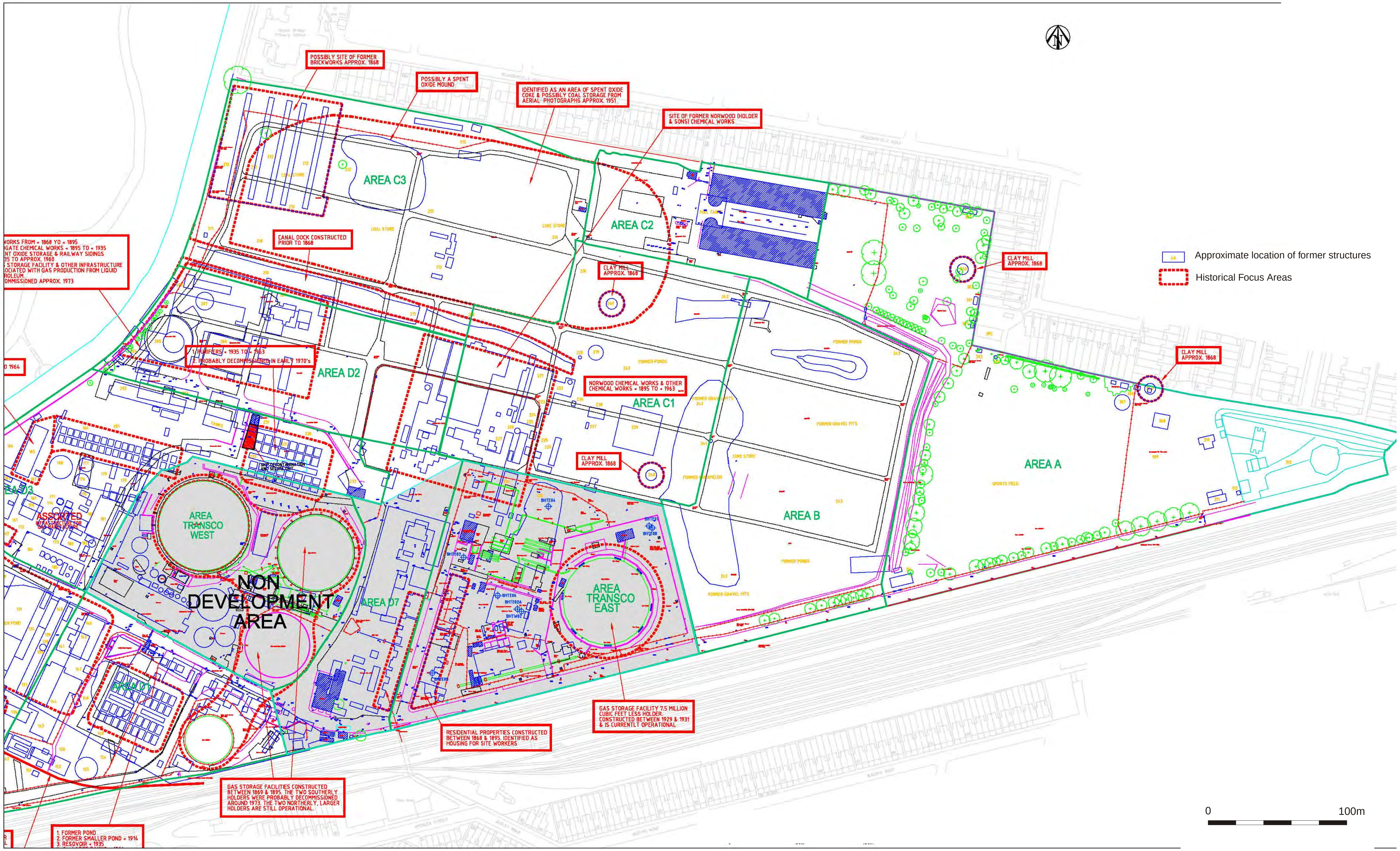
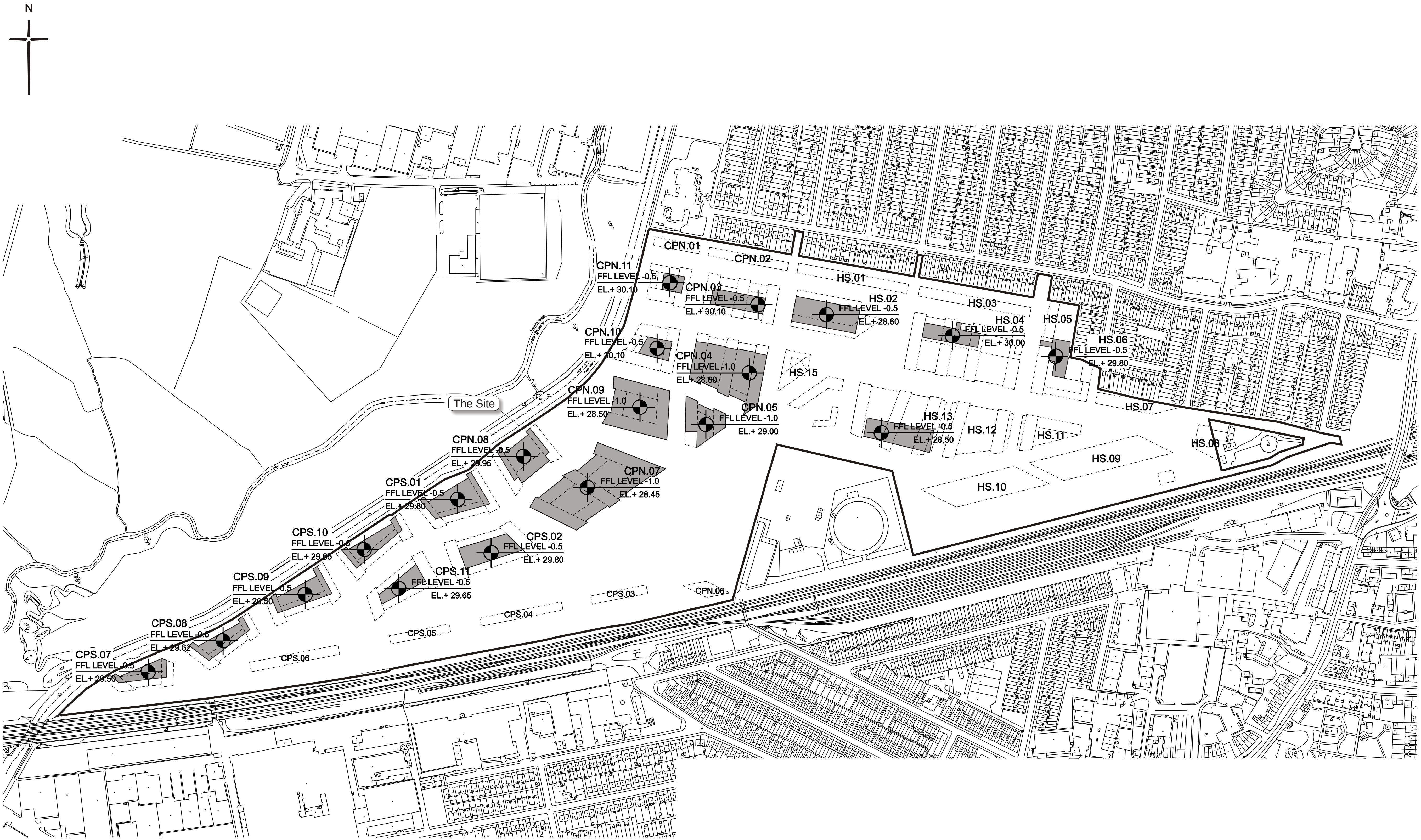


Fig 11b Previous industrial usage of the Main Site: East Side (After White, Young Green Dwg. No E0357-802E. Received 26.02.08)



scale 1:5000@A3

0 250m

proposed basement

proposed building footprint

Fig 12 Site Masterplan showing proposed basements (Drawing A2009, Rev. 00, dated 06-11-07)

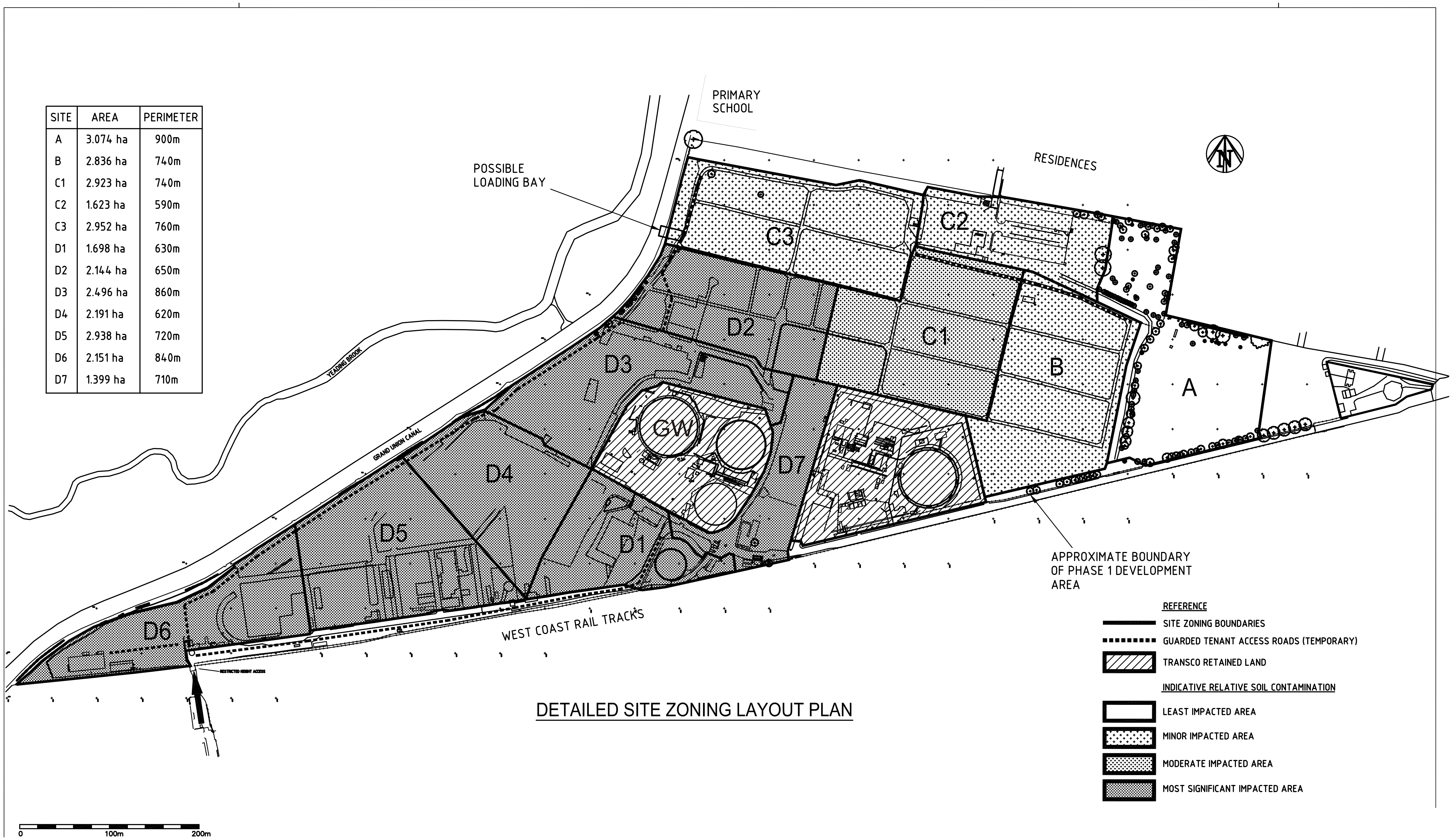


Fig 13 Levels of contamination within the Main Site (After White Young Green. Proj. E0357/ES. Dwg no 11.2.Rev. A. Dated 10/2000)

West Southall

Heritage Assessment

For

National Grid Property Ltd

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P. Insp. Ref:
Borough Council Ref:
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Date: September 2008

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LIST OF ILLUSTRATIONS

RPS

SECTION 1: INTRODUCTION

1.1 This report is prepared for National Grid Property Ltd. It addresses the heritage protection issues raised by proposals to redevelop the West Southall site, to provide a mix of new housing, retail, recreational facilities and other uses. In particular, the report deals with the proposed demolition of Nos. 20–32 The Crescent, Southall, London UB1 1BE, a late-Victorian terrace of 13 houses (Figures 1 and 2) east of the site. The proposals include the provision of a new road giving access to West Southall from South Road (the A3005), which will require the demolition of Nos. 20–32 The Crescent. Although not statutorily listed, the terrace is designated locally as a 'Building of Façade or Group Value'. The report also deals with the effect of the proposals on the setting of a Grade II-listed water tower, a separate property within the eastern part of the site.

1.2 RPS was asked to provide an account of the historical and architectural significance of Nos. 20–32 The Crescent in the light of the requirements of the relevant national and local planning policy framework, in particular *Planning Policy Guidance Note 15: Planning and the Historic Environment* (PPG15) and the London Borough of Ealing Local Plan (the Unitary Development Plan [UDP] adopted 12 October 2004). This report also considers several other buildings that are proposed for demolition under the West Southall Proposed Development, but which are not protected by any heritage designation. Two decommissioned gasholders in the centre of the site will be removed, and replaced with a park, a new road linking West Southall to the wider road network to the west, and new housing. The construction of another new road giving access to the east will require the removal of the garage that stands on the site adjoining The Crescent to the north, and of six houses (Nos. 1, 3, 5, 7 ,9 and 11) at the south end of Randolph Road near the junction with the The Crescent. In addition, the Proposed Development requires the demolition of several houses in Beaconsfield Road and Grange Road, in order to provide secondary access to the site from the north in four locations (Figures 3 and 4).

1.3 This report is structured as follows: Section 2 describes the site and gives an account of its history from the earliest development of the area to the present day. Section 3 defines the architectural and historic interest of the houses in The Crescent, the gasholders and the other buildings proposed for demolition. The proposed demolitions are justified in relation to planning policy in Section 4, and the impact of the Proposed Development proposals on the setting of the listed water tower is analysed in Section 5. Sources consulted are given in Section 6. The statutory list entry for the nearby water tower and the Council's selection criteria for locally listed buildings are appended after the illustrations.

SECTION 2: THE SITE AND ITS HISTORICAL DEVELOPMENT

2.1 The hamlet of Southall was settled by the fourteenth century, and possibly earlier, and by the mid-seventeenth century the name denoted ‘the area later known as Southall Green, centring on King Street and the Green’ (Figure 5). At this point, the area was open agricultural land, with some enclosed land around hamlets of 20 houses or fewer. This began to change in the late seventeenth and eighteenth centuries, as the local clay and gravel deposits were exploited for building materials.

2.2 The land remained predominantly agricultural until the middle of the nineteenth century, but industry developed as transport and communications improved. In 1796 the Grand Junction Canal (Grand Union Canal) was cut along a route just over 1km south of the West Southall site. The Paddington branch of the canal, just under 1km to the west, opened in 1801, and in 1839 the Great Western Railway opened a station at Southall, on the new railway line running from London to Slough and the West Country. These links made it easier to transport heavy building materials and gradually, the fields that had been devoted to crops and grazing were turned over to clay extraction and brick-making. By the 1860s most of the pupils at the recently-opened St John’s Parochial School at Southall Green were the children of brick-makers. The Ordnance Survey map of 1878–80 (Figure 6) shows how the industry was changing the landscape: the fields west of the site are designated ‘Brick Fields’ and dotted with ‘Clay Mills’, indicating intensive brick-making activity in this area.

2.3 In 1880 the villages of Southall and Southall Green remained separate settlements, and little changed from their appearance 50 years earlier. By 1895–6 (Figure 7), however, there were the beginnings of significant development associated with more intensive industrialisation. The first gasworks in the area, on a site to the west of the West Southall site, was opened in 1865, with a chemical works adjoining to the east. In the 1880s both of these were replaced by the new gasworks on the West Southall site. Other late-nineteenth-century developments include the pumping station of the South West Suburban Water Works adjoining the gasworks, and a margarine factory, which was built on the south side of the railway line in 1893.

2.4 This industry created demand for workers' housing, while regular rail passenger services from Southall to Paddington (and on the now-defunct branch line to Brentford) made it easier for white-collar workers to commute to their places of work in central London. The westward spread of the London suburbs is evident on the Ordnance Survey map of 1896–7, which shows development moving southwards from Southall across the railway and towards Southall Green, and beginning to enlarge both villages. Alongside the housing arose the facilities associated with respectable working-class and lower-middle-class suburbs: three chapels (including one Wesleyan Methodist), a mission hall, and a post office (at the junction of South Road and Beaconsfield Road, just north of The Crescent). In addition, a field to the south, on the north side of Havelock Lane, was given over to use as a cemetery

The Gasholders

2.5 The larger of the two gasholders associated with the new gasworks (gasholder No. 3) was built in 1883 or 1884, when the new gasworks was first built. The smaller (No. 5) was erected during the rebuilding of the gasworks in 1929–30, which followed the amalgamation of the owners, the Brentford Gas Co., with the Gas Light and Coke Co. (Figures 3 and 8).

The Crescent

2.6 Nos. 20–32 The Crescent, Southall, London UB1 1BE stand on level ground to the north of the Great Western railway line, a little to the west of Southall Station (Grid reference TQ125798; Figure 3). The houses and their gardens form a quadrant, bounded to the west by the gardens of Nos. 1–11 Randolph Road and to the north by a garage at No. 18 The Crescent. The convex street frontage consists of a continuous terrace of 13 two-storey houses with small front gardens; the long back gardens taper towards the rear boundary in order to accommodate the quadrant plan.

2.7 Although the terrace is on the London Borough of Ealing's local list as a 'Building of Façade or Group Value', it is not included on the Statutory List of Buildings of Architectural or Historic Interest. The site is not within a conservation area, and there are no conservation areas adjoining it. The water tower that stands approximately 200m to the west is listed, in the Grade II category, and is the only listed building in the vicinity.

2.8 From the map evidence and from their architectural appearance (although the latter has been much altered), Nos. 20–32 The Crescent can be dated to around 1890. The terrace was part of a small development consisting of only three streets: Crescent Road (subsequently changed to The Crescent), Randolph Road and the east end of Beaconsfield Road.

2.9 The terrace of 13 houses was laid out on a curve dictated by the obtuse angle of the junction between the road and the railway line. The houses are two-storey dwellings of a standard type, built on a conventional late-Victorian terraced house plan. They have paired front doors leading to adjoining halls, and stairs ascending to the rear against the party wall. In the absence of a basement, the kitchen is housed in a back extension, which gives each house an L-shaped footprint. Each front entrance is recessed to form a porch entered under a moulded arch with a keystone detail. The ground-floor front rooms have canted bay windows. The contemporary houses in Randolph Road and Beaconsfield Road (Nos 14–22, at the east end) are identical, or vary only in detail.

2.10 The garage at the north end of the terrace (Figure 9) was there by 1958. The site of the public open space at the north end of The Crescent was formerly occupied by a terrace of early Victorian houses, which was demolished in 1959 (historic photos in Ealing Local History Library; reproduction unavailable).

The Water Tower

2.11 The water tower (Appendix 1) was built around the turn of the century; it was not shown on the OS map of 1896 but does appear on the 1914 map (Figure 10). The 1914 map also shows the west end of Beaconsfield Road completed, along with Grange Road. There was a cricket ground to the south of Grange Road. The streets of houses to the north of Beaconsfield Road were built from 1914.

2.12 By the mid-1930s (Figure 11), the whole area was fully built up, with the remaining pocket of open ground west of the water tower dedicated to allotments and sports grounds.

SECTION 3: SUMMARY OF SIGNIFICANCE

The Crescent

3.1 When first built, Nos. 20–32 The Crescent would have had a uniform appearance. The front elevations were of pale yellow stock brick construction, with red brick used to frame the first-floor window openings and in three courses forming a contrasting band between the first and second storeys. This attractive use of contrasting bricks is difficult to discern now, but a row of contemporary houses, Nos. 14–22 Beaconsfield Road, gives an idea of the original intention, with the colours reversed (Figure 12). It is likely that the brickwork of the projecting bays at ground-floor level was always rendered. The roofs to the houses and the window bays were covered with Welsh slate, and there were ogee-section cast-iron gutters. The windows were sliding single-pane sashes with timber frames, glazed with plate glass. The front doors were of panelled timber, and were recessed to form small, enclosed porches. The low brick walls to the front gardens were originally fitted with cast-iron railings of ‘butterfly’ type (i.e. decorative panels socketed into the coping at three points only across the frontage of each house), and the brick piers supported cast-iron gates to match. There would have been quarry tiles on the short paths leading to each front door.

3.2 The picture today is very different. Each house has undergone several major changes to its external appearance. Typical changes are (Figure 13):

- The slate roof covering has been removed and replaced with clay or concrete tile (12 out of 13 houses; the one remaining slate roof, at No. 25, is in very poor condition).
- The slate covering to the roof of the window bay has been covered with bitumen coating, or removed and replaced by clay or concrete tile (13/13).
- Cast-iron rainwater goods have been removed and plastic substitutes have been installed (12/13).
- The front wall has been rebuilt (1/13), painted or rendered (5/13), or the piers have been altered by painting, rendering or rebuilding (11/13).

- Stucco or reconstituted stone details to the window cills and the entrances have been clogged with paint, so that the crispness and detail of the mouldings has been lost (13/13).

- The timber sash windows have been removed and replaced with double-glazed units in hardwood, aluminium or plastic frames (13/13). Windows with small toplights or vertical casements have replaced the original glazing pattern of two large sashes of equal dimensions (12/13).

- The original front doors of panelled timber have been altered or — in most cases — replaced with historically inappropriate uPVC or hardwood substitutes in various designs, many of them glazed throughout (13/13).

- The recessed porches have been incorporated into the body of the house by fitting frames to the entrance arches and adding doors in plane with the front wall (5/13).

- Tiled paths have been covered in concrete (13/13).

3.3 There have been so many of these incremental and inconsistent changes that the terrace now exhibits a patchwork appearance from which it is nearly impossible to deduce the original appearance of the houses. The visual uniformity of the terrace has been destroyed and its historic character has been seriously damaged.

3.4 The loss of so much original material and detail is regrettable, but that is not to say that if the terrace had remained unaltered it would be a significant piece of architecture. It represents a standard form of suburban speculative housing, of a type built by the thousand in the late nineteenth century, and which survives in large numbers throughout the country. Such houses were not usually designed by known architects, but were built by developers according to standardised designs in builders' pattern books.

3.5 Nos. 20–32 The Crescent do not represent a specifically regional house type, as by 1890 the materials and methods used for this type of cheap housing were pretty standardised across the country. Nor are they particularly decorative or high-quality examples of their kind. The exterior architectural decoration is limited to coloured brickwork (now concealed), consoles with foliage relief decoration to the first-floor window cills and moulded keystone arches over the entrances. These are not high-quality items produced by craftsmen, but standardised pre-cast features available ‘off the peg’ from builder’s merchants’ catalogues.

3.6 The shape of the terrace is coincidental, derived from the angle of the pre-existing road and railway. Its form is achieved by a succession of straight frontages, not by curving the front walls, and the resulting slight wedge-shape of the individual house plans is neither innovative nor remarkable.

3.7 The contribution made by the terrace to the townscape is limited and coincidental. It occupies a prominent corner in views from the railway line, but this is not intentional: it does not represent a planned termination to a view along a street or a feature in a considered townscape composition; rather, it is identical to the neighbouring streets of speculative housing, except that it curves where they are straight.

3.8 Alterations similar to those that have damaged Nos. 20–32 The Crescent have been inflicted on the other houses that are earmarked for demolition in order to provide secondary access to the site (Figure 12). Like most of the Victorian and Edwardian properties in this neighbourhood, Nos. 1–11 Randolph Road, No. 30 Grange Road and Nos. 137–143 Beaconsfield Road have suffered different combinations of painted render, replacement windows and doors, and loss of decorative detail to the front walls and elevations. Because their original brickwork is still exposed, Nos. 137, 139 and 141 Beaconsfield Road preserve rather more of their original appearance. None of these houses is of any special historic or architectural interest; they are neither on the statutory list or the local list, nor subject to any other constraints restricting demolition. Detailed proposals for the subsequent use and restoration of these sites will be submitted for approval before demolition.

3.9 The Garage is an industrial building of brick with a sheet metal roof. It is of no historic or architectural interest.

The Gasholders

3.10 The older of the two gasholders, No. 3, is a column-guided design of 1883 or 4, with box lattice standards of trapezium plan, which turn the corners so that the girders in between have straight ends. It is nearly 100 feet (30.48m) high, with only two tiers of girders, which gave a distinctive elongated appearance to the panels when the gasholder was in use. The holder had a capacity of 2.3 million cubic feet (65,129m^3). The author of this design has not been identified. Its neighbour to the west, No. 5, which dates from 1929, is a piston (waterless) gasholder of the MAN design. It has a much larger capacity, of 7.1 million cubic feet (20,1050 m^3). Both gasholders are redundant.

SECTION 4: JUSTIFICATION FOR DEMOLITION

The Crescent

4.1 This section considers the proposal to demolish the terrace consisting of Nos. 20–32 The Crescent in order to provide an eastern access road to the proposed new development on the West Southall Site, in the context of the relevant national and local legislation.

4.2 The terrace is not on the Statutory List, nor is it of listable quality. It is not within a conservation area. Therefore the precise considerations relating to these statutorily protected structures and areas outlined in *Planning Policy Guidance Note 15: Planning and the Historic Environment* (PPG 15) do not apply in this case. PPG 15 does, however, state:

> "**… many buildings which are valued for their contribution to the local scene, or for local historical associations, will not merit listing … It is … open to planning authorities to draw up lists of locally important buildings, and to formulate local plan policies for their protection, through normal development control procedures. But policies should make clear that such buildings do not enjoy the full protection of statutory listing."**

4.3 The terrace is 'locally listed', having been added to the London Borough of Ealing's schedule as a 'Building of Façade or Group Value'. It has not been possible to establish the date on which it was so designated, only that the List has not been reviewed recently. The 'group/façade value' selection criterion occurs in the Urban Design/Townscape category of the Council's criteria for the selection of locally listed buildings (Appendix 2).

4.4 It would be interesting to know what condition the terrace was in when it was added to the Council's List because it is hard to see how, in its present state, it could be considered to have façade value. As detailed in paras 3.2 and 3.3 above, the façade has been so much and so unsympathetically altered that its architectural and historic interest has been reduced almost to nil. If the intention of the local listing was to preserve a typical example of late-Victorian working-class housing, then it has failed. A better impression of the original appearance of such housing can be gained from the contemporary terrace nearby, Nos. 14–22 Beaconsfield Road (Figure 12), although the latter is not locally listed.

4.5 The present state of Nos. 20–32 The Crescent may suggest that the time has come for its inclusion in the Local List to be reviewed. Nevertheless, since the terrace *is* on the local list, the proposal to demolish it must be assessed in the light of the Council's Policy 4.7 'Locally Listed Buildings with Façade Value and Incidental Features' in the Ealing UDP. Paragraph 1 of this policy states:

> **"The Council will protect and enhance the character of locally listed buildings, and groups of buildings with façade value. Proposals for demolition and alterations will be discouraged unless alternative use of the building is not viable or the planning benefits for the community outweigh the loss resulting from demolition."**

4.6 The Council explains that:

> **"Within the Borough there are many buildings and structures that are of more local importance and interest. Whilst these do not have statutory protection, the Council would expect to see evidence that any proposed alterations to the structure or its setting is enhancing both the character and appearance."**

And:

> **"…The Council will seek the retention of these buildings, including the retention of their salient features, and will resist their alteration or demolition, except where a convincing reason for such action can be shown."**

4.7 Applying this to Nos. 20–32 The Crescent prompts the questions, what aspects of the character and appearance remain to be enhanced, and what are the salient features to be retained? The present state of the terrace does not suggest that the Council's own policy has been followed. Local listing, without the benefit of control over permitted development rights, has not protected it from a succession of incremental, inconsistent and unsympathetic changes that have undermined the architectural and historic interest of these houses, and which continue relentlessly (Figure 12).

4.8 The question of an alternative use for these houses does not arise, as at the time of writing most of them are occupied dwellings. However, the planning benefits to the community that would result from their demolition are sufficient to justify their removal. The West Southall site has been identified as a Development Site (S13) in the Ealing UDP (Section 10.21), and a Proposed Development has been prepared for its redevelopment with a mix of uses including residential, retail, office and community uses, public open space and improved public transport. The Crescent is the location for a new access roadway to link the Development Site to South Road (the A3005) and Southall Station. This roadway is essential to the provision of safe and adequate access to the West Southall Site. It is proposed that the junction with the main road will be attractively landscaped, which will substantially improve views along South Road. Provision for pedestrians will also be improved. The Transport Assessment prepared by Savell, Bird and Axon (Appendix 8.1 to the Environmental Statement) explains the reasons why there is no viable alternative route for new roadway.

4.9 The development of the West Southall Site will provide substantial planning benefits for the community — not least the provision of more than 3,400 new residential units in a range of sizes and tenures — that will far outweigh the loss resulting from the demolition of the terrace of 13 houses in The Crescent, which are of little architectural or historic interest.

4.10 Section 66 (1) of the Planning (Listed Buildings and Conservation Areas) Act 1990 requires the local planning authority to have special regard to the desirability of preserving the setting of any listed building. PPG 15 (para 2.16) points out that:

“the setting is often an essential part of the building's character, especially if a garden or grounds have been laid out to complement its design or function. Also, the economic viability as well as the character of historic buildings may suffer and they can be robbed of much of their interest, and of the contribution they make to townscape or the countryside, if they become isolated from their surroundings, e.g. by new traffic routes, car parks, or other development.”

4.11 The terrace of Nos. 20–32 The Crescent stands some 200m east of the Grade II-listed water tower, framing the right-hand side of the eastern approach to the water tower from North Road. However, in its present poor state it detracts from, rather than enhances, the approach to the listed building. It forms a small part of the late-nineteenth century suburban streetscape, but has lost so much of its original architectural character that its removal could not be said to damage the historic context of the listed building. The proposed new roadway continues to separate the water tower from the nearest housing, but the historical record shows that the water tower has always been somewhat isolated by road and railway from its surroundings (Figure 9). A degree of separation is appropriate to distinguish the listed building with its industrial origins from the modest domestic scale of the nearby streets of terraced housing; the proposed new roadway will not further isolate the listed building but will provide it with an attractively framed approach from the east, which will enhance its role as a sentinel building at the entrance to the West Southall Site.

4.12 The justification for the demolition of Nos. 20–32 The Crescent may be summarised as follows:

- The incremental effect of numerous alteration to the houses has obliterated their original appearance so as to negate any positive contribution they might once have made to the local scene
- Removal of these houses permits the construction of essential new access to the West Southall site, which will link it to Southall town centre
- Pedestrian safety will be enhanced, and walking encouraged by the new access
- The townscape will be enhanced by improvements to the landscaping at the junction with the main road
- The new roadway is essential to the success of a redevelopment scheme that will provide substantial benefits to the local community, including over 3,400 new residential units
- There is no alternative route that offers the benefits listed above

- The setting of the listed Water Tower will be enhanced.

4.13 None of the other houses proposed for demolition in connection with the West Southall Site is protected by any heritage designation, either statutory or local. The removal of the garage at No. 18 The Crescent and Nos. 1-11 Randolph Road is required to achieve the safest and most attractive layout for the new access road, which will provide the principal way into the new development from the A3005.

4.14 Secondary vehicular access to the West Southall Site will be provided from two points on Beaconsfield Road, at Nos. 137–143 and No. 249 (with garage). The removal of these properties will link the West Southall Site to Beaconsfield Road and the streets of terraced housing to the north, between Beaconsfield Road and The Broadway (the A4020). In addition, pedestrian access to the West Southall Site will be provided in at the site of No. 30 Grange Road. These secondary entrances will increase the permeability of the West Southall Site and enhance the integration of the new development into the existing neighbourhood. Local residents will be able to access the supermarket and other retail facilities on foot, thereby reducing the use of cars for short local journeys. In addition, the new pedestrian access from Grange Road will benefit families moving into the new housing by providing safe and convenient, traffic-free access from the West Southall Site to Blair Peach Primary School.

The Gasholders

4.15 The two decommissioned gasholders are not included on the Statutory List of Buildings of Special Architectural or Historic Interest, nor are they considered to make a sufficiently valuable contribution to the local scene or to have sufficient local historical associations to merit 'local listing' by LB Ealing. They were, however, included in a survey of gasholders carried out by English Heritage in the late 1980s, under the Monuments Protection Programme. The report derived from this survey has not been published, and is not available to be consulted. However, English Heritage has confirmed that in their view neither of the gasholders merits efforts for its protection. Even so, they advise that the older of the two (No. 3) should be recorded in detail prior to demolition. The gasholders do not form part of the setting of the listed Water Tower: they are some 530m to the west, and the fixed gasholder to the east, which is retained in the Proposed Development, effectively blocks views between the two. Therefore the removal of the gasholders will have no effect on the setting of the listed building.

4.16 The removal of the decommissioned gasholders is an essential element in the Proposed Development of the West Southall site. Part of the footprint of the gasholders and their associated infrastructure will become the northern part of a new public green space (Central Park in the Proposed Development), a more formal counterpart to the nearby Minet Park, with recreational and sports facilities, and a sports pavilion. The rest of the gasholder site will be redeveloped to provide a section of a new road linking West Southall and the A312 to the west, and a proportion of the new housing along the north western (canal) boundary of the West Southall site. The removal of the gasholders is essential to the creation of these substantial community benefits

4.17 It is recommended that the older, column-guided gasholder (No. 3) be recorded in detail prior to demolition, in accordance with English Heritage's advice, and that the record be lodged in the appropriate local library or archive.

Conclusions

4.18 For the reasons set out above, we conclude that the demolition of the locally listed terrace consisting of Nos. 20–32 The Crescent, the undesignated properties at No. 18 The Crescent, Nos. 1–11 Randolph Road, No. 30 Grange Road and Nos. 137–143, and 249 (with garage) Beaconsfield Road, and the two decommissioned gasholders, is justified by the planning benefits for the community of the redevelopment scheme, which outweigh any loss resulting from demolition.

SECTION 5 EFFECTS ON THE WATER TOWER

5.1 The Water Tower was added to the Statutory List of Buildings of Special Architectural or Historic Interest, in the Grade II category, on 9 October 1972 (Appendix 1). It stands on a separate parcel of land enclosed within the West Southall site at its eastern end. It was converted into private flats in the late twentieth century.

5.2 The presence of this listed structure has implications for the development of the West Southall site under Section 66 of the Planning (Listed Buildings and Conservation Areas) Act 1990, which requires authorities considering applications for planning permission which affect a listed building on it's setting to have special regard to certain matters, including the desirability of preserving the setting of the building.

5.3 Central Government policies for the identification and protection of listed buildings are provided in PPG15 – *Planning and the Historic Environment*. Paragraph 2.16 deals with the setting of listed buildings, and explains why the setting of a listed building might be considered important:

> **… The setting is often an essential part of the building's character, especially if a garden or grounds have been laid out to complement its design or function. Also, the economic viability as well as the character of historic buildings may suffer and they can be robbed of much of their interest, and of the contribution they make to townscape or the countryside, if they become isolated from their surroundings, e.g. by new traffic routes, car parks, or other development.**

5.4 The water tower does not stand within ‘a garden or grounds that have been laid out to complement its design or function’. Its immediate setting is a triangle of flat ground, approximately 50% of which is hard surfaced for car access and parking, with some shrubs and small trees. In this particular case isolation is not the disadvantage that paragraph 2.16 of PPG 15 assumes it to be. In fact, as argued at 4.11 (above), it is essential to the character of the listed building, which started life as part of the local water supply infrastructure. The boundary wall, of brick masonry approximately 2.5m high, with steel security gates at the entrance, bears witness to the original need to keep the public out. The tower has always been somewhat isolated, and a degree of separation is appropriate to the industrial character and large scale of its architecture, which is very different in character and function from that of the surrounding suburban housing.

5.5 The Proposed Development for West Southall proposes to enclose the north and south sides of the water tower triangle with new principal roads for cars and public transport. These roads will be landscaped, with soft planting, including glass verges and tree planting. Thus the historic separation of the tower will be maintained, but by landscaped corridors that will enhance the setting of the listed building.

5.6 Paragraph 2.17 of PPG 15 explains that local planning authorities are required to publish a notice of all applications they receive for planning permission for any development which, in their opinion, affects the setting of a listed building. It explains the nature and definition of the setting thus:

> **… The setting of individual listed buildings very often owes its character to the harmony produced by a particular grouping of buildings (not necessarily all of great individual merit) and to the quality of the spaces created between them. Such areas require careful appraisal when proposals for development are under consideration … Where a listed building forms an important visual element in a street, it would probably be right to regard any development in the street as being within the setting of the building. A proposed high or bulky building might also affect the setting of a listed building some distance away, or alter views of a historic skyline.**

5.7 On the subject of the design of new buildings intended to stand alongside historic buildings, PPG15 states, at paragraph 2.14:

> **… In general it is better that old buildings are not set apart, but are woven into the fabric of the living and working community. This can be done, provided that the new buildings are carefully designed to respect their setting, follow fundamental architectural principles of scale, height, massing and alignment, and use appropriate materials. This does not mean that new buildings have to copy their older neighbours in detail: some of the most interesting streets in our towns and villages include a variety of building styles, materials, and forms of construction, of many different periods, but together forming a harmonious group.**

5.7 At present, the buildings surrounding the water tower cannot be described as being in harmony with the tower and with one another (see Section 3 above), and the spaces between the tower and its neighbours are of poor quality. The proposed roads will improve the quality of the spaces immediately adjacent to the tower to north and south. Adjoining the western boundary will be the proposed ‘High Street’ containing retail shops, cafés, bars and restaurants. This will be low (equivalent to 2/3 storeys) at the boundary, so as not to compete with the water tower, and will rise towards the west, making a visual link with larger-scale buildings in the ‘Town Square’ part of the new development. The boundary with the water tower site will thus be more clearly delineated, and the listed building will be anchored into the overall Scheme whilst maintaining its historical separateness.

5.8 The proposals respect and enhance the landmark quality of the water tower. The new roads and buildings are laid out so that the tower terminates views east from the Town Square. The retention of the existing ‘blue tower’ gasholder and the provision of new tall structures at carefully considered points along the east-west axis of the West Southall site, provide a sequence of landmarks in which the water tower functions as a sentinel building announcing the entrance to the site to people approaching from the west, and as a focal point in views looking east from several points within the site.

5.9 The Proposed Development gives the water tower an important role in a new, dynamic area of residential, community and commercial development, with a public park nearby, linked to the surrounding area by new roads, bridges and paths. The tower, which has always been set apart somewhat from its surroundings, is thus 'woven into the fabric of the living and working community' as never before, yet retains its distinctive identity within a much enhanced setting. The proposals thus meet, and even exceed, the criteria for development affecting the setting of a listed building set out in PPG15.

SECTION 6 REFERENCES

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Stefan Muthesius, *The English Terraced House, New Haven and London*: Yale University Press, 1983.

C. M. Neaves, *A History of Greater Ealing*, 1971.

Kit Wedd, *The Victorian Society Book of the Victorian House*, London: Aurum Press, 2002.

The help of Dr Jonathan Oates of the Local History Centre, Ealing Central Library, in locating historic photographs, is gratefully acknowledged.

Figure 1. Nos. 20–32 The Crescent, Southall: site plan

Figure 2. Nos. 20–32 The Crescent, Southall: photomontage

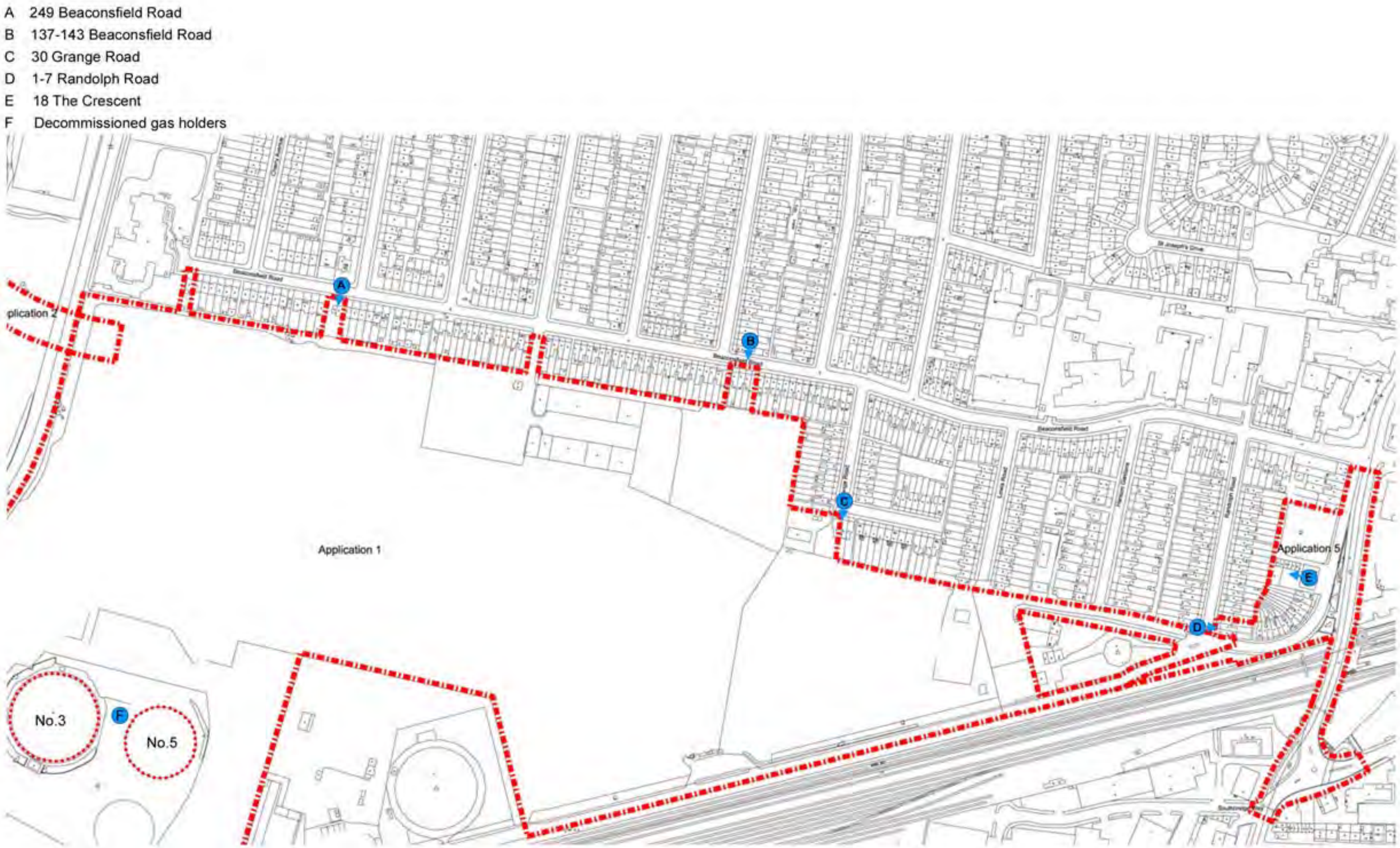


Figure 3. Photo location plan: other properties proposed for demolition

A. 283 Beaconsfield Road

B. 249 Beaconsfield Road

C. 137-143 Beaconsfield Road

D. 30 Grange Road

E. 1-7 Randolph Road

F. 18 The Crescent

Figure 4. Properties proposed for demolition

Figure 5. John Cary's map, 1786 (detail)

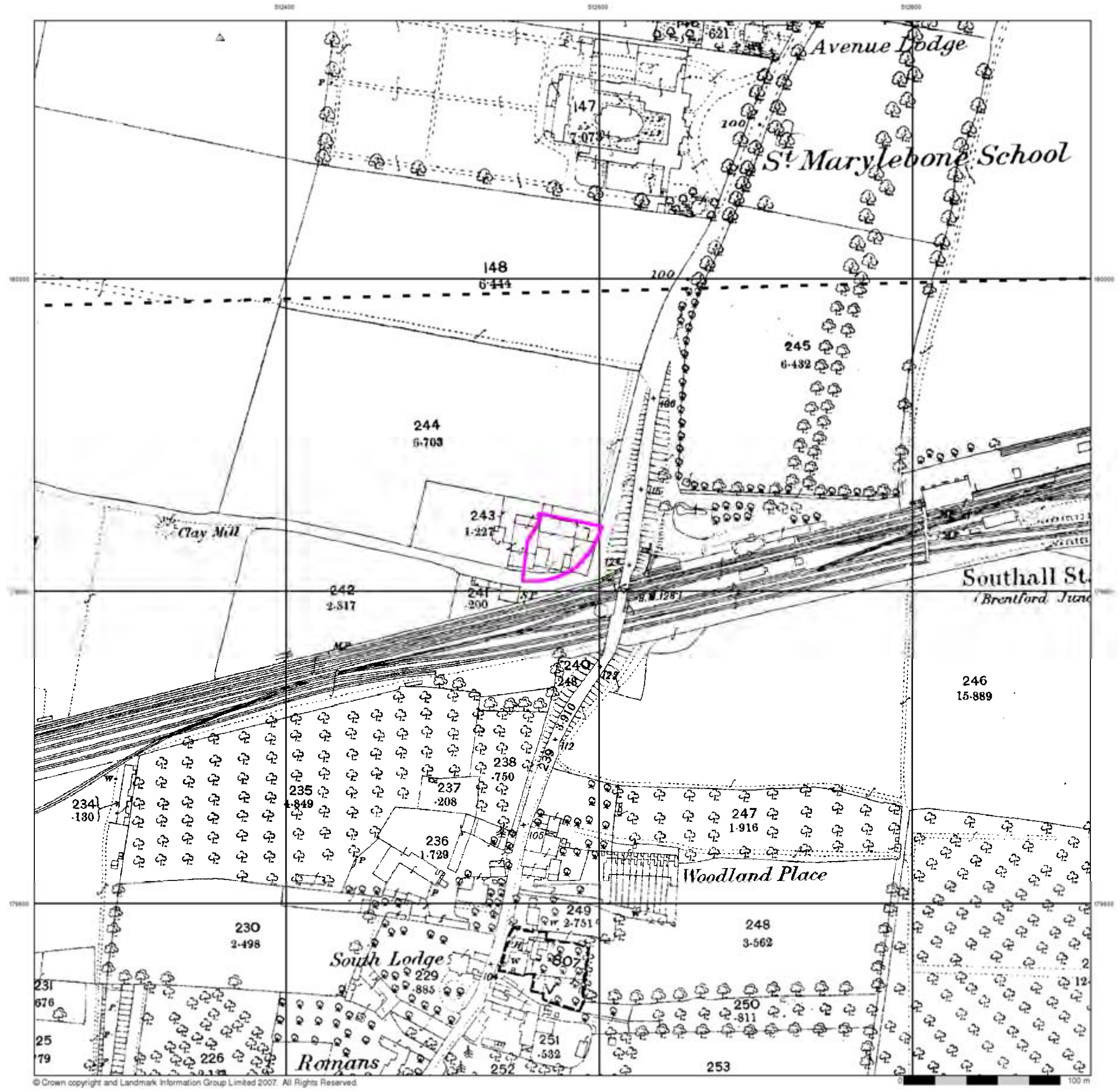


Figure 6. Ordnance Survey map, 1878–1880 (detail)

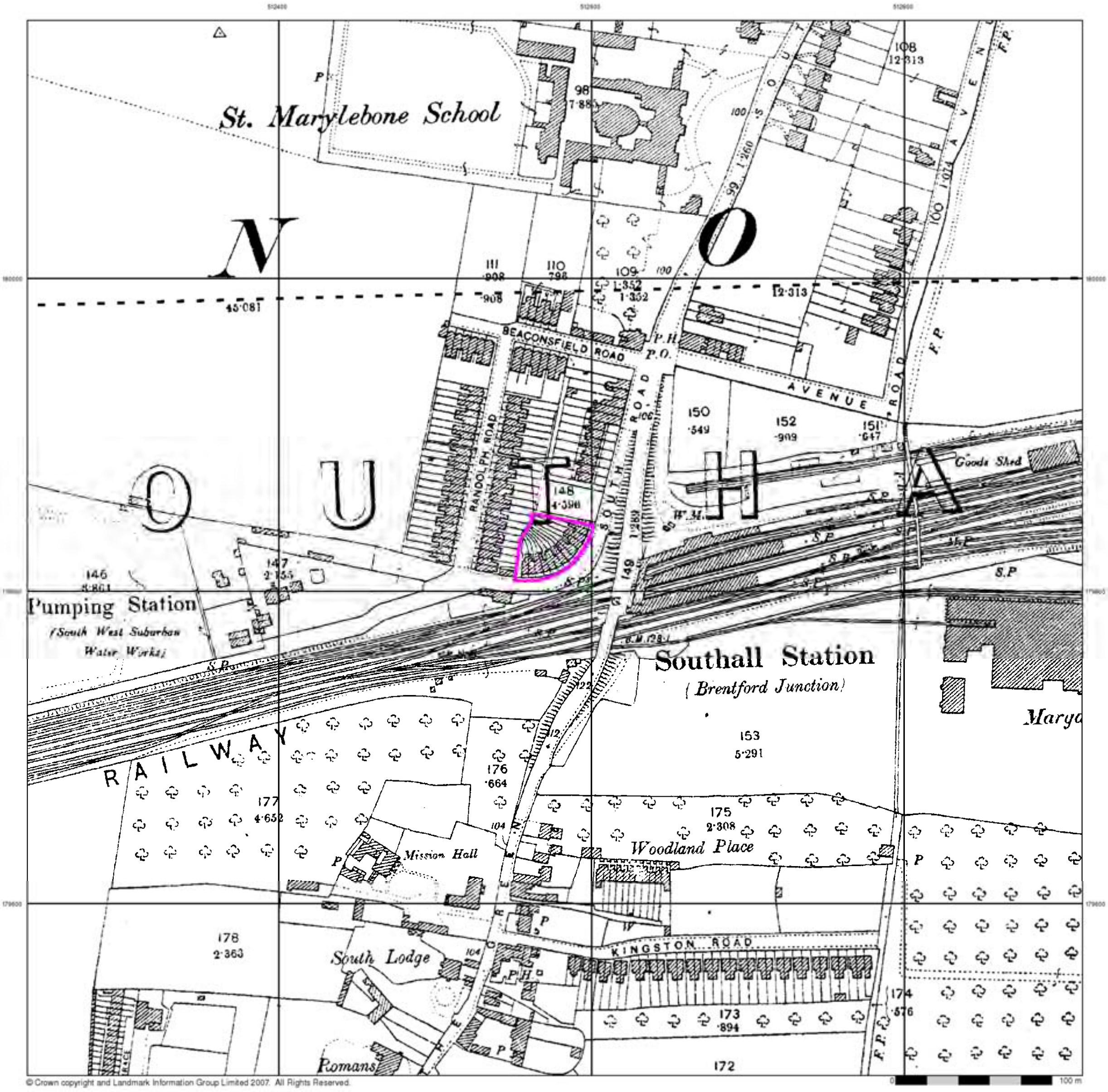


Figure 7. Ordnance Survey map, 1895–1896 (detail)

Figure 8. The gasworks site, viewed from the north-west: the box-lattice standards of No. 3 in front of the ‘blue tower’ fixed gasholder, which is to be retained

Figure 9. North end of terrace, with garage: water tower in background

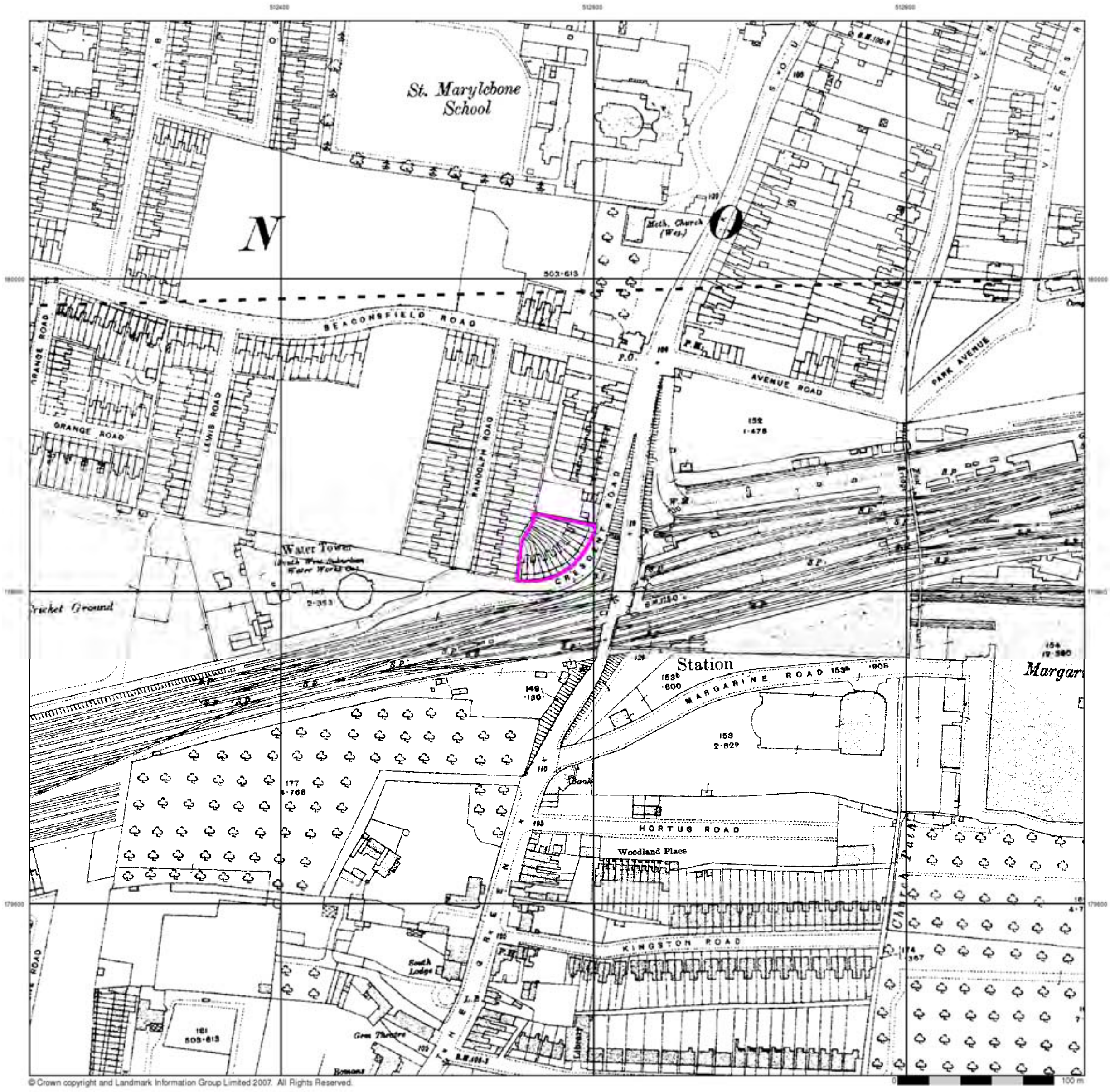


Figure 10. Ordnance Survey map, 1914 (detail)

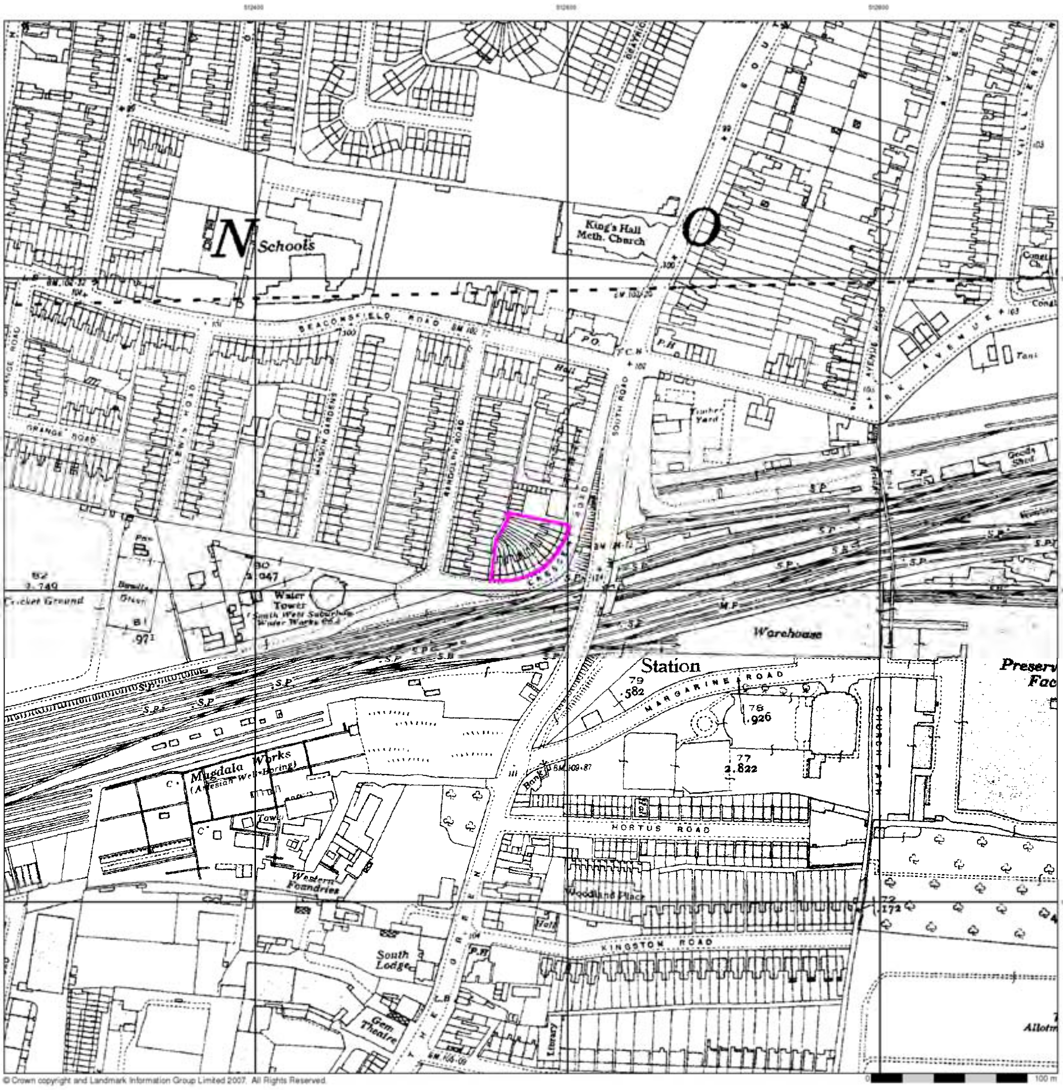


Figure 11. Ordnance Survey map, 1935 (detail)

Figure 12. Nos. 14-22 Beaconsfield Road, Southall

Figure 13. Nos. 20–28 The Crescent, Southall, photographed 20.12.07

APPENDIX 1: LIST DESCRIPTION: THE WATER TOWER

© Mr Quiller Barrett LRPS

IoE Number: 200919

Location: THE WATER TOWER, THE CRESCENT, SOUTHALL, EALING, GREATER LONDON

Photographer: Mr Quiller Barrett LRPS

Date Photographed: 01 January 2001

Date listed: 09 October 1972

Date of last amendment: 09 October 1972

Grade II

THE CRESCENT 1. 5010 Southall The Water Tower TQ 17 NW 4/2 9.10.72 II 2. Late C19. Red brick. Four stage hexagonal tower with 2 windows on each face with 3 on the top floor; drip moulds over. Vestigial corner turrets, stair turret on one face. Machicolations, battlemented parapet.

APPENDIX 2: SELECTION CRITERIA FOR LOCALLY LISTED BUILDINGS

The Council may designate additional Locally Listed Buildings that contribute to the local scene or have local historical associations.

1. *Contributions to the local scene*

Landmarks

a) Ornate corner buildings

b) Curiosities or individual buildings of merit that are different from the surrounding ones

c) Buildings too modern for statutory listing

d) Other features of interest

Urban Design/ Townscape

e) Group/façade value

f) Architectural/historical unity

g) Associated landscape

h) Townscape value

Architectural interest

j) Type of building

k) Craftsmanship

l) Design

m) Building techniques

2. *Local Historical Association*

n) Social, economic, cultural, military

o) Famous local people and events

Source: Ealing Council Unitary Development Plan (adopted 12 October 2004). Accessed: http://www.cartoplus.co.uk/ealing/text/04_urban.htm#4_7

APPENDIX 17.1 ASSESSMENT OF SOLAR SHADING ON PRINCIPAL PUBLIC REALM

Appendix 16.1 Assessment of Solar Shading on Principal Public Realm

AREA/RECEPTOR	IMPORTANCE	SENSITIVITY	MAGNITUDE	NATURE OF EFFECT	SIGNIFICANCE	COMMENTS
ADJACENT RECEPTORS						
Curtilage of Existing Properties to North						
Phase 1	Medium	High	Low	Permanent Neutral	Moderate	Beaconsfield Road/Grange Road/Lewis Road/Randolph Road - Rear gardens already partially shaded by fencing and walling along West Southall Site boundary. Potential shading effects minimised through restriction of proposed development heights to 3 to 6 storeys. Excellent to good solar access throughout the day for much of the year, reducing to large effect during Winter. Slight overshadowing late afternoon only in March.
Phase 2	Medium	High	Negligible	Permanent Neutral	Negligible	Blair Peach School off Beaconsfield Road. Existing tall brick wall along West Southall boundary already casts shade across path and southern part of play area. Potential shading effects minimised through restriction of proposed development heights to 3 storeys, may improve existing direct sunlight levels. Excellent to good solar access throughout the day for much of the year, reducing to large effect during Winter. Negligible overshadowing late afternoon only in March.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 1 and 2 developments only.
Curtilage of Listed Water Tower						
Phase 1	High	Medium	Low	Permanent	Minor	Affected by Phase 1 development only.

AREA/RECEPTOR	IMPORTANCE	SENSITIVITY	MAGNITUDE	NATURE OF EFFECT	SIGNIFICANCE	COMMENTS
				Neutral		Rear gardens of cottages within curtilage of Water Tower already partially shaded by fencing and walling along property boundary. Potential shading effects of Water Tower curtilage minimised through restriction of proposed development heights to 4 storeys. Good solar access throughout the day for much of the year, reducing during Winter. Minor overshadowing in mid to late afternoon in March.
Phase 2	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 1 development only.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 1 development only.
The Straight						
Phase 1	Low	Medium	Negligible	Permanent Neutral	Negligible	Thoroughfare linking Spencer Street area south of railway with Southall. No impact from development in throughout the day in March, negligible shading late evening in June.
Phase 2	Low	Medium	Negligible	Permanent Neutral	Negligible	Localised effect late evening in June from School/health/cinema complex only. No other Phase 2 impacts.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptor affected by Phase 1 and 2 developments only.
The Grand Union Canal						
Phase 1	High	High to Medium	Low to Negligible	Permanent Adverse	Minor	Localised effect arising from shade cast by Pump Lane Link Road bridge upon water bodies. Impacts minimised by separation from railway bridge, minimum road width and parapet design.

AREA/RECEPTOR	IMPORTANCE	SENSITIVITY	MAGNITUDE	NATURE OF EFFECT	SIGNIFICANCE	COMMENTS
						Due to orientation of Pump Lane Link Road Bridge, shading is limited to that immediately beneath the bridge deck during early morning in March, with good solar access gained to north and south. Shadow cast to north in early afternoon – some direct sunlight would be gained beneath much of the bridge during this time.
Phase 2	High	High to Medium	Negligible	Permanent Adverse	Minor (Development) to Negligible (Bridges)	Principally recreational mixed-use area, including waterway use, passive recreation (angling/sitting for long periods), and active recreation (walking – long distance route/ cycling). Towpath already shaded by fencing and walling along West Southall boundary north of proposed Minet Bridge. Orientation of Canal allows excellent solar access throughout the afternoon to much of the water body from mid morning through the remainder of the day in March, and throughout day in June. Solar access deteriorates during Winter, with 'slots' of sunlight gained between buildings. Localised effect arising from shade cast by Minet Bridge and Pedestrian Bridges upon water bodies and island during March. Effect limited by lightness of structural design and nature of bridge (cycle/pedestrian only use). As with Pump Lane Link Road Bridge, transient shadows would be cast throughout the day in March, but most of the land beneath and adhjacent to the bridges should receive some degree

AREA/RECEPTOR	IMPORTANCE	SENSITIVITY	MAGNITUDE	NATURE OF EFFECT	SIGNIFICANCE	COMMENTS
						of direct sunlight, but
Phase 3	High	High to Medium	Negligible	Permanent Adverse	Minor	As per Phase 2 impacts, but between proposed Minet Bridge and railway bridge.
WEST SOUTHALL SITE RECEPTORS						
PHASE 1 AREA - Eastern access/gateway						
Phase 1	High	Medium	Large	Permanent Beneficial	Substantial	Space forms thoroughfare for movement (brisk walking, strolling etc). Slight shading early morning in March and June, providing generally good to excellent solar access. Excellent solar access during Winter until early afternoon.
Phase 2	Medium	Medium	Small to Medium	Permanent Beneficial	Moderate to Minor	As per Phase 1, but school etc complex casts slight shadow late afternoon in March; excellent levels of solar access throughout early parts of day. Excellent solar access during Winter until early afternoon.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptor affected by Phase 1 and 2 developments only.
Eastern section of main street/boulevard						
Phase 1	Medium	Medium	Medium	Permanent Beneficial	Moderate	Space forms thoroughfare for movement (brisk walking, strolling, window shopping etc). Spatial arrangement of street permits good solar access to central and northern areas of space through the morning in March, reducing to ‘slots’ of sunlight from noon onwards. North-facing frontages along southern edge in permanent shade in March. Excellent solar access throughout the whole day in June. Wintertime sunlight limited to ‘slots’ between buildings.
Phase 2	Medium	Medium	Low	Permanent	Minor	Phase 2 impacts limited to negligible effects

AREA/RECEPTOR	IMPORTANCE	SENSITIVITY	MAGNITUDE	NATURE OF EFFECT	SIGNIFICANCE	COMMENTS
				Beneficial		arising from school/health/cinema complex at eastern extreme of street only in March. No impact in June.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptor affected by Phase 1 and 2 developments only.
Urban square						
Phase 1	High	High	Large	Permanent Beneficial	Substantial	Space envisaged for leisure uses combining active and passive activities (from brisk walking to sitting for short or long periods). Much of the Square enjoys excellent levels of solar access throughout the Spring, Summer and Autumn. Limited solar access in Winter from mid morning to mid afternoon.
Phase 2	High	High	Low	Permanent Beneficial	Moderate	As per Phase 1, but impact limited to effect of proposed hotel. Small impact late afternoon in March, and from late afternoon/early evening in June. No effect in December.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptor affected by Phase 1 and 2 developments only.
Informal recreational spaces within Phase 1 area						
Phase 1	Medium	Medium	Medium	Permanent Neutral	Negligible	Space envisaged for leisure uses combining active and passive activities (from brisk walking/children's play to sitting for short or long periods). High levels of shade until mid afternoon in March.
Phase 2	Medium	Medium	Medium	Permanent Neutral	Negligible	As per Phase 1, but localised eastern end of space affected school complex.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 1 and 2 developments only.

AREA/RECEPTOR	IMPORTANCE	SENSITIVITY	MAGNITUDE	NATURE OF EFFECT	SIGNIFICANCE	COMMENTS
Internal routes within Phase 1 area						
Phase 1	Low	Low	Medium	Permanent Beneficial	Minor	Space forms thoroughfare for movement (brisk walking, strolling etc.) Reasonable levels of solar access during Spring, increasing to good in Summer. Direct solar access limited in Winter to ‘slots’ of sunlight between buildings.
Phase 2	Low	Low	Low	Permanent Beneficial	Negligible	As per Phase 1, but localised area affected by subsequent Phase 2 development.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 1 and 2 developments only.
Private and communal courtyards/gardens within Phase 1 area						
Phase 1	Medium	Medium	Large to Negligible	Permanent Neutral	Substantial to Negligible	Private and communal (semi-private) open spaces within the curtilage of private buildings envisaged for general passive and active leisure uses. Orientation of buildings generally seeks to maximise solar access. Site constraints result in mixed solar access in March; some units gain excellent sunlight levels, whilst others receive no direct sunlight in March. All spaces receive direct sunlight from mid morning to late afternoon in June.
Phase 2	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 1 development only.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 1 development only.
PHASE 2 AREA - Central section of main street/spine road						
Phase 1	N/A	N/A	N/A	N/A	N/A	Receptor affected by Phase 2 developments only.
Phase 2	Medium	Medium	Large	Permanent Beneficial	Substantial	Space forms thoroughfare for movement (brisk walking, strolling, window shopping etc).

AREA/RECEPTOR	IMPORTANCE	SENSITIVITY	MAGNITUDE	NATURE OF EFFECT	SIGNIFICANCE	COMMENTS
						Excellent levels of direct sunlight until mid afternoon in March. Similar effects in June, with some shading from late afternoon onward.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptor affected by Phase 2 developments only.
Active canal zone and canal side park						
Phase 1	N/A	N/A	N/A	N/A	N/A	Receptor affected by Phase 2 developments only.
Phase 2	Medium	High to Medium	Large	Permanent Beneficial	Substantial	Space envisaged for leisure uses active uses associated with canal, but also likely to be used for passive uses such as sitting for short or long periods. Good levels of solar access from mid morning until mid afternoon in March; excellent levels throughout the day in June.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptor affected by Phase 2 developments only.
West Southall park						
Phase 1	N/A	N/A	N/A	N/A	N/A	Receptor affected by Phase 2 developments only.
Phase 2	High	High	Large	Permanent Beneficial	Substantial	Space envisaged for leisure uses combining active and passive activities (from brisk walking/sports courts to sitting for short or long periods). Excellent levels of solar access throughout the day in March (some shadow early morning from gasholder only). Late evening shadow only in Summer and Winter, with good levels of direct sunlight through the earlier part of the day.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptor affected by Phase 2 developments only.

AREA/RECEPTOR	IMPORTANCE	SENSITIVITY	MAGNITUDE	NATURE OF EFFECT	SIGNIFICANCE	COMMENTS
Internal routes within Phase 2 area						
Phase 1	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 2 and 3 developments only.
Phase 2	Low	Low	Medium	Permanent Beneficial	Minor	Space forms thoroughfare for movement (brisk walking, strolling etc.) Reasonable levels of solar access during Spring, increasing to good in Summer. Direct solar access limited in Winter to 'slots' of sunlight between buildings.
Phase 3	Low	Low	Low	Permanent Beneficial	Negligible	As per Phase 2, but localised edge effects arising from Phase 3 development.
Private and communal courtyards/gardens within Phase 2 area						
Phase 1	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 2 developments only.
Phase 2	Medium	Medium	Large to Negligible	Permanent Neutral	Substantial to Negligible	Private and communal (semi-private) open spaces within the curtilage of private buildings envisaged for general passive and active leisure uses. Orientation of buildings generally seeks to maximise solar access. Site constraints result in mixed solar access in March; some units gain excellent sunlight levels, whilst others receive no direct sunlight in March. All spaces receive direct sunlight from mid morning to late afternoon in June.
Phase 3	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 2 developments only.
PHASE 3 AREA - Southern section of main street/spine road						
Phase 1	N/A	N/A	N/A	N/A	N/A	Receptor affected by Phase 3 developments only.
Phase 2	N/A	N/A	N/A	N/A	N/A	Receptor affected by Phase 3 developments only.
Phase 3	Medium	Medium	Large	Permanent	Substantial	Space forms thoroughfare for movement

AREA/RECEPTOR	IMPORTANCE	SENSITIVITY	MAGNITUDE	NATURE OF EFFECT	SIGNIFICANCE	COMMENTS
				Beneficial		(brisk walking, strolling, window shopping etc). Excellent levels of direct sunlight throughout day in March. Similar effects in June, with some shading from late afternoon onward.
Informal recreational spaces within Phase 3 area						
Phase 1	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 3 developments only.
Phase 2	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 3 developments only.
Phase 3	Medium	Medium	Large	Permanent Beneficial	Substantial	Space envisaged for leisure uses combining active and passive activities (from brisk walking/children's play to sitting for short or long periods). Excellent levels of solar access throughout day in March; similar effects in June, but with shading late evening..
Internal routes within Phase 3 area						
Phase 1	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 3 developments only.
Phase 2	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 3 developments only.
Phase 3	Low	Low	Medium	Permanent Beneficial	Minor	Space forms thoroughfare for movement (brisk walking, strolling etc.) Reasonable levels of solar access during Spring, increasing to good in Summer. Direct solar access limited in Winter to 'slots' of sunlight between buildings.
Private and communal courtyards/gardens within Phase 3 area						
Phase 1	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 3 developments only.
Phase 2	N/A	N/A	N/A	N/A	N/A	Receptors affected by Phase 3

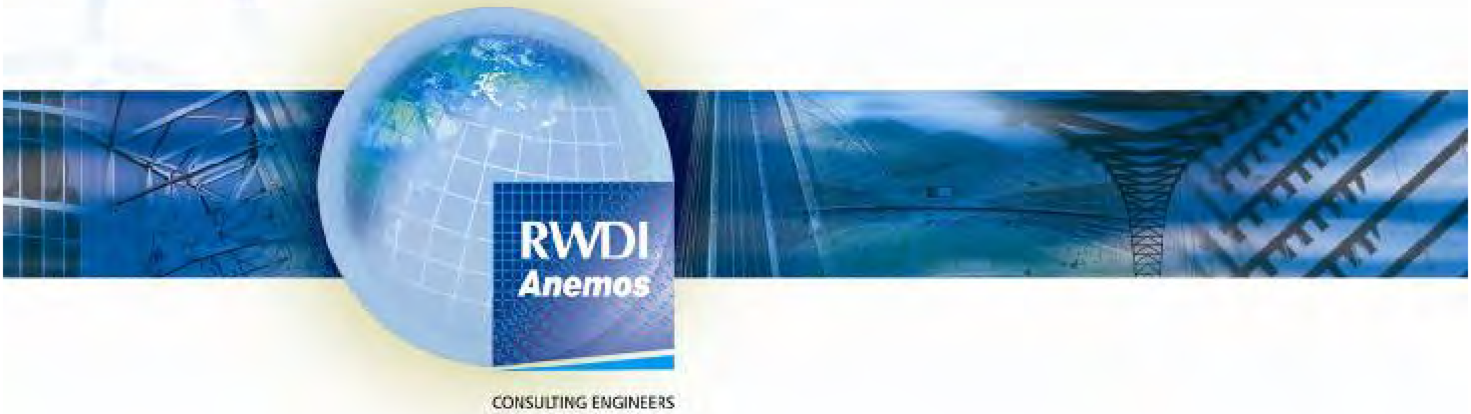
AREA/RECEPTOR	IMPORTANCE	SENSITIVITY	MAGNITUDE	NATURE OF EFFECT	SIGNIFICANCE	COMMENTS
						developments only.
Phase 3	Medium	Medium	Large to Negligible	Permanent Neutral	Substantial to Negligible	Private and communal (semi-private) open spaces within the curtilage of private buildings envisaged for general passive and active leisure uses. Orientation of buildings generally seeks to maximise solar access. Site constraints result in mixed solar access in March; some units gain excellent sunlight levels, whilst others receive no direct sunlight in March. All spaces receive direct sunlight from mid morning to late afternoon in June.

Pedestrian Wind Conditions for the West Southall Masterplan: London.

RPS

18th February 2008

Project Reference # 07-407-1B (FINAL)



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OBJECTIVE

The objective of this report is to review drawings of the proposed Masterplan for the West Southall site in London and to assess the likely environmental wind conditions around the site.

VERSION HISTORY

INDEX	*DATE*	*PAGES*	*AUTHOR*
A	*20th December 2007*	*All*	*W. Pearce*
B	*18th February 2008*	*All*	*W. Pearce*

CHECKED BY

CONTENTS

TABLES

FIGURES

1. SUMMARY

This report is an assessment of the likely wind conditions for the Masterplan (Revision 02) of the proposed redevelopment at West Southall in London. It outlines the overall methodology and the use of comfort criteria to describe the wind conditions expected on site; the criteria employed are the Lawson Criteria which are a well-known and well-established means of assessing building developments in the U.K. The site description is used mainly to identify building massing and features that are pertinent to the wind microclimate on site. The discussion describes meteorological conditions and the expected main flow interactions around the site. The assessment is based upon RWDI-Anemos' experiences with other similar schemes and our expert knowledge of the interaction of wind with the built environment.

The term tolerable, to describe the likely wind conditions, is used in a specific technical sense and is defined in Table 2 and Table 3 for different pedestrian activities using the Lawson Comfort Criteria, which RWDI-Anemos routinely use to describe the pedestrian level wind environment. In the report conditions are sometimes described as being tolerable for (say) standing or better. The "or better" qualifier reflects the general guideline that during the summer months wind conditions are typically one criterion lower than the windiest winter time results.

2. SITE DESCRIPTION

The site is in west London and the O.S. reference for the site is (511705, 179795). Figure 1 is a Masterplan of the proposed development showing the building layout and numbering system for the different plots whereas, Figure 2 shows the proposed landscape plan. The site is bounded by mainline Railway lines to the south, the Grand Union Canal to the west/northwest, Beaconsfield Road to the north and Grange Road, Lewis Road and Hanson Gardens to the east. There is a Transco compound containing three Gas Towers which the site surrounds. Figure 3 is an indicative 3D view of the scheme (not the final masterplan shown in Figures 1 & 2).

The surrounding buildings to the north and east are all residential areas comprising two and three storey housing with similar to the south of the Railway tracks. However the area to the southwest is an industrial estate comprising a dense collection of warehouse buildings. There appears to be a similar commercial area south of the east end of the site. To the west of the Grand Union Canal is the London Borough of Hillingdon and an area of undeveloped land containing sports fields and areas of scrub with trees.

The development includes residential, commercial, leisure/hotel, and retail units with buildings ranging in height from 3-storeys up to a maximum height of 17-storeys. The individual building plots have a central courtyard which is landscaped and intended for amenity space. There are also a number of larger open spaces within the development. The site is divided into three zones with the buildings in these zones denoted as 'CPS', 'CPN' and 'HS', moving from west to east across the site.

3. METEOROLOGICAL DATA

3.1 General Meteorological Conditions

The wind climate in the south of the United Kingdom (UK) is reasonably consistent with prevailing winds occurring from the southwest throughout the year and secondary prevailing winds from the northeast during late spring and early summer. The north easterlies are not as strong as the south westerlies but occur for a similar amount of time during this period and are cold winds. Winds from the south westerly quadrant typically account for around 45% of all wind. Utilising meteorological data for London as representative for the site it is apparent these trends can be clearly seen (the data shown is for each of the four seasons). The meteorological data is corrected to standard conditions of 10m above open flat level country terrain at sea level.

Knowledge of the prevailing wind direction allows us to focus attention on the likely impact of these winds on the site except where the building massing/layout indicates that winds from other directions are likely to be important. Taking account of other design constraints, it is desirable that the site is arranged so that the maximum acceleration of the wind due to the building massing occurs for the lightest and most infrequent wind speeds and directions with due consideration given to the ground roughness. In this way pedestrian comfort is optimised.

3.2 Surface Roughness

Another consideration is the ground roughness in each wind direction because wide, open spaces permit the wind to blow down to ground level generating conditions similar to that of open countryside even within a built-up area. An assessment of the ground roughness for the proposed site was conducted using the BREVe2[1] software. Table 1 presents the 'mean factors' for the site where the mean factor represents the ratio of wind speed on site, at the stated reference height, as a fraction of the wind speed in open, flat countryside at a height of 10m. The factors for 10m height vary from 0.61 to 0.84. This variation reflects the more open terrain to the west of the site with the lower numbers signifying the increased roughness of the urban terrain compared with the standard open country conditions of the corrected met data.

4. LAWSON COMFORT CRITERIA

4.1 Comfort

RWDI-Anemos routinely use criteria developed by Lawson[2]. Lawson devised a twelve-point scale (points 3 to 10 are included in Table 2) to represent equal increments of annoyance or reaction to the wind and these were then used to set threshold values for particular pedestrian activities. The criteria account for the fact that the wind conditions perceived as tolerable by pedestrians depend on the activity they are engaged in. For example, wind conditions in an area designated for sitting need to be more benign than a location that people merely walk past. In total six pedestrian activities are described in ascending order of activity: sitting, standing, leisure walking, business walking and roadways/car parks. Table 3 summarises the Beaufort Land Scale and quantifies the wind speeds associated with each Beaufort Range.

4.2 Pedestrian safety

The Lawson Criteria also specify a lower limit safety criterion when winds exceed Beaufort Force 6. Exceedence of this safety criterion may indicate a need for remedial measures or a careful assessment of the expected use of that location, e.g. is it reasonable to expect vulnerable pedestrians to be present at the location on the windiest day of the year?

As a general rule-of-thumb business walking and roadway conditions are associated with wind speeds in excess of the Beaufort Force 6 (B6) safety criterion.

5. BASELINE CONDITIONS

It is often the case that a new development dramatically alters the pedestrian activity on site and consequently a comparison of the original wind conditions with those on the developed site can be meaningless. For example wind conditions currently suitable for pedestrian walking and which remain suitable for pedestrian walking after development leads to the conclusion that there is negligible impact due to the development. However, if on the new development the location of interest is outside a main entrance then the impact is adverse and will require remedial action. This is an important consideration when defining and applying baseline conditions and is particularly relevant for the Southall Gas Works site because it is presently a large, open car park.

[1] *BREVe2 – A publicly available software implementation of the design wind speed rules of BS6399-2 sold by BSI, BRE and RWDI-Anemos. The program includes terrain and topography information from BRE and Ordnance Survey.*
[2] T.V. Lawson, 'Building Aerodynamics', Imperial College Press, © 2001

5.1 The current wind conditions on site.

Analysis of the meteorological data for the existing open site indicates that the existing conditions on site are likely to be tolerable for standing or better. The implication of this result is that, after development, if the site has a number of locations where the conditions are tolerable for (say) leisure walking, then these are likely to be perceived to be 'windy' relative to general conditions in the area.

5.2 The current wind conditions around the site (on neighbouring properties).

Although it is our understanding that the 'right of light' has no equivalent for wind it is desirable, as part of a good neighbour policy, to minimise adverse changes to the wind conditions on neighbouring buildings due to a development. It is generally the case that development may lead to increased wind speeds on adjacent properties for some wind directions but increased shelter for other directions.

5.3 Comparison of the wind conditions with the desired conditions.

In the assessment of the proposed development, comparison is made between the wind conditions expected on the developed site and the desired wind conditions. This is generally the most useful baseline for comparison because it is an assessment which indicates whether the wind conditions are suitable for the intended pedestrian activity at a location.

6. CONDITIONS AROUND THE PROPOSED DEVELOPMENT

Appendix A contains a number of general comments on the way that wind behaves in and interacts with the built environment. It is provided as a general reference.

6.1 West End of the Site – 'CPS' blocks

The west end of the site narrows to a point and comprises eleven blocks of buildings and these buildings are primarily residential.

Blocks CPS 03, 04, 05 & 06 along the southern boundary of the site are which are similar in height to the existing buildings long the southern boundary of the railway tracks. The wind conditions around these buildings are expected to be suitable for standing/entrance use or better throughout the year.

CPS01, 02, and 07 to 11 all have a courtyard area which is either surrounded on four sides or open to the north. These courtyards are therefore sheltered from the prevailing winds and conditions are expected to be suitable for sitting in the summer. There is a funnel between blocks CP07 & CP08 at the west end of the site and this will accelerate winds from the south, but southerly winds are both light and infrequent. The wind microclimate is therefore expected to be suitable for standing/entrance use in/around blocks CPS01, 02, 07 to 11. We would advise that entrances should be located away from the corners of these buildings.

These conditions are considered to be compatible with the likely pedestrian use of this part of the site.

6.2 North Central Part of the Site – 'CPN' Blocks

There are eleven buildings which make up the north, central part of the site. There is a cluster of potentially taller buildings in/around the junction between CPN06, 07 & 09 with the ends of these buildings being up to 12-storeys in height. The south elevation of this group of buildings is exposed because of the open park area adjacent to the TRANSCO compound. The south elevation of this group of buildings is also relatively tall and so the interaction with the winds from the southerly quadrant, which includes prevailing winds, is increased. We would expect leisure walking conditions to exist in the spaces between buildings along the south elevation and so entrances in these areas would require mitigation.

Away from these areas standing conditions are expected.

6.3 East Part of the Site – 'HS' Blocks

There are fifteen blocks which make the eastern part of the development. HS15 has a 17-storey corner and is the tallest building on the site, but this is restricted to the east corner of the building.

The southern ends of HS12 and HS 13 are 10-storeys which slope down to 7-storeys. At the High Street end of the blocks. It is likely that the southern corners of these blocks will experience conditions suitable for leisure walking in the winter because they are directly exposed to the prevailing winds, assuming only limited shelter from the TRANSCO compound. Provided entrances are situated away from the corner zones then the surrounding areas are expected to be suitable for standing/entrance use.

7. MITIGATION MEASURES

Specific mitigation measures are not proposed in this report because of the generic form of the buildings on the Masterplan. However, general comments can be made and these are summarised as:

- The public realm is shown generously planted with trees along the main roads through the site and also in the public realm areas between the plots. However, the shelter provided by these trees will be variable depending upon the season and also on the maturity of the specimens planted so that is may take time for the full benefit to be realised. The expectation is that shelter will be weighted toward the summer months when the trees are in full leaf but that trees, unless densely planted offer only minor protection at the windiest times of year. Because of this low-level, evergreen shrubs can be a better means of providing shelter in the wintertime.
- Entrances are sensitive areas because of the loss of reaction to the wind on leaving the building and because they are in use throughout the year. In general entrances should be located away from building corners where higher speed air flows can be a nuisance to pedestrians walking to and from the building and where the high suctions associated with these air movements can also generate draught problems through the doors. This is expected to potentially be an issue along the south elevation of the 'CPN' group of buildings and also along the south elevation of HS12 and HS13 during the winter.
- The buildings are sufficiently simple at this stage that further enhancements to the pedestrian wind environment can be achieved at the detail design stage. Typical changes could include reduced floor plates at upper levels to encourage the wind to blow around the building rather than re-directing down to pedestrian level and/or the addition of horizontal canopies or vertical screens nearer to ground level. The aim of these measures is to generally reduce the wind speeds around the building or to enhance conditions locally where there is a particular and specific issue that needs to be addressed, e.g. a windy entrance.

8. CONCLUDING REMARKS

- For London the prevailing winds are from the south west and northeast and these are aligned with the long axis of the proposed development.
- The west of the site is exposed because of the proximity to the park along the northwest elevation. However, the microclimate over the park is expected to benefit from the additional shelter afforded by the development.
- The main east-west Boulevard through the centre of the site is generously planted with trees but is exposed along its south perimeter to winds from the Transco works. Consequently, conditions along the Boulevard are expected to be generally tolerable for standing/entrances but tolerable for leisure walking in the gaps between plots.

- The development is expected to increase the shelter of the surrounding residential and commercial areas because of the change from existing flat, open land to and urban area where the wind is generally displaced upwards.
- Overall the site is expected to be suitable for standing/entrance use. Windier conditions, suitable for leisure walking, are expected between some of the buildings along the south elevation of the CPN and HS blocks. These do not represent particularly strong winds and would be compatible with a pedestrian thoroughfare. However, if there are entrances in these zones they would require localised shelter in the form of screens or recessing the entrances. It will be important to consider the interaction of air movements between the buildings. At the detail design stage, a wind tunnel test may be desirable to properly model these interactions and to test mitigation measures.

	Direction											
	0	**30**	**60**	**90**	**120**	**150**	**180**	**210**	**240**	**270**	**300**	**330**
10	0.615	0.632	0.627	0.630	0.608	0.622	0.656	0.677	0.838	0.823	0.820	0.620
2	0.450	0.463	0.459	0.462	0.446	0.456	0.480	0.496	0.720	0.707	0.704	0.454

Table 1: BREVe2 mean factors at 2m and 10m above ground at the site

DESCRIPTION	LETTER	**Threshold**
Roads and Car Parks	A	6% > B5
Business Walking	B	2% > B5
Leisure Walking	C	4% > B4
Pedestrian Standing	D	6% > B3
Entrance Doors	E	6% > B3
Sitting	F	1% > B3

Table 2: Lawson Comfort Criteria

BEAUFORT FORCE	HOURLY-AVERAGE WIND SPEED (m/s)	DESCRIPTION OF WIND	NOTICEABLE WIND EFFECT
0	< 0.45	Calm	Smoke rises vertically
1	0.45 - 1.55	Light Air	Direction shown by smoke drift but not by vanes
2	1.55 - 3.35	Gentle Breeze	Wind felt on face; leaves rustle; wind vane moves
3	3.35 - 5.60	Light Breeze	Leaves & twigs in motion; wind extends a flag
4	5.60 - 8.25	Moderate Breeze	Raises dust and loose paper; small branches move
5	8.25 – 10.95	Fresh Breeze	Small trees, in leaf, sway
6	10.95 - 14.10	Strong Breeze	Large branches begin to move; telephone wires whistle
7	14.10 - 17.20	Near Gale	Whole trees in motion
8	17.20 - 20.80	Gale	Twigs break off; personal progress impeded
9	20.80 - 24.35	Strong Gale	Slight structural damage; chimney pots removed
10	24.35 - 28.40	Storm	Trees uprooted; considerable structural damage
11	28.40 - 32.40	Violent Storm	Damage is widespread; unusual in the U.K.
12	> 32.40	Hurricane	Countryside is devastated; only occurs in tropical countries

Table 3: The Beaufort Land Scale

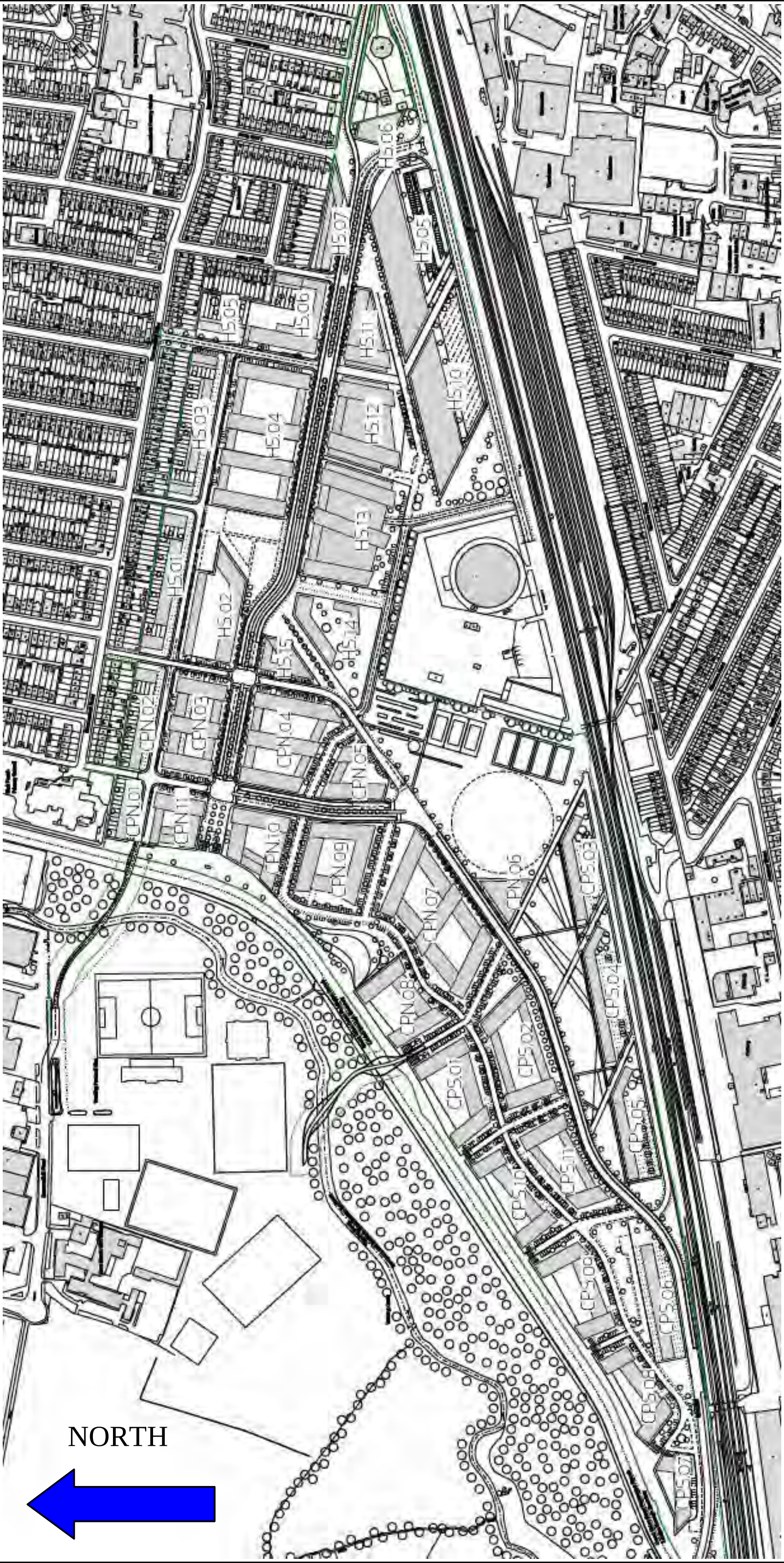


Figure 1: Site plan (with Plot Numbering)

Figure 2: Site Plan (Showing Landscaping)

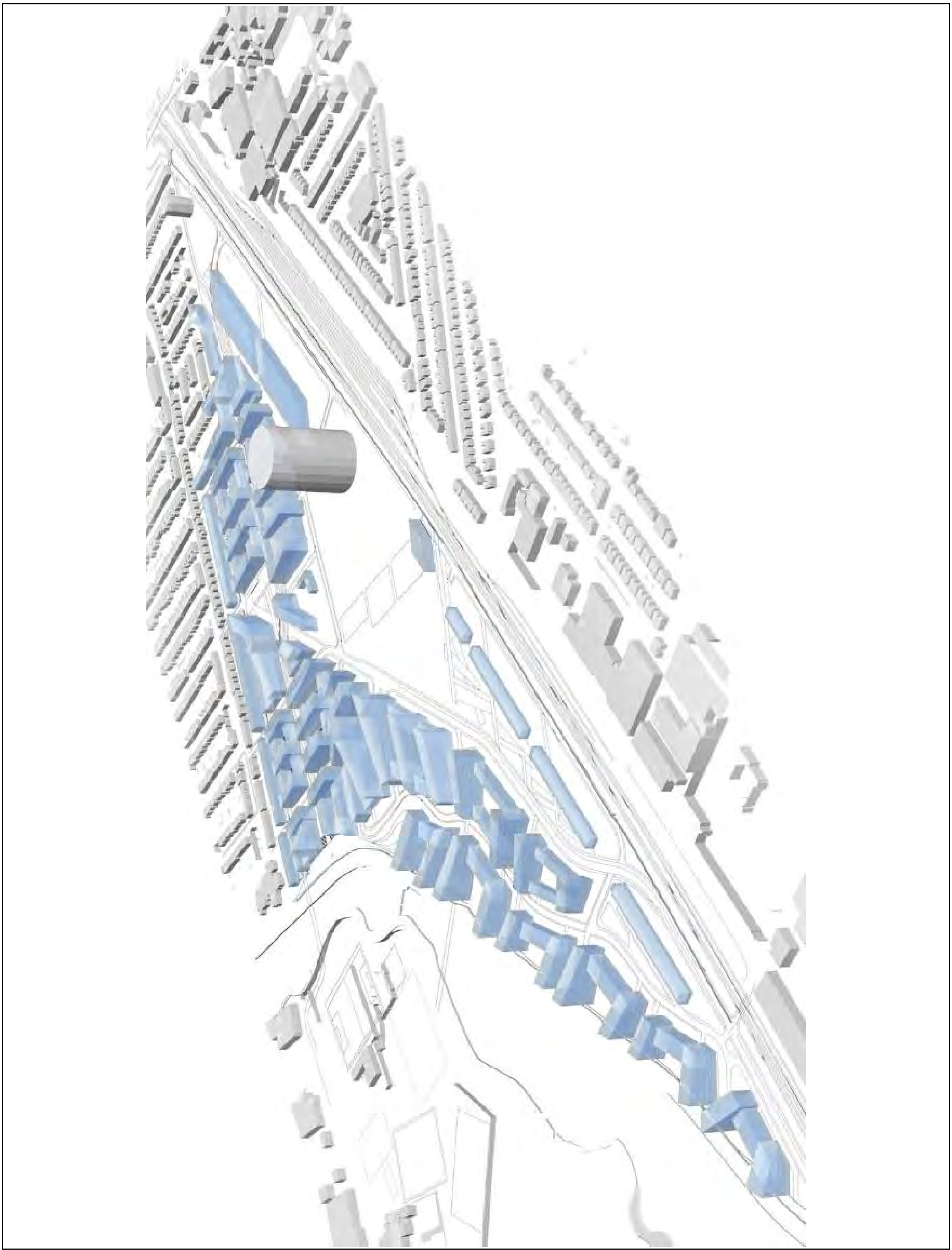
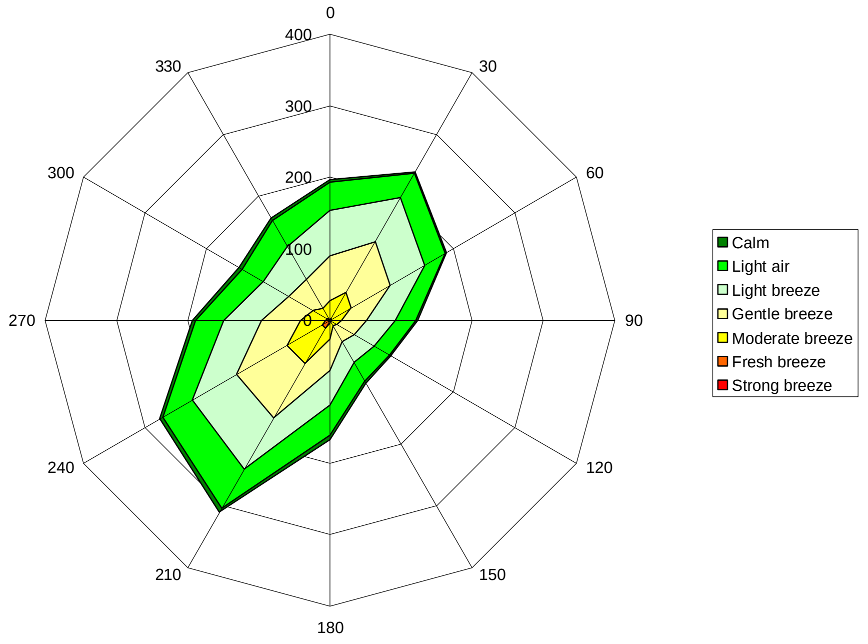
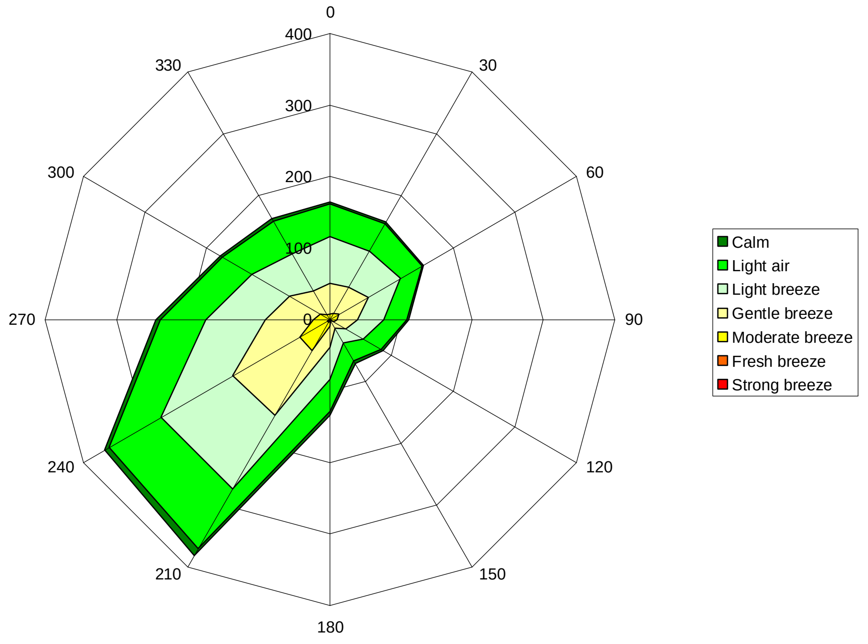


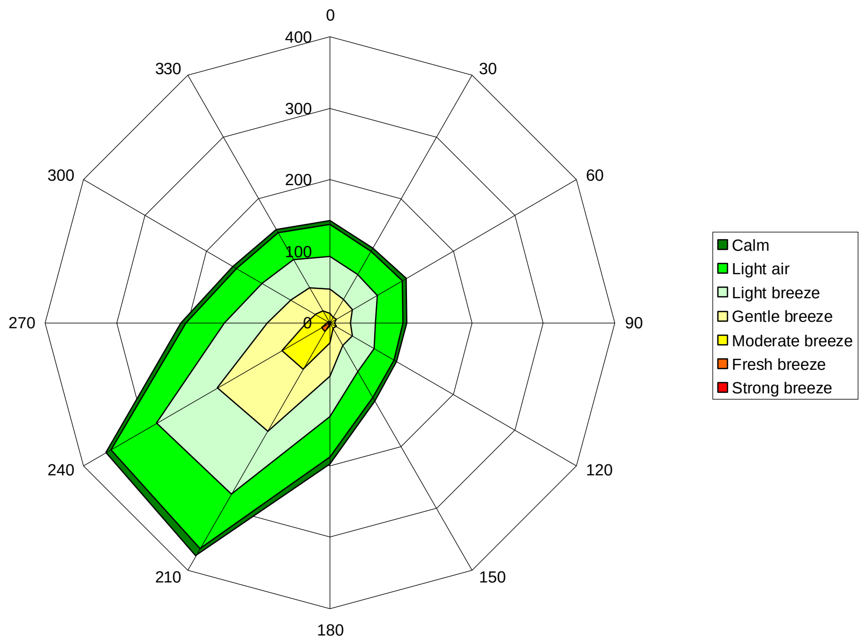
Figure 3: Indicative Massing Plan – Viewed from the South West



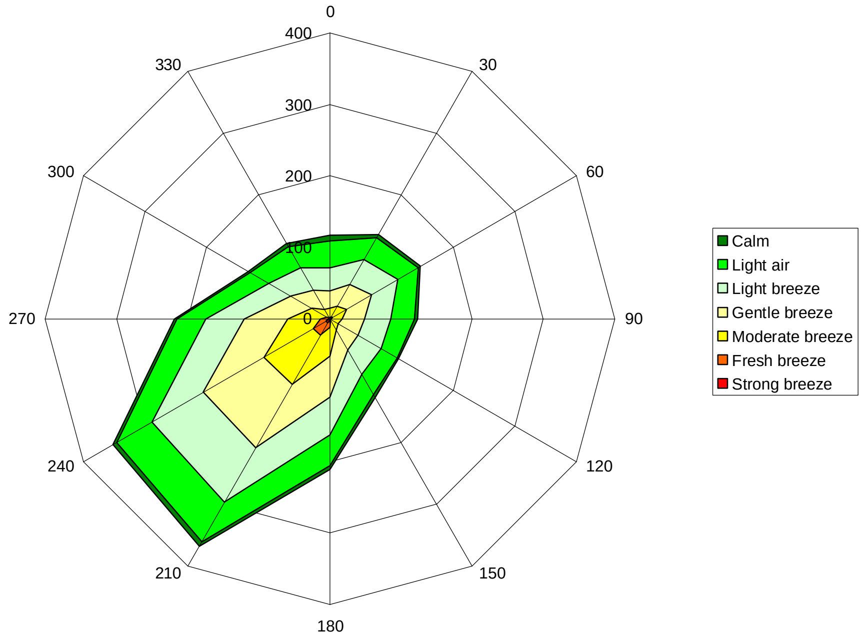
SPRING



SUMMER



AUTUMN



WINTER

Figure 4: Seasonal Meteorological data for London

(cumulative hours per year that each Beaufort Force (e.g. B5) is exceeded)

APPENDIX A: WIND IN THE BUILT ENVIRONMENT

Urban airflow

As the wind approaches a built-up area it is displaced upwards to roof level and tends to blow across the roof tops with gusts down to street level that are a function of the relative heights-to-width of the street canyon. When the height-to width ratio of the street canyon is greater than 0.7 the skimming flow regime dominates and the wind blows across the top of the street with little penetration down to ground level, whereas a height-to-width ratio less than 0.4 produces conditions similar to the isolated building scenario[3]. However, when there is an increase in building height across the street this can reinforce the rotating, or vortex, air movements within the street. Relatively open spaces, even inside a city, can be windy as the wind blows down from roof level into the open space.

Calm areas are generally desirable for pedestrian comfort. However, very slow air movement can result in poor ventilation of pollutants and in these areas it is desirable that pollutant sources are limited.

Seasonal variability

Pedestrian activity differs during the summer and winter months when other climatic conditions, for example air temperature, have a marked impact. Comfort criteria generally assume that pedestrians will be suitably dressed for the season and when making a worst-case assessment it is reasonable to assume that pedestrians will not be sitting at a street-side café on the windiest days of the year.

Entrances

Pedestrians are particularly sensitive to wind conditions at entrances because of the potentially marked change between the controlled environment inside the building and external conditions. For this reason it is important that conditions immediately adjacent to an entrance are relatively benign or that there is a sheltered ‘buffer’ zone, which allows pedestrians time to acclimatise. For recessed entrances the recess creates a buffer zone but is also prone to accumulating wind-blown debris because of the trapped vortex, or rotational, flows that can occur in the recess. Entrances are also used throughout the year so that even during the windiest days of the year the entrance should be relatively sheltered.

Entrances on different building elevations are also susceptible to pressure-driven through flows when opened simultaneously. The windward façade is generally positively pressurised whereas the side and/or downwind façades are at a lower pressure. If the entrances are into a central atrium then the different external surface pressures can be directly connected when doors are opened simultaneously. This can lead to nuisance draughts and in extreme cases difficulty in opening doors or whistling as the pressure difference forces the doors slightly ajar. Revolving doors eliminate the problem because the pressure seal across the building envelope is maintained. The extent of any potential nuisance is in part related to the footfall through the entrances because this will affect the probability of doors being opened simultaneously. Lobby doors are another means of limiting the impact of nuisance draughts, although the likelihood of both sets of lobby doors being opened simultaneously should be considered when specifying this option.

Landscaping

Planting is a very useful means of softening the streetscape and creating naturalised shelter within and around the site. There are generally two ways in which planting works; relatively dense lines of planting act like a solid screen deflecting the wind, whereas more open planting removes energy from the wind as it flows through the screen. In both cases shelter is created but for the case of the more solid screen winds can remain relatively strong at the extreme ends of the screen. If we consider the case of street canyons in UK towns and cities, the tree canopy minimises the penetration of vertical gusts down to pedestrian level and horizontal winds are displaced upwards by the canopy.

[3] T. R. Oke, ‘Boundary Layer Climates’, Routledge, © 1987

Another consideration is the seasonal variation of the species. Deciduous varieties create a denser screen during the summer months but during the winter months offer limited protection due to the bare branches. Evergreen varieties offer more consistent shelter throughout the year. When considering seasonal variability, account should be taken of the more transient pedestrian activity during the winter months where other climatic factors, e.g. air temperature, impact upon the way in which pedestrians will use a site. Finally, the maturity of the planting is significant; semi-mature species offer reasonable protection from an early stage in the life of the development, whereas immature planting will take time to establish.

More structural landscaping in the form of earth mounds or screens have the advantage of offering year-round shelter.

Balconies

If there are buildings with recessed balconies then it is generally the case that these will be sheltered unless they are particularly long balconies when the wind can blow along and into the balcony. Partition walls/screens between the balconies of adjoining properties are usually sufficient to eliminate this potential wind nuisance.

Protruding balconies are potentially more susceptible to wind nuisance because the main flow along the surface of the building can blow directly across the balcony. This condition is exacerbated if the protruding balcony skirts around a corner of the building where the strong corner winds will blow across the balcony. There is usually a requirement to screen the ends of the protruding balconies in order to displace the wind away from the balcony.

Colonnades

In this discussion a colonnade is defined as a covered walkway where the cover is generally provided by overhanging upper storeys of the building. In other words the building footprint at ground level is set-back. Colonnades create shelter from the direct effects of downdraught but are exposed to horizontal winds which can be channelled along the colonnade. If the colonnade connects windward and leeward elevations of the building then a pressure-driven flow is generated through the colonnade. If the building façade at ground level is curved then this can also be expected to accelerate the winds through the colonnade.

Colonnades do not necessarily provide shelter from the wind. Consequently, it may be necessary to increase resistance to air movement along the colonnade, and/or to prevent penetration of wind into the colonnade, by suitable screening.

Covered open spaces

Developments which are covered but open, either along the sides of the roof or at low level, will have internal environmental conditions that are variable and dependent upon the prevailing weather conditions. The canopy, typically a lightweight glazed canopy or fabric roof, may increase shelter from the rain and thereby improve the utility of the covered space; however, when the external air temperature is low and there is a breeze along the street it will generally be the case that pedestrians will need to be suitably dressed.

The challenge with these covered but open spaces is that the perception of shelter due to the canopy roof creates an expectation of shelter from both rain and wind. Put another way, if the wind conditions on a 'normal' street are identical to those in a covered street the pedestrian perception will be that the conditions beneath the canopy are less benign.

To design against this it is necessary that the wind conditions along a covered street are relatively benign. It is also important that the retail tenants on the street, particularly those operating food kiosks or cafes with 'external' seating, appreciate the variability of the weather conditions or are suitably catered for in terms of demountable screens and (say) patio heaters to enhance conditions locally.